

**To:** Paul Leonard[paul\_leonard@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2017-11-20T17:57:13-05:00  
**Importance:** Normal  
**Subject:** Caribou.docx  
**Received:** 2017-11-20T17:57:26-05:00  
[Caribou.docx](#)

Drafty section for Arctic Refuge Caribou Affected Environment



### 3.2.6 Caribou

Caribou are the most abundant large mammal in Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for brown bears and wolves.

Caribou have been present in northeastern Alaska and the northern Yukon since the early Pleistocene. Human use of caribou in the region may date back thousands of years. Remnants of caribou fences and corral structures used by the Gwich'in people are found throughout the current southern range of the Porcupine caribou herd (Warbelow et al. 1975).

Large caribou herds tend to migrate over long distances using seasonally available forage resources that are often widely distributed. Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators. In arctic areas, caribou reproduction is highly synchronous and the majority of calving occurs in a two- to three-week period. Most adult females give birth to a single calf. Caribou calves are precocious, being able to stand and nurse within one hour after birth and follow their mothers within a few hours. The first 24 hours of life are critical, when a behavioral bond is formed between the calf and its mother. Disturbance of maternal groups on the calving grounds may interfere with bond formation and can increase calf mortality. After calving, small bands of cows with newborn calves gradually merge into larger groups and are joined by yearlings, barren females, and bulls arriving from wintering areas.

Summer weather conditions promote the emergence of mosquitoes, nose bots, warble flies, and other biting insects. Insect harassment drives caribou into densely packed groups. These post-calving aggregations often move toward the Arctic coast or to higher elevations in the mountains to find relief from insects.

By August, large aggregations gradually dissolve into widely dispersed small groups that move slowly toward winter ranges. Breeding takes place en route, and by mid-November, caribou arrive in areas where they will spend the winter.

Four caribou herds live in northern Alaska. Two of these, the Porcupine and Central Arctic herds, consistently use Arctic Refuge seasonally or throughout the year. Caribou would be most susceptible to interaction and potential disturbance from winter exploration activities during their spring migration to calving grounds within the 1002 area and for those that overwinter in that area, including members of the Teshekpuk Herd.

#### ***Porcupine Caribou Herd***

An iconic symbol of Arctic Refuge, this herd migrates hundreds of miles from wintering grounds to give birth on the coastal plain and northern foothills of Arctic Refuge and nearby Yukon Territory in Canada. Residents of Arctic Village and, to a lesser extent, Kaktovik, hunt Porcupine caribou. Many visitors come to Arctic Refuge during early summer with hopes of seeing large numbers of caribou.

During the 1960s and 1970s, the Porcupine caribou herd was relatively stable at about 100,000 animals. Numbers steadily increased after 1978, peaked at 178,000 in 1989, and declined to 123,000 caribou in



2001 (Lenart 2007). Between 2002 and 2009, no estimates of abundance were available. During this period, caribou left the coastal plain and northern foothills of Arctic Refuge earlier and did not form large post-calving aggregations, or weather conditions precluded flights to photograph groups (E. Lenart, wildlife biologist, ADFG, pers. comm.). In 2010, 169,000 caribou were counted in a photocensus of the Porcupine caribou herd (Caikoski 2011). Between 2001 and 2013 the herd increased to levels not seen since monitoring began in 1977, with an estimated population of 197,000 (ADFG 2017b).

The Porcupine caribou herd ranges over 130,000 square mi (337,000 square km) of wild lands in northeastern Alaska and northwestern Canada (Lenart 2007). The entire Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou (Griffith et al. 2002). Foothills and mountains of Arctic Refuge are also important summer, fall, and winter habitats, as well as spring and fall migration routes. As the summer progresses and willows (*Salix* sp.) emerge, caribou also use riparian habitats. The Porcupine caribou herd generally overwinters south of the Brooks Range in Arctic Refuge and in the Richardson and Ogilvie mountains of the Yukon Territory, Canada. Winter distribution varies by year but is primarily south of the Brooks Range (Caikoski 2011).

Spring migration to calving grounds begins in mid-April and continues through May. Pregnant caribou move northward from wintering areas toward calving grounds, where they give birth during the first week in June. Timing and routes of migration vary annually depending on where they overwintered, snow conditions, and timing of the onset of spring weather. Caribou wintering in Alaska often follow a northeasterly route to calving grounds, crossing the southern flanks and valleys of the Brooks Range, and eventually entering Canada near the Firth River. Caribou wintering in Canada also converge in this region. Some caribou wintering in Alaska move in a more northerly direction, crossing the eastern Brooks Range and traveling more directly toward calving grounds. As snow melt progresses, caribou in the foothills spread northwestward along a broad front, primarily following the major river corridors and associated terraces where snow melt has advanced.

For the past few decades, the Porcupine caribou herd has calved in a region encompassed the Arctic foothills and the coastal plain from the Canning River in Arctic Refuge to the Babbage River in Canada, an area of nearly 8.9 million ac (3.6 million ha) (Griffith et al. 2002). During the calving season in early June, Porcupine caribou selected areas of wet sedge, herbaceous tussock tundra and riparian vegetation types (Griffith et al. 2002). Emerging tussock cotton grass (*Eriophorum vaginatum*) flowers were an important source of high quality forage in areas used by calving caribou (Jorgenson et al. 2002). This plant species had greater biomass and forage quality in tussock tundra compared with other vegetation types. The distribution of tussock tundra and moist sedge-willow tundra was greater in calving areas in the Arctic Refuge 1002 Area than in areas further south and east (Jorgenson et al. 2002).

### ***Central Arctic Caribou Herd***

The annual range of the Central Arctic caribou herd overlaps that of the Porcupine caribou herd. Two main calving concentration areas have been identified for the Central Arctic caribou herd: a western area between the Kuparuk and Colville rivers, and an eastern area between the Sagavanirktok and Canning rivers. The eastern area includes the Canning River delta region in northwest Arctic Refuge.



During most winters, scattered groups of animals range throughout the coastal plain west of the Katakaturuk River and adjacent uplands to the south. Between 2002 and 2009, the winter distribution of the Central Arctic caribou was north and south of the Brooks Range in Arctic Refuge. In some years, they mixed with Porcupine caribou wintering in the same region. In 2010, almost all Central Arctic caribou wintered on the south side of the Brooks Range in Alaska, as did Porcupine caribou.

This herd had about 5,000 caribou in the mid-1970s when it was first identified as a distinct herd (Cameron and Whitten 1979). By the early 1980s, it had grown to almost 13,000 and by the late 1990s, when net calf production was greater than 70 percent calves per female, it increased to over 25,000 (Cameron et al. 2002). A photocensus in 2010 counted more than 70,000 caribou in the Central Arctic herd, but a late spring in 2013 resulted in high mortality and the population dropped to 50,000 animals (ADFG 2017a). A 2016 estimate showed further dramatic declines, and the population estimate decreased an additional 50% and is at less than 23,000 caribou. The declines are attributed to both high adult female mortality and mixing of the Central, Teshekpuk and Porcupine herds.

The Alaska Department of Game provided the following description of the Central Arctic Caribou Herd movement in relation to oil infrastructure within their summer range in their Caribou Management Report (copied from Lenart 2011):

Within the range of the CAH, oil exploration and development began in the late 1960s and continues at present. Beginning in the late 1970s, the Alaska Department of Fish and Game (ADF&G) implemented long-term studies on population dynamics, distribution, movements, and effects of development on the CAH. During the 1980s, calving activity was rare in the Prudhoe Bay oil field, where it was known to occur before development (Whitten and Cameron 1983). In addition, cows and newborn calves were underrepresented along the trans-Alaska pipeline corridor and around oil production facilities in the early 1990s (Cameron and Smith 1992; Cameron et al. 1992). By the mid 1980s, major movements of CAH caribou through the Prudhoe Bay oil field in summer had ceased, and caribou distribution and movements within the Kuparuk oil field were altered substantially (Smith and Cameron 1983, 1985a,b; Whitten and Cameron 1983, 1985; Curatolo and Murphy 1986). In the mid 1990s, research on the CAH was reduced substantially, and efforts were focused on monitoring population parameters and their relationship to management objectives. During the mid 1990s, some of the CAH management goals and objectives were developed in response to concerns arising from research conducted during 1978–1993. Based on the hypothesis that displacement of sufficient magnitude would be harmful to the CAH (Cameron 1983), we worked with the oil industry to minimize disturbance to caribou movement due to physical barriers created by oil development. In addition, given that stress is cumulative, ADF&G reduced hunting activity in areas adjacent to the oil field and the Dalton Highway and also restricted the cow harvest. During 2001–2006, research was renewed to study the effects of oil field development on production, growth, survival, and movements of caribou calves (Arthur and Del Vecchio 2009).



- Alaska Department of Fish and Game [ADFG]. 2017a. Central Arctic Caribou Herd News, Winter 2016-17. [http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/central\\_arctic\\_herd/central\\_arctic\\_caribou\\_herd\\_news\\_winter\\_2016\\_2017.pdf](http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/central_arctic_herd/central_arctic_caribou_herd_news_winter_2016_2017.pdf)
- Alaska Department of Fish and Game [ADFG]. 2017b. Porcupine Caribou Herd News, Summer 2017. [http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/porcupine\\_caribou\\_news/porcupine\\_caribou\\_news\\_summer\\_2017.pdf](http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/porcupine_caribou_news/porcupine_caribou_news_summer_2017.pdf)
- Caikoski, J.R.. 2011. Units 25A, 25B, 25D and 26C caribou [Porcupine Herd]. Pages 251-270 *in* Harper, editor. Caribou management report of survey and inventory activities, 1 July 2008- 30 June 2010. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- Cameron, R.D. and K.R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. *The Journal of Wildlife Management*. 43:626-33.
- Cameron, R.D., W.T. Smith, R.G. White and B. Griffith. 2002. The Central Arctic Caribou Herd. Pages 38-45 *in* D.C. Douglas et al., editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001, Reston, Virginia, USA.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 *in* D.C. Douglas et al., editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001, Reston, Virginia, USA.
- Jorgenson, J.C., M.S. Udevitz and N.A. Felix. 2002. Forage quantity and quality. Pages 6-50 *in* D.C. Douglas et al., editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001, Reston, Virginia, USA.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 *in* Harper, editor. Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- Lenart, E.A. 2011. Units 26B and 26C caribou [Central Arctic Herd]. Pages 315-336 *in* Harper, editor. Caribou management report of survey and inventory activities, 1 July 2008- 30 June 2010. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.



**To:** Greg Siekaniec[greg\_siekaniec@fws.gov]; Karen Clark[karen\_clark@fws.gov]  
**From:** Mouritsen, Karen  
**Sent:** 2017-11-29T13:28:30-05:00  
**Importance:** Normal  
**Subject:** Fwd: O&G update  
**Received:** 2017-11-29T13:28:57-05:00  
[ANWR leasing Plan Nov 29.docx](#)

Greg, Karen,  
we have a more detailed version that we will send you with how we would work through the alternatives and impacts analysis, working with you all. But I decided to shorten the document a bit to send to DC. I will get the longer document from Ted and get to you.  
ps, I missed the name of your Chief of Refuges, sorry I did not send to her.

Karen E. Mouritsen  
Acting State Director for BLM-Alaska  
phone 907-271-5080  
cell 202-329-2030

----- Forwarded message -----

From: **Mouritsen, Karen** <[kmourits@blm.gov](mailto:kmourits@blm.gov)>  
Date: Wed, Nov 29, 2017 at 9:23 AM  
Subject: Re: O&G update  
To: "Cribley, Bud" <[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)>  
Cc: Gregory Siekaniec <[greg\\_siekaniec@fws.gov](mailto:greg_siekaniec@fws.gov)>, Joe Darnell <[Joe.Darnell@sol.doi.gov](mailto:Joe.Darnell@sol.doi.gov)>, Ted Murphy <[t75murph@blm.gov](mailto:t75murph@blm.gov)>, "Gambill, Zachariah" <[zachariah\\_gambill@fws.gov](mailto:zachariah_gambill@fws.gov)>, Katharine Macgregor <[kate\\_macgregor@ios.doi.gov](mailto:kate_macgregor@ios.doi.gov)>, Brian Steed <[bsteed@blm.gov](mailto:bsteed@blm.gov)>, Michael Nedd <[Mike\\_Nedd@blm.gov](mailto:Mike_Nedd@blm.gov)>, John Ruhs <[jruhs@blm.gov](mailto:jruhs@blm.gov)>, Kathleen Benedetto <[kathleen\\_benedetto@ios.doi.gov](mailto:kathleen_benedetto@ios.doi.gov)>, Timothy Spisak <[tim\\_spisak@blm.gov](mailto:tim_spisak@blm.gov)>

yikes, I am sorry everyone, the attachment didn't work. Here it is and please see my note below.

Karen E. Mouritsen  
Acting State Director for BLM-Alaska  
phone 907-271-5080  
cell 202-329-2030

On Wed, Nov 29, 2017 at 9:22 AM, Mouritsen, Karen <[kmourits@blm.gov](mailto:kmourits@blm.gov)> wrote:



Hello Bud,

Ted and I prepared the following estimate of how we might proceed if the legislation is enacted for the 1001 area. Please be aware that this is preliminary and an estimate only and that we have not consulted with our BLM Washington Office or ASLM yet, and that they will likely have some good ideas and input to add or change on this. We pulled from some papers we have used to develop the Integrated Activity Plan (or leasing plan) for the National Petroleum Reserve. The first couple pages addresses the IAP and on the last page is the estimate for how we would conduct the lease sales, using the BLM regs.

Karen E. Mouritsen  
Acting State Director for BLM-Alaska  
phone 907-271-5080  
cell 202-329-2030

On Wed, Nov 29, 2017 at 7:19 AM, Mouritsen, Karen <[kmourits@blm.gov](mailto:kmourits@blm.gov)> wrote:

Hi Bud, we are working on this and will get back to you  
Kate, Brian, John, this is in reference to the pending legislation that would open up the 1002 section of the ANWR to oil and gas development. The pending legislation says BLM is to do the leasing and development work, using the laws and regs from the BLM's NPR-A. That would require the BLM to do a leasing plan, like our Integrated Activity Plan, and then a lease sale, etc. We are coming up with some high-level steps and a time frame that would be needed if this legislation is enacted.

Karen E. Mouritsen  
Acting State Director for BLM-Alaska  
phone 907-271-5080  
cell 202-329-2030

On Wed, Nov 29, 2017 at 10:06 AM, Cribley, Bud <[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)> wrote:

Karen & Geg: There is a briefing today at 2:00 pm (East Coast time) to discuss the FRN for the reg. change for exploration in the 1002. (I wasn't aware of this when we talked yesterday) Joe, I believe you are invited. So Greg we need to the timeline for the reg. change from you as soon as possible from you all this morning.

Also at that meeting Zack would like to have the chart/table that shows what we (BLM &



FWS) need to do if the bill passes and the 1002 is opened to exploration, leasing, development and production. Again we need that, at the latest by 1:30 (east Coast time), 9:30 your time. I will try to send a start for you to work on.

Call with your questions.

Sorry

Bud

--

**Bud C Cribley**

**Senior Advisor for Energy with the U.S. Fish & Wildlife Service**

**Office # 202-208-4331**

**Cell # 907-717-5141**

**Office # MIB 3341**

**email: [bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)**



## **ANWR (Integrated Activity Plan (IAP) Leasing Plan EIS)**

An ANWR IAP/EIS will have a format similar to previous NPR-A IAP/EISs and be developed as follows:

- **Scoping:** Scoping will occur following publication of a Notice of Intent to plan in the *Federal Register*.
- **Alternative Formulation and Impact Analysis:** The planning team, led a project manager, will develop a range of alternatives, develop impact descriptions in coordination with cooperating agencies and prepare draft IAP EIS.
- **Public Comment on the Draft IAP/EIS:** Following publication of a Notice of Availability, the BLM will conduct a 60-day comment period. Outreach to tribes will also occur during this period. The public meetings on the North Slope and northwestern Alaska will also serve to fulfill BLM's obligation under ANILCA 810.
- **Response to Comments and Completion of a Final IAP/EIS:** Planning team members will respond to the comments and revise the IAP/EIS as appropriate then prepare the final IAP/EIS.
- **Issuance of a ROD:** No sooner than 30 days following issuance of the Final IAP/EIS, BLM will develop a ROD setting forth its decisions for a leasing of 1002 ANWR. Prior to finalizing the decision, BLM will consult with the cooperating agencies, providing an additional opportunity to affect the final decision. The final decision will determine whether the Preferred Alternative or other alternative is adopted, what modifications of the alternative will be incorporated into the decision, and what mitigation measures will be adopted.

The alternatives will reflect a number of themes. At pre-scoping stage, it is speculative to suggest more than the following general outline of three alternatives. The action alternatives would be consistent with protections required in a USFWS's Biological Opinion, and would likely include:

- **No Action Alternative:** All 1002 would be unavailable for leasing.
- **Oil and Gas Development-Oriented Alternative**
- **Oil and Gas Development with Conservation Protections Alternative**

All of the action alternatives, or at least those that are not the most development oriented, might have a no-surface-occupancy sub-



alternative. These sub-alternatives would require negligible additional impact analysis and offer management an opportunity to lease lands while protecting the government's ability to provide focused surface resource protections before any permanent development would occur.

## **Plan Preparation Schedule**

Major planning milestones are projected in Table 1.

**Table 1—Planning Milestones**

<b>Date</b>	<b>Milestone</b>
Jan-April 2018	Issue Notice of Intent/Conduct Scoping
September 2018	Issue Draft IAP/EIS
September 2018 -March 2019	Draft IAP/EIS comment period and analysis of comments
September 2019	Issue Final IAP/EIS
October 2019	Issue ROD

## **Public Participation Plan**

The ANWR IAP/EIS will require an extensive outreach effort. This is because the area is of interest to many, varied, distant, and dispersed groups. Major stakeholders include: TBD

## **Budget**

The primary expenditures are associated with work months for team members and relevant managers. Additional costs would be incurred for assistance by contractors, and travel, including travel to approximately fourteen villages in northwest Alaska. Assuming a Notice of Intent is published in January 2018, we anticipate the expenditures totaling approximately \$2.83-3.00 million.



## Leasing Program Schedule Development

<b>Step</b>	<b>Target Groups</b>	<b>Timing</b>
Call for Tract Nominations in Federal Register Notice	Governor of AK, local governments, Native Corporations, industry, other federal agencies, public	30 days
Environmental Analysis, tiered from ANWR IAP and lease stipulations/mitigation measures	BLM	30-60 days
Lease Tract Selections	BLM	30-60 days
Notice of Sale in Federal Register Notice	BLM	30 days
Lease Sale	BLM	



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Arthur, Stephen  
**Sent:** 2018-01-09T14:57:17-05:00  
**Importance:** Normal  
**Subject:** Re: Any info from Janet about 1002 vegetation/landscape studies needed?  
**Received:** 2018-01-09T14:58:00-05:00  
[Impacts of seismic exploration on the 1002 Area.docx](#)

Hi Wendy,

We have discussed information needs informally, so I do have some idea of Janet's major concerns. You probably are aware of her long term assessment of vegetation impacts of seismic trails created during the 1980s. Janet has been strongly urging that we revisit those plots again to obtain another set of data now that its been 15 years since the last surveys were made. I'll attach a study plan she prepared last month. She also has concerns about effects of winter travel on the relatively dry rolling tundra of the western 1002 area (more subject to scarring because of less ice content and probably less snow cover). This area is quite different geographically than the area around Prudhoe Bay and Kuparuk, so experiences there may not be a good guide for what we can expect in the 1002.

I am also concerned about effects of large-scale seismic exploration on short term growth of important caribou food plants (especially Eriophorum). I say this based on observing the brown tundra left behind by delayed melting of ice roads and winter trails in the existing oil fields to the west. In many areas, these trails basically eliminate an entire season of growth for caribou forage plants, even if the area recovers by the following year. In the 1002 area, where there is much less coastal plain available, it seems like this could have a measurable affect on food available to caribou during the calving and post calving periods (depending on how widespread these trails turn out to be).

I'd be happy to discuss these ideas further, or any other thoughts you have about the vegetation issues.

Steve

Stephen M. Arthur, Ph.D.

*Supervisory Wildlife Biologist  
Arctic National Wildlife Refuge  
101 12th Ave., Room 236  
Fairbanks, AK 99701  
(907)455-1830*

On Mon, Jan 8, 2018 at 4:15 PM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Hi Steve A , Greta, Chris, and Steve B

I wanted to check in with you and see if Janet has shared any of her thoughts about studies that she would like to see done with regards to vegetation or other terrestrial ecology



associated with advancing exploration and development of the 1002 area?

My initial thoughts are that for the summer following winter exploration activities (e.g. seismic), the Refuge would want to follow up with some vegetation surveys to observe whether there had been adequate snowcover to protect vegetation and soils where low-ground pressure vehicles are used and similarly where any ice pads or other staging might have occurred. I'll look to her 2010 publication to flesh that out and identify science gaps that could have helped mitigate damage observed

Just a couple of FYI's:

Arctic LCC supported development of an updated landform map for the wetlands of the entire Arctic Coastal Plain (although the 1002 area covers more than the lowland wetland types that were the focus). This work was done as part of an effort to describe thermokarst potential and model future active layer depths and thus landform transformation. I'll attach a poster (Lara ACP Mapping Presentation) that describes this work and Paul has the GIS data produced.

We also have a report by Torre Jorgensen on Permafrost mapping for the north slope and while not at a scale for industrial applications, that will be useful for the soils and permafrost assessment. It is not a huge file, so I will also attach it in case it can help with any hydrology or habitat descriptions you all may be working on.

Dr. Wendy M. Loya, Coordinator

Arctic Landscape Conservation Cooperative (LCC)

Anchorage, Alaska

907.786.3532 (office)

907.227.2942 (mobile)



## **Long term assessment of impacts of seismic exploration on the Arctic tundra of the 1002 Area.**

Janet Jorgenson, 12/2017

We propose to revisit and sample vegetation at permanent study plots established for the Arctic NWR seismic trail study, initiated during seismic exploration on the coastal plain of the Refuge in 1984. The plots were last sampled in 2002. The plots are accessible only by helicopter, so funding is not available within the normal Arctic NWR biological budget.

Slow growing tundra vegetation and the underlying permafrost soils on the Arctic coastal plain are very sensitive to disturbance. The creation of vehicle trails on the tundra from seismic exploration for oil and gas has accelerated in the past decade and the cumulative impact represents a geographic footprint that covers a greater extent of Alaska's North Slope tundra than all other direct human impacts combined. Seismic exploration for oil and gas was conducted on the coastal plain of the Arctic National Wildlife Refuge, Alaska, in the winters of 1984 and 1985. This study investigates the rate and extent of recovery of vegetation and permafrost soils over a period of 30+ years following vehicle traffic on snow-covered tundra. Paired permanent vegetation plots (disturbed, reference) have been monitored six times from 1984 to 2002. Data were collected on percent vegetative cover by plant species and on soil and ground ice characteristics. We analyzed the effects of vegetation type and initial disturbance levels on recovery patterns of the different plant growth forms as well as soil thaw depth. Plant community composition was altered on the trails by species-specific responses to initial disturbance and subsequent changes in substrate. Long-term changes included increased cover of graminoids and decreased cover of evergreen shrubs and mosses. Trails with low levels of initial disturbance usually improved well over time, while those with medium to high levels of initial disturbance recovered slowly. Trails on ice-poor, gravel substrates of riparian areas recovered better than on ice-rich loamy soils of the uplands, even after severe initial damage. Recovery to pre-disturbance communities had not occurred in areas where trail subsidence occurred due to thawing of ground ice. Camp move trails caused longer-term damage than the seismic grid trails because of heavier vehicles. Previous studies of disturbance from winter seismic vehicles in the Arctic predicted short-term and mostly aesthetic impacts, but we found severe impacts to tundra vegetation persisted for at least two decades after disturbance under some conditions. Further monitoring of these sites is needed to determine the long term persistence of these disturbance effects. In addition, monitoring these sites this year will enable us to determine the presence or absence of invasive plant species that may be introduced by the proposed seismic exploration activities.

Results of this study will inform management of proposed seismic exploration on Arctic tundra. There have been improvements in seismic exploration vehicles over the years since the 1980s, but various reports by BLM and contractors for the oil companies document that the current vehicles still cause some persistent damage, more so on the camp move trails than on the seismic grid trails, because they still use some of the heaviest vehicles used in the 1980s for the camp moves (D7 Caterpillar tractors). Stipulations for vehicles allowed and snow cover required before exploration can begin have changed little since the 1980s exploration in the Arctic Refuge. Current 3D seismic exploration produces a denser grid of trails than the 2D used in the 1980, suggesting that impacts to vegetation and soils might be different than in previous years.



The Arctic Refuge study is the only long-term study of seismic trail impacts in the Arctic that does quantitative sampling at permanently marked, repeatedly visited plots. Data are collected by point-sampling (lowering pins from sampling frame and recording all species hit) so data are much more repeatable and reliable than in plots done with other methods, such as ocular estimates or semi-quantitative disturbance rating schemes. In addition, the control plots from each pair of plots have been used as long-term ecological monitoring plots to track change in undisturbed tundra over time. These plots include all the major vegetation types on the coastal plain and are some of the oldest permanent vegetation plots on Alaska's North Slope.

Budget:

Item:	Cost:
Helicopter	\$28,200 if shared with lake study; \$37,500 if not shared
Food (\$10/person/day)	\$480
Salaries: one contract botanist	\$5000
Commercial flights, 4 RT Fairbanks to Barter Island	\$3200
Equipment & other	\$400
Per diem (\$5/day)	\$280
Total (shared helicopter)	\$37,560
Total (not shared)	\$46,860

Schedule:

Between July 20 - August 10; 1 helicopter contracted for 12 days and shared with other projects. We would need some helicopter support on seven of the 12 days. We would need the helicopter for partial days on five of those days and nearly full day use on two days.

Same level of effort as 2002. Do quantitative sampling of plant cover by species in 35 paired permanent plots on and off trails. At each plot, re-take permanent photo points, rate plot for seven disturbance factors and measure depth to permafrost on and off trail. This was done in 1984, 1985, 1988, 1991, and 2002. This doesn't include everything that was done in 1984 - 1991, but does include the most important parts.

Budget estimates include logistics for 4 people and salary for one contract botanist, but don't include salary for the Arctic Refuge botanist or two other assistants needed. We hope to use permanent FWS employees from other refuges for assistants.

Contract botanist = There are two people who live here in Fairbanks and each worked several field



seasons on this study. There's a good chance they would be available to hire on contract. This would be much preferable to hiring one more bio-tech because we need a really experienced person to lead one of the 2-person crews that will be camped out and working independently. This field project is too short to be worth properly training a new person.

Budget also doesn't address the time needed to do data analysis and write-up back in the office.

Invasive species: Invasive species are most likely to gain a toe-hold on disturbed ground, rather than natural native vegetation. Vehicle impacts on the seismic trails included increased bare soil, decreased vegetation cover and shifts in plant species composition. We will survey the plots for invasive species.



**To:** Gregory Siekaniec[greg\_siekaniec@fws.gov]  
**From:** Devaris, Aimee  
**Sent:** 2018-01-09T15:00:00-05:00  
**Importance:** Normal  
**Subject:** Fwd: polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
**Received:** 2018-01-09T15:00:19-05:00  
[polarbear\\_maternal\\_denning\\_habitat\\_in\\_the\\_ANWR1002\\_area\\_08Jan18.png](#)  
[polarbear\\_maternal\\_denning\\_habitat\\_in\\_the\\_ANWR1002\\_area\\_to\\_KML\\_09Jan18.kmz](#)

Greg,  
Just FYI, Wackowski came by yesterday and wanted to sit down with our GIS operator to look at the data and understand our sources. This is what we produced for him.

Hope your travels are going well.

Aimee

----- Forwarded message -----

From: **Devaris, Aimee** <[adevaris@usgs.gov](mailto:adevaris@usgs.gov)>  
Date: Tue, Jan 9, 2018 at 10:53 AM  
Subject: Fwd: polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
To: Stephen Wackowski <[stephen\\_wackowski@ios.doi.gov](mailto:stephen_wackowski@ios.doi.gov)>  
Cc: Christian Zimmerman <[czimmerman@usgs.gov](mailto:czimmerman@usgs.gov)>

Hi Steve,

Here is the information you requested. Please let me know if you need anything else.

Regards,

Aimee

----- Forwarded message -----

From: **Durner, George** <[gdurner@usgs.gov](mailto:gdurner@usgs.gov)>  
Date: Tue, Jan 9, 2018 at 10:09 AM  
Subject: polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
To: Christian Zimmerman <[czimmerman@usgs.gov](mailto:czimmerman@usgs.gov)>  
Cc: Todd Atwood <[tatwood@usgs.gov](mailto:tatwood@usgs.gov)>

Chris,

The attached information and data serves the information request made by Stephen Wackowski to the USGS polar bear research program on 8 January 2018. Please find attached the following:

1) polarbear\_maternal\_denning\_habitat\_in\_the\_ANWR1002\_area\_to\_KML\_09Jan18.kmz. This file includes spatial data of polar bear maternal denning habitat from the Colville River to the



Canada border. Maternal denning habitat within the ANWR 1002 area is included as a separate layer. This file also includes the following layers: polar bear maternal den locations identified with telemetry on land and fastice, 1982-2010; 2) 1 mile polygon buffer surrounding denning habitat in the 1002 area.

2) polarbear\_maternal\_denning\_habitat\_in\_the\_ANWR1002\_area\_08Jan18.png. This is a graphics file for viewing all layers.

The following data were also requested by Mr. Wackowski:

Total area of the ANWR 1002 area: 6741 km<sup>2</sup>

Total area of 1 mile buffer surrounding denning habitat: 5883 km<sup>2</sup>. Note this excludes marginal buffer area that occurred outside of the 1002 area.

Please contact with your questions and additional data requests.

George

Data sources:

Denning habitat: Durner et al. 2006. Arctic, 56(1): 31-36.

[https://alaska.usgs.gov/science/biology/polar\\_bears/products.html](https://alaska.usgs.gov/science/biology/polar_bears/products.html).

ANWR and ANWR 1002 boundaries: USFWS, Region 7,

Realty and Natural Resources,

<https://www.fws.gov/alaska/nwr/realty/data.htm>. Accessed 21 December 2017.

Durner, G.M., Fischbach, A.S., Amstrup, S.C., and Douglas, D.C., 2010, Catalogue of polar bear (*Ursus maritimus*) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 1910–2010: U.S. Geological Survey Data Series 568, 14 p.

--

George Durner, Research Zoologist  
US Geological Survey, Alaska Science Center  
4210 University Drive  
Anchorage, Alaska 99508

PH: 907-786-7082

--

**Aimee M. Devaris**

Regional Director

U.S. Geological Survey

4210 University Drive



Anchorage, Alaska  
907-786-7055

--

**Aimee M. Devaris**  
Regional Director  
U.S. Geological Survey  
4210 University Drive  
Anchorage, Alaska  
907-786-7055



**From:** [Devaris, Aimee](#)  
**To:** [Gregory Siekaniec](#)  
**Subject:** Fwd: polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
**Date:** Tuesday, January 9, 2018 1:00:19 PM  
**Attachments:** [polarbear\\_maternal\\_denning\\_habitat\\_in\\_the\\_ANWR1002\\_area\\_08Jan18.png](#)  
[polarbear\\_maternal\\_denning\\_habitat\\_in\\_the\\_ANWR1002\\_area\\_to\\_KML\\_09Jan18.kmz](#)

---

Greg,

Just FYI, Wackowski came by yesterday and wanted to sit down with our GIS operator to look at the data and understand our sources. This is what we produced for him.

Hope your travels are going well.

Aimee

----- Forwarded message -----

**From:** **Devaris, Aimee** <[adevaris@usgs.gov](mailto:adevaris@usgs.gov)>  
**Date:** Tue, Jan 9, 2018 at 10:53 AM  
**Subject:** Fwd: polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
**To:** Stephen Wackowski <[stephen\\_wackowski@ios.doi.gov](mailto:stephen_wackowski@ios.doi.gov)>  
**Cc:** Christian Zimmerman <[czimmerman@usgs.gov](mailto:czimmerman@usgs.gov)>

Hi Steve,

Here is the information you requested. Please let me know if you need anything else.

Regards,  
Aimee

----- Forwarded message -----

**From:** **Durner, George** <[gdurner@usgs.gov](mailto:gdurner@usgs.gov)>  
**Date:** Tue, Jan 9, 2018 at 10:09 AM  
**Subject:** polar bear maternal denning habitat in the ANWR 1002 area: data for Stephen Wackowski  
**To:** Christian Zimmerman <[czimmerman@usgs.gov](mailto:czimmerman@usgs.gov)>  
**Cc:** Todd Atwood <[tatwood@usgs.gov](mailto:tatwood@usgs.gov)>

Chris,

The attached information and data serves the information request made by Stephen Wackowski to the USGS polar bear research program on 8 January 2018. Please find attached the following:

1) polarbear\_maternal\_denning\_habitat\_in\_the\_ANWR1002\_area\_to\_KML\_09Jan18.kmz. This file includes spatial data of polar bear maternal denning habitat from the Colville River to the Canada border. Maternal denning habitat within the ANWR 1002 area is included as a separate layer. This file also includes the following layers: polar bear maternal den locations identified with telemetry on land and fastice, 1982-2010; 2) 1 mile polygon buffer surrounding



denning habitat in the 1002 area.

2) polarbear\_maternal\_denning\_habitat\_in\_the\_ANWR1002\_area\_08Jan18.png. This is a graphics file for viewing all layers.

The following data were also requested by Mr. Wackowski:

Total area of the ANWR 1002 area: 6741 km<sup>2</sup>

Total area of 1 mile buffer surrounding denning habitat: 5883 km<sup>2</sup>. Note this excludes marginal buffer area that occurred outside of the 1002 area.

Please contact with your questions and additional data requests.

George

Data sources:

Denning habitat: Durner et al. 2006. Arctic, 56(1): 31-36.

[https://alaska.usgs.gov/science/biology/polar\\_bears/products.html](https://alaska.usgs.gov/science/biology/polar_bears/products.html).

ANWR and ANWR 1002 boundaries: USFWS, Region 7,  
Realty and Natural Resources,

<https://www.fws.gov/alaska/nwr/realty/data.htm>. Accessed 21 December 2017.

Durner, G.M., Fischbach, A.S., Amstrup, S.C., and Douglas, D.C., 2010, Catalogue of polar bear (*Ursus maritimus*) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 1910–2010: U.S. Geological Survey Data Series 568, 14 p.

--

George Durner, Research Zoologist  
US Geological Survey, Alaska Science Center  
4210 University Drive  
Anchorage, Alaska 99508

PH: 907-786-7082

--

**Aimee M. Devaris**

Regional Director  
U.S. Geological Survey  
4210 University Drive  
Anchorage, Alaska  
907-786-7055

--



**Aimee M. Devaris**

Regional Director

U.S. Geological Survey

4210 University Drive

Anchorage, Alaska

907-786-7055



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Crane, Drew  
**Sent:** 2018-01-30T14:24:51-05:00  
**Importance:** Normal  
**Subject:** Re: Polar bear example?  
**Received:** 2018-01-30T14:24:54-05:00  
[Coastal Plain 1002 Area State of Knowledge - Polar Bears v3.0.docx](#)

Hey Wendy,

I have the polar bear example, but I'm waiting on a thumbs up from either Patrick or Mary to share with the larger group. I will hopefully get a response by the end of the day. In the meantime, I've attached it below for your use, but please don't share at this time.

Thanks

Drew Crane  
Deputy Chief of Refuges, Acting  
Alaska Region  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
907-786-3323

On Tue, Jan 30, 2018 at 9:32 AM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Drew,

Is it possible to get the narrative developed by the PB team as a potential example for the other teams? John Martin, Paul Leonard and I are working on providing further guidance and looking for ideas.

Thank you,

Wendy

Dr. Wendy M. Loya, Coordinator

Arctic Landscape Conservation Cooperative (LCC)

Anchorage, Alaska

907.786.3532 (office)



907.227.2942 (mobile)



**Coastal Plain 1002 Area Interagency Interdisciplinary Team**  
**TBD Jan 2018**

Tasks: Assess and summarize the state-of-knowledge for priority natural and physical resources of the Beaufort Sea coastal plain at the landscape scale and the 1002 area specifically.

1. Identify a lead or co-lead for each of the following subject areas (each team may decide to bin or separate these subjects accordingly):

(list based upon proposed rule coastal plain 1002 area EA)

- a. Soils
  - b. Water Resources and Wetlands
  - c. Climate
  - d. Air Quality
  - e. Vegetation
  - f. Fisheries
  - g. Golden Eagles, Resident Birds, Migratory Birds
  - h. Terrestrial mammals other than caribou
  - i. Caribou
  - j. Polar Bears
  - k. Bowhead Whales, Ringed & Bearded Seals
  - l. Cultural Resources and Historic Background
  - m. Socioeconomic
  - n. Subsistence
  - o. *Cumulative effects (see No 3 below)*
2. Lead works with other subject matter experts (including state agency colleagues) to populate the attached template by **INSERT DATE**  
  
\_\_\_\_\_
  3. Not considered in the above is the interface of these considerations and activities through planning (agency planners), plus the addition of cumulative effects not limited to the 1002 area but the larger landscape level (population level) of the Beaufort Sea coastal plain from Barrow to Victoria Island.



**Subject Area:** Polar Bears

**Lead (name and contact information):** Dr. Patrick Lemons, Chief Marine Mammals Management, U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99516. Phone: 907-786-3668. Email: patrick\_lemons@fws.gov

**Individuals Contacted:** Todd Atwood (USGS), George Durner (USGS), James Wilder (FWS), Christopher Putnam (FWS), Ryan Wilson (FWS), Michelle St. Martin (FWS), and Mary Colligan (FWS).

**What do we need to know and why (i.e. what decisions or determinations are required)(please address what we know about resources in the area (distribution, abundance, seasonal movements), how they may be impacted by oil and gas development, mitigation measures available and their effectiveness, subsistence activities)?**

**MMPA:** We can specify the incidental, but not intentional, taking of **small numbers** of polar bears by harassment if we can find that such harassment will have a **negligible impact** on the stock of polar bears and will not have an unmitigable adverse impact on the **availability of polar bears for subsistence uses** (emphasis added).

**ESA:** Under Section 7 of the ESA we will have to conduct consultations on federal action(s) and will have to make a determination as to whether such actions would **jeopardize** the continued existence of polar bears or **adversely modify or destroy** designated critical habitat (emphasis added).

**What information is currently available to address the information needs identified above (include citations)?**

Information needed to make the above determinations includes population dynamics of the Southern Beaufort Sea (SBS) subpopulation of polar bears, habitat and denning ecology of polar bears in the 1002 area, the subsistence and cultural use of the 1002 Area, and information on human-bear interactions that will accompany oil and gas development. We briefly describe the current state of that information relative to our determinations below.

- Population Dynamics
  - Information on the population size and trend of SBS polar bears suggests that the population experienced a 40% decline between 2001 and 2010. However, this information also suggested that the population may have stabilized by the end of that time period. Given the current information is now 8 years old, and the uncertainty surrounding the trend of the population at the end of the time period, reliance on this information for management decisions is problematic.



- **Habitat Ecology**
  - Our current understanding of polar bear habitat use and denning in the 1002 area is primarily based on satellite radio collared bears from the larger SBS subpopulation. However, because we are reliant on satellite radio collars applied primarily to the western portion of the SBS, and the number of collared bears that then use is only a subset of this larger sampling effort, we generally lack an understanding of the importance of the 1002 Area to the overall population of SBS bears. Therefore, reliance on the current information is problematic.
- **Subsistence and Cultural Use**
  - The only study conducted that included information concerning subsistence use and the cultural importance of polar bears in the 1002 Area was published in 1997. The information provided in that study pertaining to the 1002 Area is limited. Updated and more detailed information will be necessary as part of our determinations outlined above.
- **Human-Bear Interactions**
  - Because the 1002 Area was managed as a wildlife refuge in the past, no significant industrial activity and related human-bear interactions have occurred there in the last 35 years. Importantly, given the uniqueness of the habitat in this area and the importance of the 1002 Area to polar bears, reliance on mitigation measures used in the NPR-A and Prudhoe Bay may not comprehensively address potential human-bear interactions in the 1002 Area.

### **What are key information gaps?**

- **Population Dynamics**
  - An accurate and current understanding of the population dynamics of the Southern Beaufort Sea subpopulation of polar bears is needed in order to estimate the impact of anticipated take (i.e. to determine small numbers and make negligible impact determinations under MMPA and jeopardy determinations under ESA).
- **Habitat Ecology**
  - Understanding the relationship between polar bears and environmental parameters helps us explain current habitat use patterns and make future predictions on how distribution and movement is likely to respond to predicted sea ice loss and other habitat changes. This understanding is needed in order to predict how many and how animals are likely to be impacted by proposed activities (small numbers and negligible impact determination under MMPA) and whether proposed actions are likely to adversely modify or destroy designated critical habitat (ESA determination).
- **Subsistence and Cultural Use of Polar Bears**
  - An activity or suite of actions can affect the availability of polar bears for subsistence use by decreasing the overall number of animals or by changing their movements.



- Understanding polar bear movements and current hunting practices helps us understand the current availability of polar bears for subsistence hunting and predict the potential impact of proposed actions on the availability of polar bears for subsistence use (MMPA determination).
- Maintaining clear and consistent communications and relationships with communities concerning ongoing research and development activities.
- Human-Polar Bear Interactions
  - Understanding the potential spatial and temporal overlap between polar bears and oil and gas development and the factors influencing the likelihood and consequences of interactions between polar bears and those development activities is essential to our ability to determine the number of polar bears likely to be taken (small numbers determination under MMPA) and the consequences of that take to the individual animal and ultimately the stock (negligible impact determination under MMPA) and to the species (jeopardy determination under ESA).
  - Identification of possible methods to avoid overlap and interactions between polar bears and industry activities, and to reduce the potential for interactions, are essential tools to facilitating our ability to achieve a small numbers determination and reach a negligible impact determination (MMPA) as well as avoid jeopardy and adverse modification or destruction of critical habitat (ESA).

**What studies/surveys need to be conducted to fill those information gaps? Please include duration (start and end), lead, and cost estimates.**

- Population Dynamics
  - Estimation of abundance and population dynamics (i.e. demographic rates such as survival and reproduction). Surveys using mark-recapture methods are a more viable option than other non-invasive techniques (e.g., aerial survey).
  - Continue to evaluate emerging technologies (e.g., high-resolution satellite imagery, GPS collar reliability, collar drop off mechanism performance) for integration into existing monitoring plans.
- Habitat Ecology
  - Improve our understanding of the environmental and biological characteristics of important polar bear habitats, with a particular focus on denning habitat.
    - i. Continue, expand, and improve den detection, mapping, and monitoring activities. We see higher use of habitat within the 1002 area and greater reproductive success for land-based dens.
    - ii. Identify movement and land use patterns of polar bears in the 1002 area, and projected changes due to sea ice loss, especially given the increased proportion of the population coming on shore in that region. Identify potential for habitat use and behavioral patterns to be modified due to increased human activities.
- Assess Impacts to Subsistence and Cultural Use of Polar Bears
  - Periodically assess key community perspectives, values and needs regarding human-polar bear interactions and sustainable use of polar bears for subsistence purposes.



- Human-Polar Bear Interactions – Identify Current Methods and Develop New Methods to Avoid, Reduce and Mitigate impacts to Polar Bears from Oil and Gas Development Specific to the 1002 Area
  - Understand how polar bears respond to disturbance
    - i. Use existing movement data to look at relationships with existing infrastructure (does it appear bears are avoiding those areas and if so what is the impact zone)
    - ii. Monitor for potential disturbances at den sites
  - Evaluate efficacy of mitigation measures currently used outside of the 1002 area to determine effectiveness and transferability to the 1002 area
    - i. Comprehensive Review of Management Measures (e.g., season/area restrictions, den buffer zones, facility location/design)
    - ii. Avoidance: Examine available data to identify areas of particularly high use or biological importance for seasonal or year round avoidance areas
  - Develop new mitigation measures specific to the unique characteristics of the 1002 area to reduce the number of bears taken and the overall impact of Industry.



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Jorgenson, Janet  
**Sent:** 2018-02-08T16:35:42-05:00  
**Importance:** Normal  
**Subject:** Draft of vegetation 1002 assessment  
**Received:** 2018-02-08T22:43:56-05:00  
[1002VegetationResourceAssessment2-2018-2.docx](#)

Hi, here is the draft I have so far. Any comments or any large topics I'm overlooking? Is Josh Rose doing the soils and permafrost section?

--

Janet C. Jorgenson  
Botanist  
Arctic National Wildlife Refuge  
101 12th Ave, Rm 236  
Fairbanks, Alaska 99701

907-456-0216



## 1002 Vegetation Resource Assessment, February 7, 2018 - DRAFT

- Discipline/Subject Area. Vegetation
- Lead facilitator (name, affiliation, email, phone).

Janet Jorgenson, Arctic NWR, USFWS, [janet\\_jorgenson@fws.gov](mailto:janet_jorgenson@fws.gov), 907-456-0216

- Individuals contacted [name(s), affiliation, email, phone].

Melissa Head, Alaska DNR

Rebecca Baird, Alaska DNR

Scott Guyer, BLM

Donna Wixon, BLM

Martha Reynolds, UAF

M. Torre Jorgenson, Alaska Ecoscience

Todd Kemper, Environment Canada, Government of Canada

- What do we need to know and why regarding subjects?
  - 1) Impacts to be expected from three phases of oil exploration and development, and mitigation measures for each. A) Impacts if seismic exploration is done in 1002 area using current technology (eg overland vehicle travel). B) Impacts from exploratory well phase (eg temporary well pads, ice roads, overland vehicle travel). C) Impacts from production phase (eg gravel roads and pads, infrastructure). For each, need information on short and long term impacts likely to plants, soils and permafrost, including information for different vegetation communities, species, soil and soil moisture conditions and for overland travel by different types of vehicles under different snow conditions.
  - 2) Distribution of vegetation types, plant growth forms and soil and permafrost conditions across the 1002 area. In the near term this is needed to design stipulations for a seismic program that minimizes persistent damage by routing vehicles over less sensitive areas and requiring adequate snow cover and soil freeze.

- What information is currently available to address the information needs for subjects?

For 1-A (above):

Information on vegetation impacts and recovery from vehicle traffic during seismic program in the Arctic NWR in winters of 1984 and 1985:



Jorgenson, J.C., Hoef, J.M.V., & Jorgenson, M.T. (2010). Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications*, 20, 205-221

Felix, N. A., & Reynolds, M. K. (1989). The role of snow cover in limiting surface disturbance caused by winter seismic exploration. *Arctic*, 62-68.

Information on vegetation impacts and recovery from seismic programs done between 1996 – 2001:

Jorgenson, M. T., J. E. Roth, T. C. Cater, S. Schlentner, M. E. Emers, and others. (2003). Ecological impacts associated with seismic exploration on the central arctic coastal plain. Final Report for ConocoPhillips Alaska, Inc., Anchorage, AK, by ABR, Inc., Fairbanks, AK, 76 p. (Used with permission of ConocoPhillips)

Yokel, D., and J. M. Ver Hoef. 2014. Impacts to, and recovery of, tundra vegetation from winter seismic exploration and ice road construction. (2014). BLM Arctic District, Fairbanks, AK, 61 p.

Information on vegetation impacts from Alaska DNR modeling study 2003 - 2004:

Bader, H. R., and Guimond, J. (2004). Tundra Travel Modeling Project. Alaska Dept. of Natural Resources, Division of Mining, Land and Water. 65 p.

Bader, H. R. (2005). Tundra Travel Modeling Project: validation study and research recommendations. Alaska Dept. of Natural Resources, Division of Mining, Land and Water. 20 p.

Information on vegetation impacts and recovery from seismic programs done between 2002 and present:

For 1-A, no published papers and no in-house reports found yet (checked BLM and AK DNR).

For 1-B and 1-C (above):

National Research Council. (2003). *Cumulative environmental effects of oil and gas activities on Alaska's North Slope*. National Academies Press.

Truett, J. C., & Johnson, S. R. (Eds.). (2000). *The natural history of an Arctic oil field: Development and the biota*. Elsevier.

Reynolds, M. K., Walker, D. A., Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., ... & Webber, P. J. (2014). Cumulative geocological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global change biology*, 20(4), 1211-1224.

For 2 (above):



Two state-wide vegetation maps exist (NLCD and Landfire) but the scale of mapping and accuracy are inadequate for planning purposes. Ducks Unlimited produced a map of the North Slope on contract for the North Slope Science Initiative in ~2015, but used existing maps where available; maps from 1994 and 1986 were used for the Arctic Refuge portion. No new imagery classification was done.

The most detailed vegetation map of the 1002 area is from 1994:

Jorgenson, J.C., Joria, P.E., McCabe, T.R., Reitz, B.E., Raynolds, M.K., Emers, M., & Wilms, M.A.(1994). User's guide for the land-cover map of the coastal plain of the Arctic National Wildlife Refuge. In (p. 46). Anchorage, AK: U. S. Fish and Wildlife Service.

➤ What are key information gaps?

For 1-A) Have found no written documentation of vegetation impacts and recovery after vehicle traffic during seismic programs conducted between 2002 and the present. The most recent was follow-up monitoring of a 2001 seismic survey.

For 1-B & C) Development beyond the seismic exploration stage in 1002 area would probably follow the trajectory of the Alpine Field, rather than the older Prudhoe Bay field. Need information on the history and current status at Alpine. Haven't found a paper on this yet.

For 2) Vegetation maps: no detailed high-accuracy map exists. The 1994 map of 1002 area had a measured accuracy of 52% for 18 vegetation classes. The age and low accuracy make this map inadequate for planning of industrial operations or stipulations on vehicle routing.

➤ What studies/surveys need to be conducted to fill those information gaps?

For 1-A) Studies of impacts and recovery from seismic exploration currently occurring on north slope are needed. Do a literature search for draft or in-house documents regarding any follow-up done after seismic exploration.

For 1-B & C) Summary of history and current status at Alpine oil field or other newer oil fields on North Slope.

For 2) A new vegetation map is needed. Cost estimate:



**To:** Ryan Wilson[ryan\_r\_wilson@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-02-21T18:59:18-05:00  
**Importance:** Normal  
**Subject:** PB document  
**Received:** 2018-02-21T18:59:28-05:00  
[Polar Bear v3.0.docx](#)

Dr. Wendy M. Loya,  
Arctic Program Coordinator, Office of Science Applications  
US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.227.2942 (mobile)



**Subject Area:** Polar Bears

**Lead (name and contact information):** Dr. Patrick Lemons, Chief Marine Mammals Management, U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99516. Phone: 907-786-3668. Email: patrick\_lemons@fws.gov

**Individuals Contacted:** Todd Atwood (USGS), George Durner (USGS), James Wilder (FWS), Christopher Putnam (FWS), Ryan Wilson (FWS), Michelle St. Martin (FWS), and Mary Colligan (FWS).

**What do we need to know and why (i.e. what decisions or determinations are required)(please address what we know about resources in the area (distribution, abundance, seasonal movements), how they may be impacted by oil and gas development, mitigation measures available and their effectiveness, subsistence activities)?**

**MMPA:** We can specify the incidental, but not intentional, taking of **small numbers** of polar bears by harassment if we can find that such harassment will have a **negligible impact** on the stock of polar bears and will not have an unmitigable adverse impact on the **availability of polar bears for subsistence uses** (emphasis added).

**ESA:** Under Section 7 of the ESA we will have to conduct consultations on federal action(s) and will have to make a determination as to whether such actions would **jeopardize** the continued existence of polar bears or **adversely modify or destroy** designated critical habitat (emphasis added).

**What information is currently available to address the information needs identified above (include citations)?**

Information needed to make the above determinations includes population dynamics of the Southern Beaufort Sea (SBS) subpopulation of polar bears, habitat and denning ecology of polar bears in the 1002 area, the subsistence and cultural use of the 1002 Area, and information on human-bear interactions that will accompany oil and gas development. We briefly describe the current state of that information relative to our determinations below.

- Population Dynamics
  - Information on the population size and trend of SBS polar bears suggests that the population experienced a 40% decline between 2001 and 2010. However, this information also suggested that the population may have stabilized by the end of that time period. Given the current information is now 8 years old, and the uncertainty surrounding the trend of the population at the end of the time period, reliance on this information for management decisions is problematic.
- Habitat Ecology
  - Our current understanding of polar bear habitat use and denning in the 1002 area is primarily based on satellite radio collared bears from the larger SBS subpopulation. However, because we are reliant on satellite radio collars applied primarily to the western portion of the SBS, and the number of collared bears that then use is only a subset of this larger sampling effort, we generally lack an understanding of the



importance of the 1002 Area to the overall population of SBS bears. Therefore, reliance on the current information is problematic.

- Subsistence and Cultural Use
  - The only study conducted that included information concerning subsistence use and the cultural importance of polar bears in the 1002 Area was published in 1997. The information provided in that study pertaining to the 1002 Area is limited. Updated and more detailed information will be necessary as part of our determinations outlined above.
- Human-Bear Interactions
  - Because the 1002 Area was managed as a wildlife refuge in the past, no significant industrial activity and related human-bear interactions have occurred there in the last 35 years. Importantly, given the uniqueness of the habitat in this area and the importance of the 1002 Area to polar bears, reliance on mitigation measures used in the NPR-A and Prudhoe Bay may not comprehensively address potential human-bear interactions in the 1002 Area.

#### **What are key information gaps?**

- Population Dynamics
  - An accurate and current understanding of the population dynamics of the Southern Beaufort Sea subpopulation of polar bears is needed in order to estimate the impact of anticipated take (i.e. to determine small numbers and make negligible impact determinations under MMPA and jeopardy determinations under ESA).
- Habitat Ecology
  - Understanding the relationship between polar bears and environmental parameters helps us explain current habitat use patterns and make future predictions on how distribution and movement is likely to respond to predicted sea ice loss and other habitat changes. This understanding is needed in order to predict how many and how animals are likely to be impacted by proposed activities (small numbers and negligible impact determination under MMPA) and whether proposed actions are likely to adversely modify or destroy designated critical habitat (ESA determination).
- Subsistence and Cultural Use of Polar Bears
  - An activity or suite of actions can affect the availability of polar bears for subsistence use by decreasing the overall number of animals or by changing their movements.
  - Understanding polar bear movements and current hunting practices helps us understand the current availability of polar bears for subsistence hunting and predict the potential impact of proposed actions on the availability of polar bears for subsistence use (MMPA determination).
  - Maintaining clear and consistent communications and relationships with communities concerning ongoing research and development activities.
- Human-Polar Bear Interactions



- Understanding the potential spatial and temporal overlap between polar bears and oil and gas development and the factors influencing the likelihood and consequences of interactions between polar bears and those development activities is essential to our ability to determine the number of polar bears likely to be taken (small numbers determination under MMPA) and the consequences of that take to the individual animal and ultimately the stock (negligible impact determination under MMPA) and to the species (jeopardy determination under ESA).
- Identification of possible methods to avoid overlap and interactions between polar bears and Industry activities, and to reduce the potential for interactions, are essential tools to facilitating our ability to achieve a small numbers determination and reach a negligible impact determination (MMPA) as well as avoid jeopardy and adverse modification or destruction of critical habitat (ESA).

**What studies/surveys need to be conducted to fill those information gaps? Please include duration (start and end), lead, and cost estimates.**

- Population Dynamics
  - Estimation of abundance and population dynamics (i.e. demographic rates such as survival and reproduction). Surveys using mark-recapture methods are a more viable option than other non-invasive techniques (e.g., aerial survey).
  - Continue to evaluate emerging technologies (e.g., high-resolution satellite imagery, GPS collar reliability, collar drop off mechanism performance) for integration into existing monitoring plans.
- Habitat Ecology
  - Improve our understanding of the environmental and biological characteristics of important polar bear habitats, with a particular focus on denning habitat.
    - i. Continue, expand, and improve den detection, mapping, and monitoring activities. We see higher use of habitat within the 1002 area and greater reproductive success for land-based dens.
    - ii. Identify movement and land use patterns of polar bears in the 1002 area, and projected changes due to sea ice loss, especially given the increased proportion of the population coming on shore in that region. Identify potential for habitat use and behavioral patterns to be modified due to increased human activities.
- Assess Impacts to Subsistence and Cultural Use of Polar Bears
  - Periodically assess key community perspectives, values and needs regarding human-polar bear interactions and sustainable use of polar bears for subsistence purposes.
- Human-Polar Bear Interactions – Identify Current Methods and Develop New Methods to Avoid, Reduce and Mitigate impacts to Polar Bears from Oil and Gas Development Specific to the 1002 Area
  - Understand how polar bears respond to disturbance
    - i. Use existing movement data to look at relationships with existing infrastructure (does it appear bears are avoiding those areas and if so what is the impact zone)
    - ii. Monitor for potential disturbances at den sites



- Evaluate efficacy of mitigation measures currently used outside of the 1002 area to determine effectiveness and transferability to the 1002 area
  - i. Comprehensive Review of Management Measures (e.g., season/area restrictions, den buffer zones, facility location/design)
  - ii. Avoidance: Examine available data to identify areas of particularly high use or biological importance for seasonal or year round avoidance areas
- Develop new mitigation measures specific to the unique characteristics of the 1002 area to reduce the number of bears taken and the overall impact of Industry.



**To:** Greg Siekaniec[greg\_siekaniec@fws.gov]; Clark, Karen[karen\_clark@fws.gov]  
**From:** Crane, Drew  
**Sent:** 2018-04-20T12:39:31-04:00  
**Importance:** Normal  
**Subject:** Fwd: Documents to share  
**Received:** 2018-04-20T12:39:43-04:00  
[CoastalPlain\\_Q\\_A.pdf](#)  
[DTS 1996 Coastal Plain EIS NOI 4.16.18.docx](#)  
[Coastal Plain NOI News Release 04.19.18.pdf](#)

Mainly FYI.  
I shared these with Andrea and Sara yesterday.

Thanks  
Drew Crane  
Regional Endangered Species Coordinator  
Alaska Region  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
907-786-3323

----- Forwarded message -----  
From: **Hayes, Miriam (Nicole)** <[mnhayes@blm.gov](mailto:mnhayes@blm.gov)>  
Date: Thu, Apr 19, 2018 at 1:07 PM  
Subject: Documents to share  
To: Drew Crane <[drew\\_crane@fws.gov](mailto:drew_crane@fws.gov)>

Here you go!

**Nicole Hayes**  
Project Coordinator  
Bureau of Land Management  
222 W. 7th Avenue #13  
Anchorage, Alaska 99513  
Desk: (907) 271-4354



**Coastal Plain Oil and Gas Leasing Program Environmental Impact Statement  
Notification and Response**

**What is a Notice of Intent to Reorganize an Oil and Gas Leasing Program?**

A: A Notice of Intent (NOI) initiates the public process to prepare an Environmental Impact Statement under the National Environmental Policy Act (NEPA). It provides notification to the public that BLM is soliciting scoping comments on the proposed action, in this case to establish an oil and gas leasing program for the Coastal Plain. The purpose of the public scoping process is to determine relevant issues that will influence the scope of the EIS, including alternatives to the proposed action within the parameters outlined in the Tax Cuts and Jobs Act of 2017.

**How is the action in accordance with**

A: The proposed action is in accordance with the requirement in the Tax Cuts and Jobs Act of 2017 (Tax Act) to implement a leasing program within the Coastal Plain. The Leasing EIS will serve to inform BLM's implementation of the Tax Act, including the requirement to hold not fewer than two lease sales area-wide within seven years. It may also inform post-lease activities, including seismic and drilling exploration, development, and transportation of oil and gas in and from the Coastal Plain, which would require additional analysis under the NEPA before being authorized. Specifically, the Leasing EIS will consider and analyze the potential environmental impacts of various leasing alternatives, including the areas to offer for sale, and the terms and conditions (i.e., lease stipulations and best management practices) to be applied to leases and associated oil and gas activities to properly balance oil and gas development with existing uses and conservation of surface resources, and to limit the footprint of production and support facilities on Federal lands to no more than 2,000 surface acres as required by the Tax Act.

**What are the estimated impacts of the Coastal Plain Oil and Gas Leasing Program on the Arctic National Wildlife Refuge?**

A: Affected by the EIS are approximately 1.6 million acres of the Coastal Plain of the Arctic National Wildlife Refuge, as defined by the Tax Act (roughly 8 percent of total ANWR acreage). The area was previously known as the 1002 Area, which refers to that section of the Alaska National Interest Lands Conservation Act (ANILCA) which previously addressed the Coastal Plain.

**What is the proposed action for the Coastal Plain area?**

A:

- Notice of Intent (NOI) to prepare the EIS to be published in the Federal Register: April 20
- Conduct Public Scoping Meetings and Alaska Native Consultation: (time period specified in NOI April 20-June 19)
- Prepare the Draft EIS
- Publish Notice of Availability (NOA) for the Draft EIS. The Federal Register announcement will include the dates of the public review period and information



concerning the location and dates of public meetings to be held in conjunction with the comment period.

- Publish Call for Nominations and Comment in the Federal Register to solicit interest in lease sale areas (potentially concurrent with the NOA for the Draft EIS).
- Assess comments received on the Draft EIS and the expressions of interest and prepare final EIS.
- Publish a NOA for the final EIS in the Federal Register.
- Issue a record of decision (ROD) and Lease Sale Notice.
- Hold Lease Sale.

#### What information is required for notification?

A: The Notice of Intent begins a 60-day public scoping period. During this time, we will hold public meetings in affected communities on the North Slope and in other relevant cities, and we will conduct Tribal and Alaska Native Corporation consultation. There will also be extensive outreach via social media and the BLM Alaska website. Scoping comments can be submitted through the BLM Alaska website, by email or regular mail, or can be dropped off to the BLM in person at the BLM Alaska State Office or at any of the public meetings.

- website: [www.blm.gov/alaska/coastal/plain/eis](http://www.blm.gov/alaska/coastal/plain/eis)
- email: [blm\\_ak\\_coastalplain\\_eis@blm.gov](mailto:blm_ak_coastalplain_eis@blm.gov)
- mail: Attn: Coastal Plain Oil and Gas Leasing Program EIS  
222 West 7<sup>th</sup> Avenue, Stop 13  
Anchorage, Alaska 99513.



**To:** Sara Boario[sara\_boario@fws.gov]; Karen Clark[karen\_clark@fws.gov]; Gregory Siekaniec[gregory\_siekaniec@fws.gov]  
**From:** Howard, Amee  
**Sent:** 2018-05-24T17:54:30-04:00  
**Importance:** Normal  
**Subject:** Fwd: Ethics Guidance re. Public Comments by FWS Employees  
**Received:** 2018-05-24T17:54:38-04:00  
[Employees-public-expression-of-personal-opinions.pdf](#)

Hi All,  
Here is the guidance for your dissemination from our Ethics office regarding public comments by employees during the NEPA process.

Thanks so much!  
Amee

----- Forwarded message -----

From: **Aronson, Virginia** <[virginia\\_aronson@fws.gov](mailto:virginia_aronson@fws.gov)>  
Date: Thu, May 24, 2018 at 1:43 PM  
Subject: Re: Ethics Questions  
To: "Howard, Amee" <[amee\\_howard@fws.gov](mailto:amee_howard@fws.gov)>

Hello,  
I am forwarding this response:

Federal employees may voice their personal opinions but are prohibited under the Standards of Ethical Conduct ([5 CFR 2635.701-705](#)) from using their Service position, title or any authority associated with your public office in a manner that could reasonably be construed to imply that the Service or the Government sanctions or endorses any of their personal activities or opinions or the personal activities or opinions of another. It also cannot appear that they are speaking or writing on behalf of the Federal Government.

The only way employees can provide comments in-person or in writing on the oil and gas program in the Arctic Refuge is to do so in a personal capacity on their own time, not using any government resources and not make any reference to their position with the Service to make sure it does not appear that they are doing so on behalf of the Service.

Attached is some guidance about the public expression of personal opinions and how to stay within the ethics rules when expressing those opinions.

If specific situations come up, it is recommended to contact the Ethics Official for specific guidance before proceeding.

Virginia Aronson  
Human Resources Specialist (ER)  
AK Combined Services Center  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
Phone #: 907-786-3647  
Fax #: 907-786-3841



Email Address: [virginia\\_aronson@fws.gov](mailto:virginia_aronson@fws.gov)

On Thu, May 24, 2018 at 9:10 AM, Howard, Amee <[amee\\_howard@fws.gov](mailto:amee_howard@fws.gov)> wrote:

Hi Virginia,

It is in regard to the National Environmental Policy Act (NEPA) public process for establishing an oil and gas program in Arctic Refuge. BLM is the lead agency, FWS is a cooperating agency. We have a myriad of people working with BLM as subject matter experts to create the required NEPA documents.

The scenario is, what guidance should we give FWS employees that have concerns regarding the oil and gas program in Arctic Refuge who may want to comment (in person or in writing) as a private citizen?

Are there parameters that leadership can provide to keep everyone informed? It would be good to give dos and don'ts (if available) for all scenarios - written, public meetings, media, and social media.

Thank so much for your time and assistance in this effort.  
Amee

On Thu, May 24, 2018 at 8:37 AM, Aronson, Virginia <[virginia\\_aronson@fws.gov](mailto:virginia_aronson@fws.gov)> wrote:

Good morning,

I was contacted by the HQ Ethics Office. These are the questions they asked:

- 1) What type of public comments are the employees anticipating?
- 2) Would it be providing comments online, or appearing at public hearings or what?
- 3) Would any of this involve media coverage?
- 4) What are the specific projects?

Virginia Aronson  
Human Resources Specialist (ER)  
AK Combined Services Center  
U.S. Fish and Wildlife Service  
[1011 E. Tudor Road](#)  
[Anchorage, AK 99503](#)  
Phone #: 907-786-3647  
Fax #: 907-786-3841  
Email Address: [virginia\\_aronson@fws.gov](mailto:virginia_aronson@fws.gov)



--

***Amee Howard***

*Congressional and State Liaison*

U.S. Fish & Wildlife Service

Anchorage, Alaska

Office: (907)786-3509

Mobile: (907)229-8575

[Get Inspired](#)

--

***Amee Howard***

*Congressional and State Liaison*

U.S. Fish & Wildlife Service

Anchorage, Alaska

Office: (907)786-3509

Mobile: (907)229-8575

[Get Inspired](#)





## U.S. Fish & Wildlife Service - Ethics Program

### Existing Laws, Regulations and Guidance: Employees' Public Expression of Personal Opinions

February 2017

The Federal ethics rules do not prohibit Service employees from expressing their personal views on their personal time and in a personal or individual capacity. However, Federal ethics laws, regulations, the Hatch Act, and Service guidance provide some sideboards to Service employees' public expression of personal opinions in both their official and personal time. Following is a brief summary of the key laws, regulations and guidance. For more information see the [Service Ethics webpage](#), the [Department of the Interior Ethics website](#), and the [Office of Government Ethics \(OGE\) website](#).

- **Government position, title, or authority:** Federal employees may not use their Government positions, titles, or authority when signing letters or petitions, writing op-eds, or speaking in their personal capacity. This prohibition also includes the wearing of a Service uniform when speaking in a personal capacity. *For example*, employees may not use their official positions, titles, Service name, or Service contact information in personal comment letters regarding a Federal regulation. However, employees may send comment letters voicing their personal views, if they use their personal contact information (e.g. John Smith PhD, personal email, phone, etc.). Similarly, employees may not use their official Service position, title, authority or contact information when sending a letter voicing their personal views to a member of Congress. However, they may send letters to Congress voicing their personal views using their personal information. (See [5 CFR 2635.702](#), *Use of Public Office for Private Gain*.)
- **Government property:** Federal employees may not use Government property, or allow its use, for any unauthorized purpose. The term "Government property" includes real or personal property that the Government owns or leases such as: telecommunications equipment, computers, office supplies, Government mail systems; or vehicles. *For example*, a Service employee may not use his Government equipment at any time for outside fundraising, soliciting money for gifts, endorsing any product or service, participating in improper lobbying activities, or engaging in political activities. (See at [410 DM 2](#), *DOI Limited Personal Use of Government Office Equipment and Library Collections*; [5 CFR 2635.704](#), *Use of Government Property*.)
- **Government time:** Service employees must use official time to perform official duties only, unless specifically authorized. In addition, employees may not direct or request subordinates to use official time to perform any unauthorized activities. See [5 CFR 2635.705](#), *Use of Official Time*.
- **Nonpublic information:** Service employees may not use or allow the use of nonpublic Government information to further their own private interests or the private interests of others. Nonpublic information is information that is gained through Federal employment and that the employee knows or should know has not been made available to the general public. It includes information that the employee knows or reasonably should know is routinely exempt from disclosure by statute, regulations, or agency policy. It also includes information that has not been disseminated to the general public and is not authorized to be made available to the public on request. If an employee is unsure whether information is nonpublic, she should ask her supervisor. See [5 CFR 2635.703](#), *Use of Nonpublic Information*.
- **Conflicts of interest and impartiality:** The criminal conflict of interest statutes prohibit official actions by Federal employees when the action affects their own financial interests, or the financial interests of other persons imputed to the employee, including any organization for which the employee currently serves a board member or officer. In addition, Federal regulations require Service employees to act impartially when performing Government duties. [18 USC 208](#), *Acts Affecting a Personal Financial Interest*; [5 CFR 2635.501 and .502](#), *Impartiality in Performing Duties*.





## Existing Laws, Regulations and Guidance for Employees' Public Expression of Personal Opinions

- **Fundraising:** Employees may not use or permit the use of their Service titles, positions, or any authority associated with their offices to further a fundraising effort (except for the CFC.) For example, an employee may not permit the use of her official Government title in an organization's fundraising, lobbying or political activities. In addition, an employee may not solicit funds or other support from a subordinate or from a person whom the employee knows to be a "prohibited source" (as defined in [5 C.F.R. § 2635.203](#)), even if the employee does not refer to his or her official Government title or position. See [5 CFR 2635.808](#), *Fundraising Activities*.
- **Political activities.** The Hatch Act limits certain political activities of Federal employees. The law's purposes are to ensure that Federal programs are administered in a nonpartisan fashion, to protect Federal employees from political coercion in the workplace, and to ensure that Federal employees are advanced based on merit and not based on political affiliation. Information regarding the Hatch Act, including FAQs, can be found on the Office of Special Counsel [OSC website](#). Generally, all federal employees may discuss current events, policy issues, and matters of public interest at work or on duty. The Hatch Act does not prohibit employees at any time, including when they are at work or on duty, from expressing their personal opinions about events, issues, or matters, such as healthcare reform, gun control, abortion, immigration, federal hiring freeze, etc. For example, while at work employees may express their views about healthcare reform, e.g., "I agree with healthcare reform." However, the Hatch Act prohibits federal employees at work or on duty from engaging in political activity. Political activity is activity that is directed at the success or failure of a political party, partisan political group, or candidate for partisan political office. Thus, employees may not express their personal opinions on such events, issues, and matters if such views also are political activity. For example, while at work employees may not express their views about healthcare reform tied to a candidate for partisan political office, e.g., "If you disagree with healthcare reform you should support candidate X." Finally, even when federal employees are expressing personal opinions that are permissible under the Hatch Act they should be mindful of how such views may be received by their coworkers and whether such comments are consistent with the Hatch Act's underlying purpose of maintaining a politically neutral workplace.
- **Supervisors' responsibilities:** Supervisors must refrain from pressuring their employees to participate in activities unrelated to their official duties: Supervisors must be very careful about discussing their personal participation in outside activities with their subordinate employees, to ensure that the employees do not feel coerced to become involved in those same activities. *For example*, if a supervisor intends to participate in an activity (volunteer for a local food bank, petition drive, etc.) the supervisor should refrain from taking actions that will be real or perceived pressure on his employees to also participate in that activity.
- **Social media:** Additional rules govern the use of social media. Following are several links to guidance on that topic: Office of Government Ethics guidance: [OGE guidance on social media use](#); Office of Special Counsel guidance regarding the Hatch Act and political activity [OSC Social media hand-out](#); [OSC Frequently Asked Questions about political activity and social media](#).
- **Communicating official and scientific information:** Service manual chapters provide guidance on official communications on behalf of the Service ([115 FW 1](#), *Official Public Communications – General Policy and Procedure*); employees' rights and obligations when expressing their individual opinions concerning Service or Departmental programs, operations or activities ([115 FW 2](#), *Other Public Communications*); and requirements regarding employees' publishing of scientific information in any outlet ([117 FW 1](#), *Policy Review Guidance for Scientific Publications*).

For assistance with specific questions that are not covered by this guidance, employees should contact their servicing ethics counselors. Contact information may be found on the [Service Ethics Webpage](#).



**To:** Andrea Medeiros[andrea\_medeiros@fws.gov]  
**Cc:** Mitch Ellis[mitch\_ellis@fws.gov]; Socheata Lor[socheata\_lor@fws.gov]; Doug Damberg[doug\_damberg@fws.gov]; Bud Cribley[bud\_cribley@fws.gov]; Karen Clark[karen\_clark@fws.gov]; Paul Ross[paul\_ross@ios.doi.gov]; Barbara Wainman[barbara\_wainman@fws.gov]; Gavin Shire[gavin\_shire@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-05-31T13:00:47-04:00  
**Importance:** Normal  
**Subject:** FW: [EXTERNAL] Companies' first step in drilling for oil in ANWR draws scathing federal response  
**Received:** 2018-05-31T13:01:06-04:00  
[SAE seismic questions 5.22.2018.pdf](#)  
[FWS questions and comments re SAE seismic application.docx](#)

Andrea,

Below is the response I provided to the Alaska Region RDT this morning. Bud Cribley would be a resource for our HQ staff to understand the context and process, and of course I am available for further information.

Thank you,  
Wendy

Dr. Wendy M. Loya, Coordinator  
Office of Science Applications -Arctic Program  
US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

---

**From:** Wendy Loya <[Wendy\\_loya@fws.gov](mailto:Wendy_loya@fws.gov)>  
**Sent:** Thursday, May 31, 2018 8:45 AM  
**To:** Bud Cribley <[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)>  
**Cc:** Mitch Ellis <[mitch\\_ellis@fws.gov](mailto:mitch_ellis@fws.gov)>; Karen Clark <[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)>; Mary Colligan <[mary\\_colligan@fws.gov](mailto:mary_colligan@fws.gov)>; Joanna Fox <[joanna\\_fox@fws.gov](mailto:joanna_fox@fws.gov)>; Andrea Medeiros <[andrea\\_medeiros@fws.gov](mailto:andrea_medeiros@fws.gov)>  
**Subject:** RE: [EXTERNAL] Companies' first step in drilling for oil in ANWR draws scathing federal response

Hi Everyone,

With regards to: [https://www.washingtonpost.com/business/economy/companies-take-first-steps-to-drill-for-oil-in-arctic-national-wildlife-refuge/2018/05/31/8f133464-643a-11e8-a768-ed043e33f1dc\\_story.html?utm\\_term=.3fb70592e362](https://www.washingtonpost.com/business/economy/companies-take-first-steps-to-drill-for-oil-in-arctic-national-wildlife-refuge/2018/05/31/8f133464-643a-11e8-a768-ed043e33f1dc_story.html?utm_term=.3fb70592e362)

Here is the context and documents related to the FWS and BLM response to the seismic application by SAE for the 1002 area:

After receiving the seismic application for activities in the Arctic National Wildlife Refuge Coastal Plain, BLM Arctic Field Office made a request to their staff and FWS Arctic Refuge staff on May 7<sup>th</sup> for



additional information needed to process the application, with questions due back by May 11<sup>th</sup>.

- Arctic Refuge staff contributed their comments on what additional information they felt was needed and that was collated and returned to BLM Arctic Field Office. The file name of the attachment is "FWS Questions and Comments re SAE seismic application.doc" and it is 14 pages.
- BLM then collated the comments they felt were necessary to be answered, which is attached as "SAE seismic questions 5.22.2018" and is 11 pages.

Thank you,  
Wendy

Dr. Wendy M. Loya, Coordinator  
Office of Science Applications -Arctic Program  
US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

**From:** Cribley, Bud <[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)>  
**Sent:** Thursday, May 31, 2018 8:02 AM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>  
**Cc:** Mitch Ellis <[mitch\\_ellis@fws.gov](mailto:mitch_ellis@fws.gov)>; Clark, Karen <[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)>; Colligan, Mary <[mary\\_colligan@fws.gov](mailto:mary_colligan@fws.gov)>  
**Subject:** Re: [EXTERNAL] Companies' first step in drilling for oil in ANWR draws scathing federal response

Thank you Wendy. There isn't any rush.

Bud

On Thu, May 31, 2018 at 11:57 AM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:  
I am on my way in and will work with you all to share documents that relate to our input to BLM on the application for seismic exploration in the Arctic Refuge.

See you shortly,  
Wendy

Dr. Wendy M. Loya, Coordinator  
Office of Science Applications- Arctic Program  
Anchorage, Alaska  
[907.786.3532](tel:907.786.3532) (office)  
[907.227.2942](tel:907.227.2942) (mobile)

On May 31, 2018, at 07:41, Mitch Ellis <[mitch\\_ellis@fws.gov](mailto:mitch_ellis@fws.gov)> wrote:

Hi Karen. I haven't seen the "18-page" memo. Wendy and I were discussing this yesterday. I think she may know what doc the article was referring to. We can get folks a copy this morning.



Sent from my iPhone

On May 31, 2018, at 7:35 AM, Clark, Karen <[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)> wrote:

Including Mary and Mitch on the email- do you know anything about the "18-page Fish and Wildlife Service response" referenced in this article?

Thanks, Karen

Karen P. Clark  
Deputy Regional Director  
U.S. Fish & Wildlife Service- Alaska Region  
[1011 E Tudor Rd](#), MS 374  
Anchorage, AK 99503  
[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)  
907.786.3542 office  
907.786.3493 direct  
907.786.3306 fax

On Thu, May 31, 2018 at 7:09 AM, Cribley, Bud  
<[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)> wrote:

Karen,

Would you please send me a copy of the commitment letter we submitted to BLM on the seismic application for the Coastal Plain.

Thanks

Bud

----- Forwarded message -----

From: **Bud Cribley** <[bccribley@gmail.com](mailto:bccribley@gmail.com)>

Date: Thu, May 31, 2018 at 10:31 AM

Subject: [EXTERNAL] Companies' first step in drilling for oil in ANWR  
draws scathing federal response

To: Bud Cribley <[bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)>

<http://www.adn.com/business-economy/energy/2018/05/31/companies-first-step-in-drilling-for-oil-in-anwr-draws-scathing-federal-response/>

Sent from my iPhone



--

**Bud C Cribley**  
**Senior Advisor for Energy with the U.S. Fish & Wildlife**  
**Service**  
**Office # 202-208-4331**  
**Cell # 907-717-5141**  
**Office # MIB 3341**  
**email: [bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)**

--

**Bud C Cribley**  
**Senior Advisor for Energy with the U.S. Fish & Wildlife Service**  
**Office # 202-208-4331**  
**Cell # 907-717-5141**  
**Office # MIB 3341**  
**email: [bud\\_cribley@fws.gov](mailto:bud_cribley@fws.gov)**



## Marsh Creek 3D 2018 Winter Seismic Survey Plan of Operations (PoOP): Comments and Questions

### General comments:

1. Overall, narrative sections of the proposed action, i.e., Plan of Operations (PoOP) (SAExploration 2018) has a lack of applicable details for proper agency review, effects analysis, and comment.
2. Neither the BLM, which provides the lead for oil and gas permitting on federal lands, nor the Refuge Manager are listed as points of contact in the application. Many other discrepancies are annotated below.
3. The PoOP does not address the standing and relevant regulatory criteria under 50 CFR §§ 37 - Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska: specifically,
  - a. application requirements (50 CFR § 37.21), notwithstanding voiding of the closure date, i.e., 31 May 1986 [50 CFR § 37.21(b) and (c)] through the enactment of the 2018 Tax Bill;
  - b. environmental protections (50 CFR § 37.31); or,
  - c. special areas (50 CFR § 37.32).
  - d. Relevant Arctic Refuge statutory purposes under ANILCA, including 2018 updates, or Refuge Administration Act/Improvement Act are not addressed.
4. A few examples of mitigation guidance for geological and geophysical exploration include the following: Clough et al. (1987) and BMPs and ROPs identified by the NPRA Final Integrated Activity Plan EIS (BLM 2012) among many other more recent NEPA documents for the North Slope oil and gas industry (USACE 2012; BLM 2014, 2015, 2016; SAExploration 2016a, 2016b; BOEM 2017).
5. There is no compliance with NEPA for the PoOP, especially in view of potential significant direct, indirect, and cumulative effects for the past, present, and foreseeable future. As a result, there is no documentation of environmental effects, whether positive or adverse, nor recommendations for mitigation including project design features, otherwise termed best management practices (BMPs) or required operating procedures (ROPs) (e.g., Clough et al. 1987; BLM 2012, 2013, 2014, 2015, 2016; SAExploration 2016a, 2016b; BOEM 2017; among others).
6. Air quality, although presumed to be a minimal effect for seismic exploration, is not addressed from a cumulative perspective with past, present and reasonably foreseeable activities for the larger airshed of the North Slope.
7. Refuge purposes include ensured continuation of subsistence opportunities. Please include a section on subsistence that includes timing and routes so that it is possible to evaluate the potential effects on subsistence users and resources.

### Section 4.0

1. 1st paragraph, last sentence – for ‘what we have learned over the past several years’, are there reports documenting what has been learned, reports either by SAE, oil companies or BLM or DNR regulators? If not reports, are there trip reports or memos? If so, can FWS staff see them? What is the power to detect change and statistical inference of these studies?



2. What is your experience conducting specific activities with specific equipment at the most environmentally risky conditions (slopes and snow, soil, and vegetation conditions) that you propose to encounter? Have there been studies assessing the impacts and risks when operating under these conditions with specific types of equipment? If so, what is the statistical inference of these studies and please provide the reports and data.

## Section 5.0 Cultural Interface

1. How are the concerns of Arctic Village and Venetie addressed?

## Section 6.0 Oversight Panel

1. Who does the biologist hired by SAE report to? BLM? FWS? Will this be an independent contractor hired by BLM and FWS and paid for by SAE? On a project like this we would generally have FWS monitors assigned to the project to answer questions in real-time on the ground.

## Section 9.0 Mobilization and Access (and follow-up monitoring and restoration related to these activities)

1. "The crews will mobilize to existing gravel pads which will allow access to the tundra and provide a resupply area for the crews" (Page 7: SAExploration 2018). These gravel pads are not identified in the PoOP – whether inside the 1002 area boundary or adjacent to it. Where are the gravel pads and travel corridors? Locations of ingress and egress?
2. SAE states "SAE will attempt to coordinate with companies to use any existing or planned trails." There are no existing trails in the permit area and what other companies do they refer to? Coordination should be happening with BLM and/or FWS in regards to avoiding sensitive areas. Also, an analysis of the effects of maintaining a stationary camp in a non-sensitive area vs. dragging it along every few days is needed. Do you have information to address these needs? How large of a gap between work areas can there be before your operations are impacted?
3. Note that the suggested ingress/egress route from Deadhorse to the 1002 area across the coastal plain, and inferring a similar, continuing route across the 1002 area, traverses critical denning habitat for the polar bear (FWS 2008, FWS 2009, FWS 2016a).
4. The stated operating period of the PoOP is 1 Dec through 31 May\* annually, or upon adequate snowfall or other environmental conditions to support winter travel, until the tundra travel is closed by onset of spring weather conditions. However, this does not address:
  - a. assumed annual winter seismic exploration activity periods and phases as industry standard and convention used for reference in this review; note this would be problematic for activities during late (beyond 1 May) seasonal demobilization as breeding and calving are occurring on the coastal plain
  - b. staging of equipment outside of that annual performance window, nor ingress and egress timing to the 1002 area, such that mobilization begins at Deadhorse on 1 Dec and return by 31 May, or when conditions are such that tundra travel



- c. if (how and where) seismic surveys will be conducted when adequate snowfall or other environmental conditions are not conducive to tundra travel – including how will this be assessed/monitored to preclude soil compaction and/or vegetation damages when adequate snow is not present and the spatial inference of these surveys be (Also see questions under 10.0 Surveys and Ice Check Section);
  - d. how changing weather and climate may affect seismic survey operations with an increasingly shortened winter period
- 5. What dates and when and where will they be operating? (not enough to say “1 December to May 31”) The PoOP identifies the entire coastal plain 1002 area (1,665,280 ac) as the project area for the 2018-2019 and 2019-2020 winter seasons. There is no defined project area or project definition from which specific effects may be evaluated or mitigation recommendations offered by the Arctic Refuge Manager. A map identifying when, where, what, etc., per 50 CFR § 37.21(d)(4) is needed. The PoOP title implies the Marsh Creek environs but there is no mention of this tributary beyond the title. Please provide routes and what type of activity, storage, etc will occur at locations within the permit area. For example, if you plan to be working near any of the Refuge springs or other special areas, we will need to develop relevant stipulations and will need more information on what type of activity is proposed.
- 6. It is surprising that older technologies known to cause substantial impacts have not been updated. For example, 2 D7G CAT Dozers are listed as equipment for the sled camp (Page 17, Appendix B: SAExploration 2018). This tracked equipment, or equivalent is documented as causing the most damage to tundra, requiring decades to recover, if at all (Truett and Kertell 1992; Emers and Jorgenson 1997). Are there advances in technology that we are not aware? If so, what is the documented effectiveness and did associated surveys have a statistically valid design, what was the change detection capability, and what is the statistical inference for various vegetation and soil types, snow and soil conditions, slopes, etc.
- 7. Will SAE be allowed to mobilize, resupply, use airstrip, etc. at Point Thompson? This could reduce vehicle traffic across tundra on state land to Dalton Highway.
- 8. Are there ice or snow roads between Dalton Highway and Point Thompson that you could travel on to reduce tundra damage? If not, could you travel some of the distance on sea ice?
- 9. To assess vulnerability, inform route planning and avoid unnecessary damage, what soil and vegetation surveys will be conducted along the proposed routes and what will the spatial resolution of these surveys be? Note – that supplying this information for routes where extremely heavy equipment (e.g., camp moves, resupplies) will be moved is particularly important.
- 10. What are the operating plans and environmental protection protocols for tundra travel? How will these protocols differ for different snow and soil conditions and for travel on steep slopes, areas with sensitive soil/vegetation types, and near special areas (e.g. groundwater-fed springs, overflow ice, ice-hummocks, and waterbodies that may support fish?
- 11. For each type of activity/equipment (e.g. camp moves, resupplies, snow machine access, refueling, transport of fuel and hazardous chemicals), describe what the environmental regulations/limits will be for the following:
  - a. What is the maximum slope that operations for each type of activity/equipment would occur on? This information will allow us analyze the potential for impacts of different activities (e.g. fuel storage, transport of hazardous materials, camp moves, seismic) would be occurring on steep slopes.



- b. What are the soil and vegetation type requirements for each type of operation/equipment? This information will allow for a more meaningful analysis of impacts to tundra.
  - c. What are the criteria for snow and soil characteristics that will be required for each type of activity/equipment? Will these criteria vary with slope and type of soil and vegetation?
12. What are the proposed routes for camp moves or other travel that may cause substantial damage to the tundra? Please provide a map and GIS file. Please provide the following information broken down in a table and linkable to GIS format:
- a. Proposed route distance
  - b. Timing
  - c. Type of activity (e.g. resupply, camp move)
  - d. Type of equipment (e.g. vehicle type, sled, skis)
  - e. Weight of vehicle/equipment empty
  - f. Weight of equipment/vehicle fully loaded
  - g. Pounds per square inch (PSI) pressure of vehicle, sled, or skis empty
  - h. Pounds per square inch (PSI) pressure of vehicle, sled, or skis fully loaded (note – this especially important for sleds or vehicles that haul large volumes of water or fuel, kitchen and bath units, etc.)
  - i. Total footprint of all vehicle or other equipment in contact with ground
  - j. Type of tire (tracked versus wheeled)
  - k. Track material (e.g. steel versus rubber)
  - l. Are tracks cleated or uncleated? Number of times a particular route would be exposed to a particular PSI from a particular vehicle, sled, or skis.
  - m. Maximum slope that this equipment would travel on and at what weights (minimum and maximum)
  - n. Snow depth requirements for this type of vehicle/equipment
  - o. Freezing depth requirements for this type of vehicle/equipment
  - p. Link to soil and vegetation type requirements for use of this vehicle/equipment and environmental protections protocol
  - q. Are hazardous material transported on this type of equipment?
  - r. Is more than 500 gallons of fuel be transported on this type of vehicle/equipment?
13. How and where will snow be gathered and moved for construction of snow trails and ramps?
14. What are the soil and snow characteristics that would elicit the need for creating snow trails?
15. How far can snow be transported for trail making?
16. What are the topographic and other criteria that elicit the need for creating snow ramps?
17. More detail about snow packed trails: can you preplan a route well enough to prepack trails for all of the camp moves and long-haul fuel moves? If not, can you prepack main routes through the work area and minimize movement of heavier vehicles off of those prepacked routes? For example, move camps and fuel on prepacked trails with only short spurs off of it to reach camp sites.
18. When would be prepacking be done? Will it be done before snow is deep enough for the tundra travel season to open? What vehicles would be used during this time?



19. What equipment will be used for moving and placing snow, what is the operating plan, and what is the environmental protection protocol?
20. How will the permittee ensure that significant volumes of snow/water (snow water equivalent) are not translocated (e.g. by snow-fence captures or removal and application of snow) to other drainages?
21. Snow compaction can impede natural surface flows during breakup. What are the locations of proposed snow trails? What operating procedures will be followed to reduce hydrologic impacts of snow trails?
22. How many resupply trips will be needed along routes?
23. How many vehicles and what type will be involved in resupply trips?
24. Will resupply vehicles use existing trails?
25. What is the typical size (area covered) of a 3D seismic grid that would be completed by 2 crews in one winter season? Or what size would a grid in the 1002 area in 2018-19 probably be? Would it probably be roughly a square? For the expected size and shape of the grid area, how many miles of camp move trails would there be within the work area (not including miles of access to reach the edge of the work area)?

#### 10.0 Survey and Ice Check

1. This appears to be from a sea-ice based project proposal or from an area where there are many lakes. It should be reworked to account for activities in a mostly tundra environment where snow is known to blow around making snow drifts with intermittent bare ground or thin snow.
2. The applicant states that "In low snow years, snow surveys will be conducted to substantiate depths and will be recorded for equipment movement efforts" and sentence ends - (Page 8 under 10.0 Survey and Ice check: SAExploration 2018). This does not address the adequacy of snow nor preclusion of survey impacts. A description of activities is needed for "low" snow years, including a description of what they feel "adequate" snow cover would be. How might weather and changing climate affect seismic survey operations with an increasingly shortened winter period. Is the applicant prepared to deal with early melts? If so, how?
3. What provisions are there for the possibility that snow conditions deteriorate before the train returns?
4. Where would snow surveys be done in order to decide when exploration could begin?
5. What is the proposed survey design and statistically determined spatial and temporal inference for collecting data (e.g. weather, snow, slope and soil) necessary to assess whether or not activities can occur?
6. How will SAE gather data on frost and snow conditions and provide them to the authorized officer, so the he/she can make an informed decision?
7. There can be large expanses with no snow cover in the 1002 Area. What are the contingency plans in the event extensive areas with low snow cover and/or unfrozen ground are encountered? Do you plan to conduct aerial snow surveys at least a year ahead of time or conduct snow modeling efforts to get a general sense of where these large expanses are to help develop your contingency plans for these areas?



## 11.0 River Crossings (and lake)

1. Ice-road, ice ridge and ramp construction across deep ravines need to consider spring snowmelt or storm events to preclude damming that could cause impounded water as a heat sink, flooding, erosion and mass wasting, water turbidity, suspended solids, stream rechanneling, and/or bank stabilization.
2. SAE refers here, and throughout the document, to coordinating with the State of Alaska. Note that coordination with the BLM and FWS will also be necessary.
3. Need a clear understanding of how they plan to move across areas where the banks are deep and steep.
4. Constructing ice bridges in the absence of water or water-limited conditions is problematic – isolated, shallow lakes; minimal or absent winter flows in streams and rivers; minimum pool size and freezing-depth to protect overwinter fish habitat (in contrast with the NPRA where water is abundant and average snow depths much deeper). The PoOP provides no specific information on accessing water, water requirements, or ice bridge locations, given the overall limitation of water in the 1002 area,
5. What are the environmental protection protocols for building ice roads, traveling on river and lake ice, and preventing additional freeze-down of ice, impacts to spring fish migration, and altering spring flooding events?
6. Are there special provisions for avoiding spring-fed areas, aufeis, deep pools that do not freeze to the bottom, ice-hummocks, and potential fish-bearing lakes?
7. Cross-slope travel is indicated and implied in PoOP Appendix C (SAExploration 2018) not only from Deadhorse to the 1002 area, but within the 1002 area with steeply sloped topography and cut by deep ravines. Stream crossing points are not identified nor consolidated for seismic surveys or sled camps – this links back to the need for more specifically defining the project area and providing a detailed map.
8. What are the locations and dates of proposed lake and river crossings?
9. What are the proposed locations for ice bridges? Where will water for construction of ice bridges come from?
10. If travel near, springs, aufeis, or potential fish-bearing habitat is proposed, what baseline monitoring of ice depth, winter water volume, invertebrates, fish, and water chemistry will be conducted prior to, during and after the proposed activity? What will the statistical inference and change detection capabilities of these surveys be?
11. For areas that ice bridges are being proposed, what studies on channel morphometry and spring discharge/flooding extent will be conducted prior to, during and after ice breaches are created and breached? What will the statistical inference and change detection capabilities of these surveys be?

## 13.0 Recording Operations (and sound)

1. Noise or acoustic disturbance considerations, including ground penetrating vibrations, are not addressed from an environmental effects perspective.
2. Frequency, intensity, and duration of vibroseis?
3. Proximity to non-fish bearing and fish bearing waterbodies?



4. Potential impacts to fish considered?
5. 2nd paragraph, last sentence - Documents from the 2D seismic in 1002 in 1980s mentioned that the seismic receiver lines could be diverted a certain distance if needed to avoid areas of inadequate snow cover or sensitive vegetation. With the 3D seismic, is there a distance that a line could be altered if needed for some reason without compromising the data?

#### 14.0 Camp Facilities

1. How many camp areas will be used?
2. How many day on average will a camp be on a site?
3. Please give a breakdown of the ground pressure and footprint of the entire camp, vehicles, and equipment that will be there.
4. What are the proposed locations and timing of use for camps?
5. How close will camps be to a waterbody or wetland?
6. How close does the campsite need to be to the area you are working in?
7. The sentence in section 13, 2nd paragraph, should be added to this section. Like vibrators, camps, fuel haulers and small personnel carriers will also travel only on snow covered tundra or grounded sea ice, I assume.
8. How much water will be required for camp each day?
9. More detailed description of grey water discharge is needed (also part of section 18).
10. What is the maximum gradient the tracked tractors can pull the camp sleds? This is needed to determine where they would need to use the D7 Cats for moving the camp and an analysis of under what circumstances the camps cause damage. Is it when they remain in a place too long or is it the dragging them over the tundra or both?
11. What provisions are there for the after-shift outdoors activities of camp employees?

#### 15.0 Water Withdrawal (from lakes)

1. Any water withdrawal or additional freeze-down in a very water-limited environment is problematic – isolated, shallow lakes; minimal or absent winter flows in streams and rivers; minimum pool size and freezing-depth to protect overwinter fish habitat (in contrast with the NPRA where water is abundant and average snow depths much deeper). The PoOP provides no specific information on accessing water, fulfilling water requirements, or project locations, given the overall limitation of water in the 1002 area, and the effective working radius for travel from a water access point. Refer to 50 CFR § 37.31(c) Aquatic environment stipulations regarding water withdrawals, fisheries and fish habitat. The only exception to PoOP water discussion is sled camp usage (Page 10 under Water Withdrawal: SAExploration 2018) for potable water.
2. Is this proposal requesting withdrawal of lake water (or ice) that would be greater than 5,000 gallons? The Refuge has federal reserved water rights for all waterbodies and must ensure that adequate water quality and quantity meet Refuge purposes for diversity and maintenance of fish and wildlife populations.
2. What are the proposed locations of water withdraw from lakes? What is the recharge capability of these lakes based on drainage area and snow survey data? What baseline monitoring of invertebrates, water level, water chemistry, flow, and fish will be conducted prior to, during and



after any water withdraw greater than 5,000 gallons? What will the statistical inference and change detection capabilities of these surveys be?

#### 16.0 Temporary Snow Air Strips

1. What are the proposed locations of air strips? Conditions may change, but scouting sites at least a year in advance should be done to ensure feasibility. Grounded ice is often buckled and may be difficult and possibly unsafe to land on. There are large expanses of land greater than 30 miles with no lakes. There are also large expanses of land that are completely blown free of snow.
2. Are you proposing to use water and or ice chips to prepare landing strips on lakes?
3. When lakes cannot be used as airstrips, what is the site prep for tundra air strips? If there is minimal snow cover and the area is tussocks, will this be possible? Will tussocks and other sensitive areas be avoided? What equipment is involved and what environmental protection protocols will be in place?
4. What is the operating plan for working in areas that fixed-wing aircraft cannot access? Is there a need for helicopter access?
5. How many crew swaps will be carried out? i.e. how many times will an airstrip be used per week?
6. The original proposal notes that an example of an airstrip is listed in appendix E. Please provide appendix E.
7. What type of aircraft will be used? Wheeled or skis?

#### 17.0 Fuel Supply and Storage

1. How much fuel will be used per day?
2. What are the proposed locations for refueling and fuel storage and how much will be stored at each location and in what type of containers? What is the maximum amount of fuel that will be stored at a particular location? How many of these locations will there be at a given time and during the entire course of the project?
2. How far will fuel storage and fueling activity be from the active floodplain of any waterbody? How far away can fuel reasonably be stored from particular areas of concern?
3. Since there will be no refueling within a certain distance of any waterbody, what is the protocol for aerial fuel delivery, should it be needed. Will fuel be delivered in drums or will a tanker be used?
4. Please provide the Spill Prevention Countermeasure Control plan for fueling and fuel storage operations as appendix.
5. Please see questions in section 9.0 regarding what type of vehicle/equipment and environmental protection criteria will be required for transport of fuel. With regard to fuel transportation, we are particularly interested in the volume of fuel that will be transported in a particular vehicle under what environmental conditions (e.g., slope, snow and soil freezing depths, soil type).

#### 18.0 Waste Management

1. What are the volumes and proposed locations of discharge of gray water? How many gray water discharge locations will there be?
2. It is unclear how graywater discharge on the tundra meets standards for SAExploration environmental management (Page 4ff) or industry standards to minimize attracting human-



subsidized predators and other camp following wildlife (Pages 9-10 under 14.0 Camp Facilities and Page 11 under Waste Management: SAExploration 2018). Soapy water and floating bits of pasta in commercial quantities will leave a signature on the tundra well into the growing season regardless of APDES permit conditions. More importantly, this appears to contravene SAExploration's statement that "Food and food waste will be kept inside vehicles while out in the field" (Page 12 under 19.0 Wildlife: SAExploration 2018).

3. What type of hazardous wastes and in what quantities will be generated, stored and/or transported? What type of containers will they be stored in? Please provide a table.
4. Please see questions in section 9.0 regarding what type of vehicle/equipment and environmental protection criteria will be required for transport of hazardous materials. With regard to transport of hazardous material, we are particularly interested in the type and volume of hazardous materials that will be transported in a particular type of vehicle/equipment type and under what environmental conditions (e.g., slope, snow and soil freezing depths, soil type).
5. How will sanitary waste be disposed of (e.g., incinerated and then backhauled)?

## 19.0 Wildlife

1. The suggested ingress/egress route from Deadhorse to the 1002 area across the coastal plain, and inferring a similar, continuing route across the 1002 area, traverses critical denning habitat for the polar bear.
2. What is the intensity and wavelength of sound of equipment?
3. What types of animals will be impacted by sound and/or compaction of snow and disturbance? We don't just mean charismatic megafauna.
4. The only PoOP wildlife considerations are framed in human-wildlife encounters, inferring conflict situations principally with polar bears. Denning polar bears are one of the main concerns in this area during the winter. This section needs to be greatly expanded to discuss this issue. There are no environmental protections or wildlife mitigation measures to avoid, minimize, rectify, reduce, or compensate direct, indirect or cumulative effects of exploration similar to activities in the NPRA or adjoining areas (BLM 2012, 2013); Alpine Satellite Development Plan (BLM 2014, 2015); Greater Mooses Tooth Unit EA (e.g., Pp. 38-49 Appendix B Stipulations and Best Management Practices: BLM 2016); and, offshore areas (SAExploration 2016a, 2016b; BOEM 2017).
4. What are the potential impacts to freshwater and marine species from sound generated by vibrators?
5. What measures will be taken to reduce impacts of vibroseis sound on fish?
6. See additional questions regarding Wildlife Interaction Plan
7. What are the potential impacts of snow compaction on subnivian species?
8. Note – that the proposed dates of operation extend into the caribou calving season
9. There is no acknowledgement of snow-free tundra that may be attractive forage sites for caribou remaining through the winter period; higher than average denning of polar bears in the northeast section of the 1002 area ranging up to 25 miles or more from the coastline in the deep river ravines; pre-survey reconnaissance to identify and avoid bear dens; seasonal demobilization phase (25 Apr-31 May) when caribou may be arriving on calving grounds and calving, nor arrival of migratory birds, including raptors that may be establishing territories and nest sites; nor any other wildlife avoidance mitigation offered as a BMP, in a manner similar to ... (BLM 2012, 2013), etc. (BLM 2014, 2015, 2016; SAExploration 2016a, 2016b; BOEM 2017).



## 20.0 Historic and Cultural Resources

1. Is SEA implying that buffers for historic and cultural resources be determined from a point on the map that indicates the general vicinity of these resources or will the buffer be drawn from the actual area that resources cover?
2. There is no compliance with NHPA, nor any communication SHPO. See 50 CFR § 37.31(d) Cultural resources.

## Recommended Section: Wilderness

1. Could the objectives of the project be met with a buffer for designated Wilderness?

## Recommended Section: Post-Survey Impact Evaluation

1. What are the proposed survey designs and statistical inference short and long-term follow-up monitoring efforts to assess impacts and recovery of soil, tundra, and water resources following seismic exploration and how will this information be reported?
2. What are SAE's plans for supporting Post-Survey Impact Evaluations? SAE should be responsible for evaluating impacts to the tundra following the first winter's activities, so that adjustments can be made if necessary. Also, if warranted, SAE should be accountable for monitoring recovery of tundra/vegetation, soils, and water in the post survey years to follow. The evaluation of impacts should be done by third-party persons with defined qualifications, who report directly to BLM/FWS, and are paid for by SAE. Of course SAE would have full access to monitoring reports, but would not be a filter between resource monitor and us. This is also consistent with SAE's assertion in its plan of operations that it is continually assessing the impacts of its operations and making improvements in equipment and methods.

## Appendix B:

1. See questions related to section 9.0 for more information needs that should be added to equipment tables for each vehicle.
2. We would like more information on the equipment. Add some columns to table, to provide the following information for each line of table:
  - a. Vehicle weight
  - b. Pounds per square inch (psi)
  - c. Is unit tracked or wheeled?
  - d. If tracked, are tracks steel or rubber?
  - e. Are tracks cleated or cleatless?
3. Instead of putting 150-man sleigh camp in one line in table, itemize vehicles, sleds, and skis. For example, how many sled units are there, what is the footprint, and what is weight and the ground pressure (pounds per square inch) when empty and loaded to maximum? See additional questions related to section 9.0 for more information needs for vehicles and other equipment.



4. Itemize vehicles for transporting fuel. Are there just the 4 long haul fuelers or are there other smaller fuel vehicles? Do the fuel tanks on the list get hauled between camps full or empty? For each unit that is used to transport fuel over tundra, what is the footprint of the vehicle, and what is weight and the ground pressure (pounds per square inch) when empty and loaded to maximum??
5. CAT dozers and CAT loaders have high weight and psi. What are they used for? What precautions are taken to limit disturbance to tundra from them, travelling between camps as well as in camp? What is their weight empty and at maximum load, what is their footprint, what is their ground pressure empty and at maximum load?

#### Appendix D:

1. Add more photos, including camp sleighs, long haul fueler, Case/Steiger tractor, CAT dozer and CAT loader.

#### Appendix F: Wildlife Interaction Plan

1. This plan is not adequate. This proposal lays out a window of December 1 to May 31. Going this late impinges on the beginning of the calving and nesting season of wildlife using this area. As such, this proposal should have a significant section that lays out the Affected Environment and Environmental Consequences. Basically, all the details needed for the NEPA analysis should be included. They are not. These concerns include polar bears, particularly denning bears; caribou, particularly during calving; shorebird nesting which may be starting during this window; and water usage, especially considering that this is a relatively dry landscape compared to the NPRA and fish and other aquatic organisms are constrained to critical habitats that may already be near environmental thresholds.
2. In the SAE plan of operations, “heavy equipment” and “seismic activity” with regard to wildlife interactions needs to be further defined. For example, if there is a one mile avoidance area for a polar bear den, does that apply to laying of recording devices by hand or smaller vehicle, or just to the large vibroseis activity? For example, does a one mile avoidance area mean that no personnel, equipment, gear or anything else will come within one mile of a polar bear den? Does this apply to seal birthing dens and grizzly bear dens as well?
3. The Wildlife Interaction Plan and field operating procedure state that denning sites will be identified prior to operations, and then seems to leave setback and other stipulations as “to be determined” or “protocols of FWS will be followed.” There will be cases when decisions must be made while activities are in progress, but SAE should provide protocols and information that indicate their capabilities to make informed decisions ahead of time rather than during activities.
4. What is the survey design, operating procedure and resulting accuracy in identifying denning sites? Are these surveys done prior to any other activity or occupation of an area including caching equipment or fuel or conducting reconnaissance surveys to assess ice conditions, locations for camp moves, etc?
5. There is no compliance with ESA/MMPA, with focal emphasis on denning polar bears. Although not listed at the time of generating 50 CFR §§ 37, denning bears were considered [50 CFR §



37.31(b)(11); 50 CFR § 37.32(c)], now updated via MMPA incidental take regulations (ITR) (FWS 2013, FWS 2016b, FWS 2016c, FWS 2016d).

6. The data provided for polar bear numbers in the southern Beaufort Sea is out of date (Page 23 Polar Bears: SAExploration 2018).

#### Literature Cited

BLM (Bureau of Land Management). 2012. National Petroleum Reserve-Alaska: final integrated activity plan/environmental impact statement (7 vols.). Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.

BLM (Bureau of Land Management). 2013. National Petroleum Reserve-Alaska, integrated activity plan record of decision. Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.

BLM (Bureau of Land Management). 2014. Final supplemental environmental impact statement for the Alpine Satellite Development Plan GMT1 development project. Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.

BLM (Bureau of Land Management). 2015. Supplemental environmental impact statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project. Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.

BLM (Bureau of Land Management). 2016. Environmental assessment DOI-BLM-AKF01000-2107-001-EA [Greater Mooses Tooth Unit NPR-A]. Anchorage, AK: ConocoPhillips Alaska.

BOEM (Bureau of Ocean Energy Management). 2017. Liberty Development Project: development and production plan in the Beaufort Sea, Alaska, draft environmental impact statement. Anchorage, AK: U.S. Department of the Interior, Bureau of Ocean Energy Management OCS EIS/EA BOEM 2016-010.

Clough, N.K., P.C. Patton, and A.C. Christiansen. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resources assessment: report and recommendation to the Congress of the United States and final legislative environmental impact statement. Washington, D.C.: U.S. Department of the Interior, Geological Survey and Bureau of Land Management.

Emers, M. and J. C. Jorgenson. 1997. Effects of winter seismic exploration on the vegetation and soil thermal regime of the Arctic National Wildlife Refuge, Alaska. Pp. 443-456 in R.M.M. Crawford (ed.), Disturbance and recovery in Arctic lands: an ecological perspective. Dordrecht, Netherlands: Kluwer Academic Publishers.

Felix, N.A., and M.K. Raynolds. 1989a. The role of snow cover in limiting surface disturbance caused by winter seismic exploration. *Arctic* 42(2):62-68.

Felix, N.A., and M.K. Raynolds. 1989b. The effects of winter seismic trails on tundra vegetation in northeastern Alaska, U.S.A. *Arctic and Alpine Research* 21(2):188-202.



- Felix, N.A., M.K. Reynolds, J.C. Jorgenson, and K.E. DuBois. 1992. Resistance and resilience of tundra plant communities to disturbance by winter seismic vehicles. *Arctic and Alpine Research* 24(1):69-77.
- FWS (Fish and Wildlife Service). 2008. Endangered and threatened wildlife and plants; Determination of threatened status for the polar bear (*Ursus maritimus*) throughout its range; final rule. *Federal Register* 73(95):28212-28303.
- FWS (Fish and Wildlife Service). 2009. Endangered and threatened wildlife and plants; designation of critical habitat for the polar bear (*Ursus maritimus*) in the United States. *Federal Register* 74:56058-56086.
- FWS (Fish and Wildlife Service). 2013. Endangered and threatened wildlife and plants; special rule for the polar bear under Section 4(d) of the Endangered Species Act. *Federal Register* 78(34):11766-11788.
- FWS (Fish and Wildlife Service). 2016a. Polar bear conservation management plan. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.
- FWS (Fish and Wildlife Service). 2016b. Marine mammals; incidental take during specified activities: final rule. *Federal Register* 81(151):52276-52320.
- FWS (Fish and Wildlife Service). 2016c. Finding of no significant impact and environmental assessment for a final rule to authorize the incidental take of small numbers of polar bear (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) during oil and gas activities in the Beaufort Sea and adjacent coastal Alaska. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Marine Mammals Office.
- FWS (Fish and Wildlife Service). 2016d. Biological Opinion for polar bears and conference opinion for Pacific walrus on the proposed issuance of 2016-2021 Beaufort Sea incidental take regulations. Fairbanks, AK: U.S. Department of the Interior, Fish and Wildlife Service, Fairbanks Field Office.
- ~~Gliders, M.A., and M.A. Cronin. 2000. North Slope oil field development. Pp. 15-33 in J.C. Truett and S.R. Johnson (eds.), The natural history of an arctic oil field: development and the biota. San Diego, CA; Academic Press.~~
- SAExploration. 2016a. Aklaq 3D 2016/2017 program: plan of operations winter seismic survey. Anchorage, AK: SAExploration.
- SAExploration. 2016b. Beaufort Sea 3D-seismic survey: offshore seismic survey plan of operations 2016. Anchorage, AK: SAExploration.
- SAExploration. 2018 [assumed]. Marsh Creek 3D plan of operations winter seismic survey. Anchorage, AK: SAExploration, Inc.
- Truett, J.C., and K. Kertell. 1992. Tundra disturbance and ecosystem production: implications for impact assessment. *Environmental Management* 16(4):485-494.
- USACE (US Army Corps of Engineers). 2012. Point Thompson Development Project record of decision. Anchorage, AK: U.S. Department of the Army, Corps of Engineers, Alaska District.





BUREAU OF LAND MANAGEMENT  
Arctic District Office  
222 University Avenue  
Fairbanks, Alaska 99709-3816  
<http://www.blm.gov/ak>



May 22, 2018

In reply refer to:  
FF097424  
3152.00 (AKR000)

Ms. Suzan Simonds  
Permit and Regulatory Manager  
SAExploration Inc.  
8240 Sandlewood Place, Suite 102  
Anchorage, Alaska 99507

Subject: Oil and Gas Geophysical Exploration Application

Dear Ms. Simonds,

Title II of the Tax Cuts and Jobs Act of 2017 directed the Secretary of Interior to establish and administer a competitive oil and gas program within the Coastal Plain of Alaska. Because the Bureau of Land Management (BLM) manages the National Petroleum Reserve in Alaska (NPR-A) pursuant to the Naval Petroleum Reserves Production Act (1976), the BLM has been identified as the lead agency for permitting oil and gas related activities in the Arctic National Wildlife Refuge Coastal Plain area, including seismic exploration activities. Within the BLM the Arctic District Office has been tasked to process seismic applications for the area.

On April 19, 2018 the Alaska BLM State Office received an application from SAExploration to conduct seismic activity in the 1002 area of the Alaska National Wildlife Refuge. On May 3, 2018 the BLM Arctic District received a nonconfidential version of the plan of operations. BLM and USFWS met on May 4<sup>th</sup> to discuss the proposed action.

The regulations that cover the proposed action are 43 CFR 3152, Exploration in Alaska. Part 3152.1 provides information on what is required to be submitted as part of the application. SAExploration has provided information for items a thru f. Part f requires a plan for conducting the exploration activities. While SAExploration has submitted a plan of operations, the plan does not provide enough information for the BLM to adequately evaluate impacts of the proposed action on the environment as required by the National Environmental Policy Act (NEPA).



Please see attached list of questions entitled: "Marsh Creek 3D 2018 Winter Seismic Survey Plan of Operations (POO) BLM/USFWS Comments and Questions." We would ask that you respond to the questions and comments as soon as possible so that we may begin the NEPA process on the proposed action. Once BLM receives the answers to the attached questions we will start the 90 day review clock as required by 43 CFR 3152.2 a. and notify you if the 90 days cannot be met and refine our estimation of time needed to process your application

If you have any questions please contact Donna Wixon of my staff at 907-474-2301.

Sincerely,  
Nichelle Jones, Manager



Arctic District Office

Enclosures (1):

Marsh Creek 3D 2018 Winter Seismic Survey Plan of Operations (POO) BLM/USFWS Comments and Questions



## **Marsh Creek 3D 2018 Winter Seismic Survey Plan of Operations (POO): BLM/USFWS Comments and Questions**

### **General comments:**

1. What kind of lighting will be needed - tall light posts for equipment and storage areas; aircraft operations, localized lighting for worker camps, seismic line work, etc?
2. What is the normal and peak operating decibel levels of the camp generator and hours of operation each day or 24/7?
3. What are the total miles of seismic trails planned?
4. Will SAExploration Inc. be submitting a more detailed map of the actual proposed area of survey? This would greatly help in addressing impacts.
5. Does SAExploration, Inc. plan to avoid native allotments entirely?

### **Section 4.0 Environmental Management**

1. Please provide a write up of how you are doing things differently based on lessons learned from the past.
2. What are the steepest slopes that you would be conducting activity on and how do you propose to protect soil and vegetation?

### **Section 5.0 Cultural Interface**

1. This section mentions coordination with Kaktovik, what about Arctic Village and Venetie?
2. Applicant needs to submit a Subsistence Plan that meets the requirements of the 2013 Record of Decision (ROD) Best Management Practice (BMP) H-1 and also include:
  - Precise meeting dates and locations.
  - The names of and contact information for subsistence representatives and the biologist hired by SAE to work with the panel.
  - Reporting on mitigation measures and conflict avoidance agreements, if any, developed through such consultation.
  - Documentation of notification to allotment owners and camps and cabins users.
  - Procedures necessary to facilitate access by subsistence users to conduct their activities.
3. Applicant needs to follow the requirements of BMP H-2.

### **Section 6.0 Oversight Panel <sup>1</sup>**

1. When will the oversight Panel be formed?
2. How many people will be on the panel?
3. What types of people will be on the panel?
4. Will its members be residents of Kaktovik only?
5. Will the panel only report to Kaktovik?

---

<sup>1</sup> BLM would like to set up a meeting in June or July to discuss.



6. Does “cultural sites” refer to archaeological, historic, and/or traditional land use sites? If so, will this subsistence observer also be an archaeologist with access to the Alaska Heritage Resources Survey (AHRs) database (maintained by the Alaska State Historic Preservation Office) and the Traditional Land Use Inventory (TLUI) site within the study area (maintained by the North Slope Borough Department of Planning and Community Services)?

## **Section 7.2 Training Process**

1. Please provide an Orientation Program Plan following NPR-A BMP I-1 for BLM’s approval.

## **Section 8.0 Permit Requirements**

1. In table please include ESA Consultation under BLM
2. In table, under ADFG and Fish Habitat Permits, please add stream/river crossings.
3. In table under other approvals what lease holders are in the area?
4. What public outreach has taken place prior to application submittal, or as of today’s date?<sup>2</sup>

## **Section 9.0 Mobilization and Access**

1. “The crews will mobilize to existing gravel pads which will allow access to the tundra and provide a resupply area for the crews” (Page 7: SAExploration 2018). These gravel pads are not identified in the POO – whether inside the 1002 area boundary or adjacent to it. Where are the gravel pads and travel corridors? Locations of ingress and egress? Please submit a map showing ingress and egress with land status layer.
2. SAE states “SAE will attempt to coordinate with companies to use any existing or planned trails.” There are no existing trails in the permit area, what other companies are you referring to?
3. How close does the campsite need to be to the area you are working in?
4. What criteria will be used to determine if snow depth and coverage is adequate to minimize damage to the tundra vegetation?
5. Does SAE have a contingency plan should snow depth and cover not be adequate to minimize soil compaction and vegetation damage?
6. Please provide routes and what type of activity, storage, etc. that will occur at locations within the permit area.
7. Please provide a description of the current camp move practices and how they would help to protect the tundra.
8. Are there ice or snow roads between Dalton Highway and Point Thompson that you could travel on to reduce tundra damage? If not, could you travel some of the distance on sea ice?

---

<sup>2</sup> BLM would like to set up a meeting in June/July to discuss.



9. What are the operating plans and environmental protection protocols for tundra travel? How will these protocols differ for different snow and soil conditions and for travel on steep slopes, areas with sensitive soil/vegetation types, and near special areas (e.g. groundwater-fed springs, overflow ice, ice-hummocks, and waterbodies that may support fish?
10. For each type of activity/equipment (e.g. camp moves, resupplies, snow machine access, refueling, transport of fuel and hazardous chemicals), describe what the environmental regulations/limits will be for the following:
  - a. What is the maximum slope that operations for each type of activity/equipment would occur on? This information will allow us analyze the potential for impacts of different activities (e.g. fuel storage, transport of hazardous materials, camp moves, seismic) would be occurring on steep slopes.
  - b. What are the criteria for snow and soil characteristics that will be required for each type of activity/equipment? Will these criteria vary with slope and type of soil and vegetation?
11. Please provide the following information broken down in a table and linkable to GIS format along with a map:
  - a. Proposed route distance
  - b. Timing
  - c. Type of activity (e.g. resupply, camp move)
  - d. Type of equipment (e.g. vehicle type, sled, skis)
  - e. Weight of vehicle/equipment empty
  - f. Weight of equipment/vehicle fully loaded.
  - g. Pounds per square inch (PSI) pressure of vehicle, sled, or skis empty
  - h. Pounds per square inch (PSI) pressure of vehicle, sled, or skis fully loaded (note – this especially important for sleds or vehicles that haul large volumes of water or fuel, kitchen and bath units, etc.)
  - i. Total footprint of all vehicle or other equipment in contact with ground
  - j. Type of tire (tracked versus wheeled)
  - k. Track material (e.g. steel versus rubber)
  - l. Are tracks cleated or uncleated? Number of times a particular route would be exposed to a particular PSI from a particular vehicle, sled, or skis.
  - m. Maximum slope that this equipment would travel on and at what weights (minimum and maximum)
  - n. Snow depth requirements for this type of vehicle/equipment
  - o. Freezing depth requirements for this type of vehicle/equipment
  - p. Are hazardous material transported on this type of equipment?
  - q. Is more than 500 gallons of fuel be transported on this type of vehicle/equipment?
12. How and where will snow be gathered and moved for construction of snow trails and ramps?
13. How far can snow be transported for trail making?
14. What are the topographic and other criteria that elicit the need for creating snow ramps?
15. Verify that you would be prepacking snow trails.



16. What vehicles would be used for prepacking?
17. What equipment would be used for moving and placing snow?
18. How many resupply trips will be needed along routes?
19. How many vehicles and what type will be involved in resupply trips?
20. Will resupply vehicles use existing trails?
21. For the expected size and shape of the grid area, how many miles of camp move trails would there be within the work area (not including miles of access to reach the edge of the project area)?

## **Section 10.0 Survey and Ice Check**

1. What does low snow years mean exactly? If it means they will ensure that enough snow cover is present for equipment movements, then what are the minimum snow depths? Will tundra freeze-down be quantified prior to and/or during operations?
2. What provisions are there for the possibility that snow conditions deteriorate before the train returns?
3. Where would snow surveys be done in order to decide when exploration could begin?<sup>3</sup>
4. How will SAE gather data on frost and snow conditions?
5. There can be large expanses with no snow cover in the 1002 Area. What are the contingency plans in the event extensive areas with low snow cover and/or unfrozen ground are encountered?
6. What Lakes, rivers or sea ice would be traveled across?

## **Section 11.0 River Crossings (and lake)**

1. This element of the operations cannot just be permitted with ADF&G. In addition to ADF&G FHPs, the BLM & FWS must evaluate this activity as part of the NEPA process. The BLM already has some Best Management Practices (in the 2012 NPR-A IAP) related to stream/river crossings that can be used for guidance, but site specific evaluations will be necessary to determine if these BMPs or a modified version of the BMPs are most appropriate for this landscape. (Comment not question).
2. Describe how deep/steep banks would be crossed.
3. The POO provides no specific information on accessing water, water requirements, or ice bridge locations. Please provide.
4. Please provide a map that shows stream and lake crossings with a table that identifies the latitude and longitude of the corresponding crossings.
5. What are the proposed locations for ice bridges? Where will water for construction of ice bridges come from?
6. Does SAE propose any baseline monitoring of ice depth, winter water volume, invertebrates, fish, and water chemistry
7. If a crossing needs to be reinforced/built up for supporting equipment, where will liquid water come from? The BLM currently does not allow liquid water to be removed from rivers during the winter. If liquid water may need to be removed from lakes to build any

---

<sup>3</sup> BLM would like to set up a meeting in June/July to discuss



“ice bridges”, then the volumes would need to be accounted for in the lake water use request to the BLM/FWS for evaluation in the EA and in ADF&G FHPs and ADNR Temporary Water Use Permits.

8. Would the removal of snow for this purpose only occur on areas of grounded ice (from lakes and/or rivers)?
9. Would the removal of ice aggregate from grounded ice areas on a river be requested?

## **Section 12.0 Willow Protocol**

1. What criteria will be used to identify location and size of sensitive willow areas?
2. Will other vegetation types sensitive to seismic activities be considered when designing and constructing snow roads and trails? (Sensitive vegetation types include moist tussock tundra and low shrub vegetation categories.)
3. Please provide a weed plan following requirements of the NPR-A BMP M-2 for BLM Approval.

## **Section 13.0 Recording Operations (and sound)**

1. What is the frequency, intensity, and duration of vibroseis?
2. What is the proximity to non-fish bearing and fish bearing waterbodies?
3. Provide the location of waterbodies and table of information of the proximity to non-fish bearing and fish bearing waterbodies.
4. With the 3D seismic, is there a distance that a line could be altered if needed for some reason without compromising the data?
5. Please verify that vibrators would not be operating on lakes or rivers.
6. If vibroseis shots will be made over liquid water under ice, the permittee needs to review the following document and indicate how they would implement or otherwise address recommendations made to reduce potential impacts to fish.  
Morris, W., and J. Winters. 2005. Fish Behavioral and Physical Responses to Vibroseis Noise, Prudhoe Bay, Alaska 2003. Technical Report No. 05-02. Alaska Department of Natural Resources, Office of Habitat and Permitting.
7. What is SOS Methodology?

## **Section 14.0 Camp Facilities**

1. How many camp areas will be used?
2. How many days on average will a camp be on a site?
3. How much water will be required for camp each day?
4. What are the water requirements each year for this project?
5. Provide a more detailed description of grey water discharge
6. What is the maximum gradient the tracked tractors can pull the camp sleds?
7. Section 14 states: “If existing airstrips are within the project area those area may be utilized to allow personnel, food and fuel to be delivered to the work area”. Are there existing airstrips in the project area?
8. What is the predetermined route?



9. What is the Vsat communication system?

## **Section 15.0 Water Withdrawal (from lakes)**

1. Would snow for drinking water only be removed from grounded ice areas?
2. Water volume (liquid water and ice aggregate) requests must be made for each specific lake that might be used, for evaluation in the EA.
3. What information does SAE plan to collect or compile for planned use lakes.<sup>4</sup>

## **Section 16.0 Temporary Snow Air Strips**

1. Are you proposing to use water and or ice chips to prepare landing strips on lakes?
2. When lakes cannot be used as airstrips, what is the site prep for tundra air strips?
3. What equipment is involved in creating and maintaining airstrips?
4. We need to know which specific lakes might be used for an airstrip, the size of the airstrip, the procedure for building and maintaining an airstrip, and the intended placement and orientation.
5. If airstrips are built on lakes, additional data collection may be required to provide data regarding the extent of additional freeze-down under the airstrip, as compared to the remainder of the lake.
6. What is the operating plan for working in areas that fixed-wing aircraft cannot access? Is there a need for helicopter access?
7. How many crew swaps will be carried out? i.e. how many times will an airstrip be used per week?
8. What type of aircraft will be used? Wheeled or skis?
9. Section 16 states: "SAE will create a flat area on predetermined grounded, frozen lakes, or tundra to serve as landing strip to receive the aircraft for crew changes." This is in the Temporary Snow Airstrips section. Will tundra airstrips be built of snow or will ice be needed to make the airstrip?

## **Section 17.0 Fuel Supply and Storage**

1. How much fuel will be used per day?
2. How much fuel will be used for each year of the project?
3. What are the proposed locations for refueling and fuel storage?
4. What is the maximum amount of fuel that will be stored at a particular location? How many of these locations will there be at a given time and during the entire course of the project?
5. The POO states that the refueling distance from waterbodies would be 100 feet. The BLM NPR-A BMP requires 500 ft distance and we will consider this requirement for this project. We allow a deviation from the 500 ft. in the NPR-A because of the high density/close proximity of so many lakes that makes it impractical in many areas.

---

<sup>4</sup> BLM would like to set up a meeting in June/July to discuss.



6. Provide a copy of the SPCC plan(s) for this project with site-specific information included. Until it is complete provide:  
The size, type, and number of fuel storage tanks or other containers.  
What type of equipment/supplies will be available on site to respond to a spill?  
Describe any training requirements for employees handling fuel.
7. Since there will be no refueling within a certain distance of any waterbody, what is the protocol for aerial fuel delivery, should it be needed. Will fuel be delivered in drums or will a tanker be used?

## **Section 18.0 Waste Management**

1. What are the volumes and proposed locations of discharge of gray water? How many gray water discharge locations will there be?
2. Provide a copy of your APDES permit, and any requirements it may have for treatment before discharge.
3. Provide a hazardous waste plan following the requirements of the NPR-A BMP A-3.
4. Provide a Comprehensive Waste Management Plan following the requirements of the NPR-A BMP A-2.
5. What types of wastes are anticipated to be generated by seismic operations?

## **Section 19.0 Wildlife**

1. What is the intensity and wavelength of sound of equipment?

## **20.0 Historic and Cultural Resources**

1. Is SAE implying that buffers for historic and cultural resources be determined from a point on the map that indicates the general vicinity of these resources or will the buffer be drawn from the actual area that resources cover?
2. In response to the “if required,” in addition to background research of documented (“known”) cultural (historic, prehistoric, and TLUI) sites, SAE Exploration should conduct archaeological field surveys of all proposed travel routes and survey locations prior to the proposed seismic survey.<sup>5</sup>
3. The 500 foot minimum avoidance boundary around all cultural sites is adequate for seismic exploration. However, does SAExploration plan to consider the boundaries of all sites within the proposed seismic testing areas?
4. Most of the sites in both the AHRS and TLUI are referenced geospatially by a 1-dimensional point that is typically somewhere near the center of a 2-dimensional area. Sometimes cultural remains within a site can be distributed over hundreds of meters, thus extending beyond a roughly 150 meter (500 foot) buffer. SAExploration should not only survey for undocumented sites within the proposed seismic study areas, but also consider sites documented in the AHRS and TLUI databases and that are within the proposed seismic study areas. These sites should be included in the 2018 cultural field survey,

---

<sup>5</sup> BLM would like to set up a meeting in June/July to discuss.



where archaeologists should at minimum map the boundaries (i.e. the extent of cultural remains within a site) of sites within the seismic study areas that are spatially referenced by a point. Site buffers should then extend 500 feet from the site boundary.

## **Appendix D:**

1. Request more photos, including camp sleighs, long haul fueler, Case/Steiger tractor, CAT dozer and CAT loader.

## **Appendix F: Wildlife Interaction Plan**

1. In the SAE plan of operations, “heavy equipment” and “seismic activity” with regard to wildlife interactions needs to be further defined. For example, if there is a one mile avoidance area for a polar bear den, does that apply to laying of recording devices by hand or smaller vehicle, or just to the large vibroseis activity? For example, does a one mile avoidance area mean that no personnel, equipment, gear or anything else will come within one mile of a polar bear den? Does this apply to seal birthing dens and grizzly bear dens as well?
2. “A polar bear den detection survey shall be conducted prior to activities occurring in polar bear denning habitat during the maternal denning period (November to mid-April).” How will this survey be conducted?
3. Will all suitable denning habitat within the entire 1002 area be surveyed?
4. What is the survey design, operating procedure and resulting accuracy in identifying denning sites? Are these surveys done prior to any other activity or occupation of an area including caching equipment or fuel or conducting reconnaissance surveys to assess ice conditions, locations for camp moves, etc?<sup>6</sup>
5. The data provided for polar bear numbers in the southern Beaufort Sea is out of date (Page 23 Polar Bears: SAExploration 2018).
  - a. Current estimate of polar bears in the Southern Beaufort Sea population is estimated to be 900 and declining (see Bromaghian 2010)
  - b. Global population is estimated to be 22,000 – 31,000 with an average of 26,000 (see FWS 5-year review 2017)
6. “Aircraft will avoid flying over ideal Polar Bear habitat including but not limited to sea ice and barrier islands.” Please define what is considered to be “ideal” polar bear habitat.
7. “Vessels and aircraft will avoid areas in which subsistence hunting is being conducted.” Are vessels being used for this project? If so please describe.
8. “The Project Manager and wilderness guides have overall responsibility.” What are “wilderness guides” (also called wildlife guide in some places in the document)? Please describe training and responsibilities. This is not a position that was described in the polar bear section of this plan.
9. If the bear takes refuge near or in a vehicle and does not appear likely to move, crew HSE will be notified depending on the location of operation. No action will be taken unless

---

<sup>6</sup> BLM would like to set up a meeting in June/July to discuss.



authorized by the AKFG or their designated agents.” Assuming that AKFG is the Alaska Department of Fish and Game (ADFG), please correct in all locations in document.

10. Field Operating Procedure Polar Bear Protocol

- a. In numbers 1 and 7 of this protocol include the distance that must be maintained from known densities.



**To:** Bud Cribley[bud\_cribley@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-06-12T13:07:18-04:00  
**Importance:** Normal  
**Subject:** FW: DS Memo on Cooperating Agency process  
**Received:** 2018-06-12T13:07:30-04:00  
[DS Memo Coop Agency Process.pdf](#)

FYI ☺

---

**From:** Greg Siekaniec [mailto:[greg\\_siekaniec@fws.gov](mailto:greg_siekaniec@fws.gov)]  
**Sent:** Tuesday, June 12, 2018 8:55 AM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>  
**Cc:** Karen Clark <[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)>; Mary Colligan <[mary\\_colligan@fws.gov](mailto:mary_colligan@fws.gov)>; Mitch Ellis <[mitch\\_ellis@fws.gov](mailto:mitch_ellis@fws.gov)>; Socheata Lor <[socheata\\_lor@fws.gov](mailto:socheata_lor@fws.gov)>  
**Subject:** Re: DS Memo on Cooperating Agency process

Thanks Wendy. I read this last night and agree that the changes address what you note. A new way of conducting business.

Greg

Sent from my iPhone

On Jun 12, 2018, at 8:49 AM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Hi Greg and Karen,

Attached is new guidance from the Deputy Secretary on MOUs for DOI agencies working together, and it appears to make unnecessary the MOU we were in the process of sunning for our work with BLM on the Coastal Plain Leasing EIS. I believe it is also likely applies to the Seismic EA for which we are attempting to finalize a project initiation letter.

Let me know if you believe otherwise.

Thanks,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

<DS Memo Coop Agency Process.pdf>






THE DEPUTY SECRETARY OF THE INTERIOR  
WASHINGTON

JUN 11 2018

Memorandum

To: Assistant Secretaries  
Head of Bureaus and Offices  
Directors of State, Regional, and Field Offices

From: Deputy Secretary 

Subject: Standardized Intra-Department Procedures Replacing Individual Memoranda of Understanding for Bureaus Working as Cooperating Agencies

Department of the Interior (Department or DOI) Bureaus that are asked by another DOI Bureau that is the lead agency in a National Environmental Policy Act (NEPA) review shall act as a cooperating agency based on the following parameters, and without the need for an individual Memorandum of Understanding (MOU).

**Background**

The National Environment and Policy Act (NEPA),<sup>1</sup> through the Council on Environmental Quality,<sup>2</sup> directs lead agencies conducting environmental reviews to include other Federal or State agencies with jurisdiction, either by subject matter expertise or by law, as cooperating agencies during a NEPA analysis. Federal and State Agencies historically formalize this relationship through the use of a MOU to clarify each agency's roles and responsibilities.

Despite residing within the same department, DOI's Bureaus have also employed NEPA cooperating agency MOUs. Intra-Department MOUs were intended to coordinate Bureau efforts and direct the deployment of resources, yet they often and unnecessarily delay environmental reviews. Accordingly, the following guidance replaces the Intra-Department MOU process with standardized guidance for efficient NEPA review and Bureau collaboration.

**Directive**

Intra-Department Bureaus that are asked to participate in the NEPA process<sup>3</sup>, where another DOI Bureau is the lead Agency, and that qualifies as a cooperating agency under 42 U.S.C. § 4332 and 40 CFR 1501.6, shall act as a cooperating agency without developing an individual MOU. Instead, the agreements below should serve as their operating agreement.

---

<sup>1</sup> 42 U.S.C. §4332.

<sup>2</sup> 40 CFR 1501.6.

<sup>3</sup> The direction in this Memorandum applies to Environmental Impact Statements, Environmental Assessments, Categorical Exclusions, and any other form of analysis under NEPA.



## **Agreements**

Intra-Department cooperating agency relationships shall be conducted in accordance with 40 CFR 1501.5 and 1501.6 and this section, which sets forth the Bureaus' cooperative roles in the NEPA review process:

## **Determination of Lead Agencies**

When a project proponent or agency proposes an action as defined by the Administrative Procedure Act §704 or by 40 CFR §1508.18, lead and cooperating agencies shall be determined as soon as practicable according to 40 CFR 1501.5 and 1501.6. The lead and cooperating agency shall immediately designate a Point of Contact (POC) to represent each Bureau in Intra-Departmental consultations regarding that project or action.<sup>4</sup>

In executing this process, Lead Agencies shall:

- a. request the participation of each cooperating agency in the NEPA process at the earliest practicable time;
- b. use the environmental analysis and proposals of cooperating agencies with jurisdiction, by law or special expertise, to the maximum extent possible, consistent with its responsibility as the lead agency;
- c. to the extent possible:<sup>5</sup>
  1. Recover costs from project proponents; and
  2. Fund major activities or analyses it requests from cooperating agencies, and include such funding requirements for NEPA analysis in project budget requests, to the extent that project proponents are not already paying for the analysis.
- d. organize the NEPA review for a proposed project or action, including assigning a Senior Executive Service (SES) official to lead the NEPA review process and identifying a primary POC at each cooperating or participating agency;
- e. meet with a cooperating agency at that Bureau's request;
- f. prepare and coordinate Federal Register notices and filing Environmental Impact Statement (EIS) with EPA;
- g. prepare the sole NEPA analysis for the project in coordination with the cooperating agencies. All NEPA analyses should include an adequate level of detail to inform decision makers regarding the environmental impacts of a proposed project or action while maintaining the Department's document and timeline standards;
- h. inform cooperating agencies of new material information and changes related to the project or action;
- i. review and consider comments submitted by cooperating agencies;

---

<sup>4</sup> In instances where Bureaus are co-lead agencies, it is incumbent upon them to determine which acts as the administrative lead agency with final responsibility responsible for completion of the tasks within the Lead Agency section of this Memorandum. However, co-lead agencies shall work together to complete these responsibilities.

<sup>5</sup> The terms in this paragraph apply to both intra and inter Departmental NEPA analysis.



- j. if required, develop the NEPA document's purpose and need, identify the range of alternatives to be analyzed, identify the preferred alternative(s), and determine whether to develop the preferred alternative to a higher level of detail;
- k. provide cooperating agencies the opportunity to review and contribute to all relevant and substantive phases of the NEPA analysis and its preparation;
- l. if required by One Federal Decision (OFD), prepare and publish a single Record of Decision (ROD) for all cooperating agencies responsible for the project or action to support any necessary authorization decisions. The ROD will incorporate the decisions of each such agency; and
- m. maintain a contemporaneous Decision File of the information assembled and utilized by the cooperating agencies as the basis for their NEPA review.

In executing this process, Cooperating Agencies shall:

- a. participate in the NEPA process beginning at the earliest practicable time;
- b. participate in the scoping process, attend regularly scheduled meetings, and engage in any other activity necessary to efficiently conduct a project's NEPA analysis;
- c. upon the request of the lead agency, assume responsibility for developing information and preparing environmental analyses, including portions of an Environmental Assessment (EA) or EIS with which that Bureau has special expertise;
- d. review and submit comments to the lead agency on the environmental analysis performed by the lead and other cooperating agencies within the specified timeframe;
- e. if required by OFD, participate in the preparation of a single ROD by providing technical drafting assistance and comments that support the underlying authorization decision;
- f. compile a contemporaneous Decision File composed of all documents and communications that inform the cooperating agency's analysis, and systematically provide those documents to the lead agency; and
- g. make staff support available at the lead agency's request, within the Bureau's available resources.

### **Dispute Resolution**

- a. Any disputes arising among lead and cooperating agencies in the NEPA review process shall be promptly brought to the attention of the appropriate first line SES members with authority over the project, or the office responsible for the NEPA review, and be resolved by them;
- b. In the event that first line SES members are unable to resolve such disputes, the issue shall be raised to the appropriate Bureau directors for resolution;
- c. In the event that Bureau directors are unable to resolve such disputes, the issue shall be raised to the appropriate Assistant Secretaries for resolution; and
- d. In the event that Assistant Secretaries are unable to resolve such disputes, the issue shall be raised to the Office of the Deputy Secretary for resolution.



## **NEPA Timelines, Schedules, and Document Page Count**

- a. When conducting a NEPA analysis, Intra-Departmental cooperating agencies shall strive to meet the page count and timelines set forth in Secretarial Order 3355 by agreeing upon a timeline or schedule of milestones;
- b. If a proposed project or agency action qualifies as a Fixing America's Surface Transportation Act or OFD action, then Intra-Departmental Bureaus will comply with the timelines set forth in the OFD Memorandum of Understanding;
- c. To comply with agreed upon timelines, Intra-Departmental agencies shall cooperate, communicate, share information, and resolve conflicts that could prevent timely completion of the NEPA review; and  
Each agreed upon project or action schedule shall be uploaded to the NEPA and Permit Database by the lead agency, and where appropriate, the Federal Permitting Dashboard, as soon as is practicable based upon the timely filing of the project or action's Notice of Intent (NOI).

## **Communication**

Intra-Department cooperating agencies shall proactively participate in environmental reviews by communicating with one another, as well as project proponents and stakeholders, in an effective and structured manner that starts early and continues throughout the review process. Active communication will provide all cooperating agencies with the opportunity to identify concerns, raise potential issues early in the review process, and identify solutions.

## **Concurrent Reviews**

Cooperating agencies shall carry out their obligations with respect to NEPA concurrent to the review performed by the lead agency.<sup>6</sup> Intra-Department NEPA reviews shall also be conducted according to the guidelines within Secretary Order 3355.

## **Additional Provisions**

- a. Nothing contained in this Memorandum is intended to or should be construed to limit or affect the authority or legal responsibilities of the Department's Bureaus, nor bind Bureaus to perform actions beyond their respective authorities;
- b. This Memorandum shall be implemented consistent with applicable law and subject to the availability of appropriations;
- c. Specific activities that involve the transfer of money, services, or property between or among the Bureaus may require execution of separate agreements or contracts that occur as a matter of course;
- d. This Memorandum does not preclude the utilization of NEPA compliance agreements between Bureaus that were in place prior to its effective date; and

---

<sup>6</sup> Concurrent review includes but is not limited to Section 7 review under the Endangered Species Act, Section 106 review under the National Historic Preservation Act, and other permitting activities such as coordinating Right-of-Way authorizations.



- e. This Memorandum is not intended to and does not create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

**Effective Date**

This Memorandum is effective immediately upon distribution and shall remain in effect until revoked in writing by the Deputy Secretary.

The Heads of Bureaus and Offices are responsible for transmitting this Memorandum to the appropriate staff in the State, regional, and field offices.



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Trawicki, John  
**Sent:** 2018-06-12T14:16:23-04:00  
**Importance:** Normal  
**Subject:** Fwd: Scoping Comments  
**Received:** 2018-06-12T14:17:09-04:00  
[Coastal plain w characteristics and values 6 11 2018 \(1\).docx](#)

sorry- thought I sent them last night.

----- Forwarded message -----

From: **Joanna Fox** <[joanna\\_fox@fws.gov](mailto:joanna_fox@fws.gov)>  
Date: Mon, Jun 11, 2018 at 2:23 PM  
Subject: Re: Scoping Comments  
To: John Trawicki <[john\\_trawicki@fws.gov](mailto:john_trawicki@fws.gov)>

Hi John,

Here are Roger's revised comments. Feel free to give me a call before 3pm today, or to call Roger if you have questions or need clarification. I'll be out of the office attending scoping meetings in Kaktovik tomorrow and Wednesday, and will return Thursday.

Thank you,  
Joanna

---

Joanna L. Fox  
Deputy Refuge Manager  
Arctic National Wildlife Refuge  
101 12th Avenue, Room 236  
Fairbanks, AK 99701  
(907) 456-0549

Follow us on Facebook!  
[www.facebook.com/arcticnationalwildliferefuge](https://www.facebook.com/arcticnationalwildliferefuge)

*"Do what you can, with what you have, where you are." -- Theodore Roosevelt*

On Mon, Jun 11, 2018 at 7:36 AM Trawicki, John <[john\\_trawicki@fws.gov](mailto:john_trawicki@fws.gov)> wrote:

Joanna-

Could you work with Rodger to phrase wilderness and wildness into a scoping comment. Most of the background information will not be included. Other topics were a bit easier to sort through, Wilderness/wildness is a bit of a challenge.

Attached is what is submitted and I will also forward a few examples of scoping comments from other projects. Sorry for the rush, but will need this by noon today.



--

John Trawicki  
Water Resources Branch Chief  
National Wildlife Refuge System, Alaska  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
Work: (907) 786-3474  
Mobile: (907) 360-1656

"The single biggest problem with communication is the illusion that it has taken place"  
George Bernard Shaw

--

John Trawicki  
Water Resources Branch Chief  
National Wildlife Refuge System, Alaska  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
Work: (907) 786-3474  
Mobile: (907) 360-1656

"The single biggest problem with communication is the illusion that it has taken place"  
George Bernard Shaw



## Arctic Refuge Coastal plain wilderness characteristics and values

The Arctic Refuge, including the coastal plain, was initially proposed by the National Park Service as “The Last Great Wilderness” (Kaye 2006) and Public Land Order 2214 (1960) which established the Range identified preservation of wilderness values as one of the area’s three purposes. So to clarify, the wilderness characteristics and values we ask BLM to incorporate are based on the still applicable 1960 wilderness purpose of the original Arctic Range and the wilderness values referenced in ANILCA sections 101(b) and 304(g).

Consistent with this wilderness purpose, the Refuge’s 2015 Comprehensive Conservation Plan (CCP) recommended the 1002 area for Wilderness designation because it exemplifies these wilderness qualities which provide the context within which most of the Refuge’s Special Values (FWS 2015) are understood and appreciated. These include qualities that are tangible, and those that are intangible and resist quantification but are central to the coastal plain’s wilderness purpose and its function within the larger Refuge. It includes the experiential values of those who visit, and vicarious values for those who find satisfaction and inspiration in just knowing the area exists. Wilderness associated characteristics include ecological, scientific, wildlife, aesthetic, recreational, and wildness qualities, and an encompassing symbolic value.

We ask BLM to recognize that these qualities comprise the composite, holistic resource of wilderness and that it is more than the sum of its parts. The degree to which wilderness is perpetuated or diminished depends on the collective degree to which the components are protected or impacted. As well, BLM should recognize that every degradation of the area’s wilderness qualities erodes its encompassing symbolism, that is, its representation of the hope that one of the finest remnants of our natural heritage will be passed on to future generations, undiminished. Thus, we ask BLM to include wilderness and its symbolism as among the qualities that would be lost to the proposed action.

Beyond the coastal plain, we request that BLM recognize potential impacts upon the adjacent designated Wilderness area, and that it develop buffer zones to minimize the effect of exploration activities on the Wilderness area.



## Literature Cited

Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. *International Journal of Wilderness*. 16: 13-20.

Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

Kaye, R. 2006. *Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge*. University of Alaska Press, Fairbanks, Alaska.

Sumner, L. 1985. Arctic National Wildlife Refuge address, 25<sup>th</sup> anniversary. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

U. S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.



**To:** Joshua Rose[Joshua\_Rose@fws.gov]; Wendy Loya[wendy\_loya@fws.gov]; Joanna Fox[joanna\_fox@fws.gov]  
**From:** Trawicki, John  
**Sent:** 2018-06-13T13:09:00-04:00  
**Importance:** Normal  
**Subject:** Fwd: Annotated Literature Updates & Cumulative Effects Matrix  
**Received:** 2018-06-13T13:09:53-04:00  
[Coastal Plain 1002 Area Oil & Gas Cumulative Lit Review 11Jun2018jwm.docx](#)  
[MITIGATION MATRIX Coastal plain 1002 area DRAFT11Jun2018.docx](#)

fyi

----- Forwarded message -----

From: **Martin, John** <[john\\_w\\_martin@fws.gov](mailto:john_w_martin@fws.gov)>  
Date: Mon, Jun 11, 2018 at 2:20 PM  
Subject: Annotated Literature Updates & Cumulative Effects Matrix  
To: Stephanie Brady <[stephanie\\_brady@fws.gov](mailto:stephanie_brady@fws.gov)>, John Trawicki <[john\\_trawicki@fws.gov](mailto:john_trawicki@fws.gov)>, Margaret Perdue <[margaret\\_perdue@fws.gov](mailto:margaret_perdue@fws.gov)>, Greta Burkart <[greta\\_burkart@fws.gov](mailto:greta_burkart@fws.gov)>, Paul Leonard <[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)>

FYI

Latest updates per subject line - 11 Jun 2018. All are subject to change, further discussion and input, and may still be considered less-than-exhaustive.

Both have been added to RO Natural Resources Common Drive/1002ArcticRefuge/1-Working under Literature to support Resource Assessments.

Please distribute to whoever may benefit.

Thanks

John

--

John Trawicki  
Water Resources Branch Chief  
National Wildlife Refuge System, Alaska  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
Work: (907) 786-3474  
Mobile: (907) 360-1656

"The single biggest problem with communication is the illusion that it has taken place"  
George Bernard Shaw



**Coastal plain 1002 area, Arctic NWR, oil & gas program environmental effects summary.**

- identify the desired functional landscape with a historic range of variability (HRV), or alternatively, future desired condition (FDC) sequentially & collectively through all phases of oil & gas program: seismic exploration, development, production, transportation, & oilfield abandonment. Note cumulative effects considers all phases of oil & gas program.
- account for projected milder climate regimes, e.g., annual mean high & low temperatures; longer frost-free growing season; fewer days below freezing; changes in precipitation & transpiration; etc.
- scenario planning that will most likely entail: (1) rapid & continuing change (disruptive, punctuated); (2) sequential & measured change (steady state); (3) refugia (no change from present); or, combinations of these.
- industry & land management BMPs/ROPs work only at the broadest level & only if monitored & enforced

subject (overlap will need to be addressed, with final categorical definitions)	environmental effects context and intensity							connected resources, factors, or other considerations	unavoidable adverse effects (aka BLM residual effects)
	direct short-term	direct long-term	indirect short-term	indirect long-term	cumulative - a climate change	cumulative - b industry incremental	cumulative collective		
<b>soils, permafrost &amp; wetlands</b>									
permafrost					yes	incremental	yes	climate change; <i>uncertainty</i> ;	incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
thermokarst & ponding					yes	incremental	yes	climate change; <i>uncertainty</i> ; restoration & rehabilitation	
soil temperature					yes	incremental	yes	climate change; <i>uncertainty</i> ; biotic communities & vegetation	
soil compaction					yes	yes	yes	industry activity; <i>uncertainty</i> ; biotic communities & vegetation; ecosystem resilience; available snow depth; restoration & rehabilitation	
freeze-thaw/rain-on-snow events					yes	no	yes	climate change; caribou foraging; storm events	
<b>biotic communities &amp; vegetation</b>									
invasive species (all taxa: nonvascular & vascular plants, invertebrates, vertebrates, pathogens)	yes	yes	Yes	yes	yes	yes [any BMPs need to be adaptive, continuously reviewed & updated]	yes	surface disturbance type; ecosystem resilience; small mammal herbivory; BMPs effective only if enforced; effective EDRR; restoration & rehabilitation	> any invasive species pioneering & establishment directly connected with industry that cannot be contained or controlled via BMP/ROP or mitigation > incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
<b>coastal resources &amp; processes</b>									
erosion, mass wasting					yes	incremental	yes	climate change; storm events; permafrost; hydrological cycle change	
sea level rise					yes	no	yes	climate change; coastal erosion; coastline wildlife movement corridors	
declining sea ice					yes	no	yes	polar bear & seals; marine forage fish	
<b>water resources (quality &amp; quantity)</b>									
freshwater								climate change; erosion, mass wasting; recharge - glacial meltwater, precipitation, groundwater	
running waters								industry activity;	
water quality (turbidity, bank stability, sedimentation, nutrient recharge, temperature, O <sub>2</sub> )									
water quantity -									
ponds & lakes									
water quality (saltwater intrusion, temperature change with withdrawal, O <sub>2</sub> , sedimentation, nutrient recharge)									
water quantity -									
groundwater					yes	incremental	yes	industry activity;	
water quality -									
water quantity -									
gravel & substrate (incl within & independent of primary channels)					unlikely	yes	yes	industry activity; invasive species	
brackish & marine								sea level rise,	incremental-incremental may positively affect overwinter habitat for fisheries through creation of new deep water pools of abandoned gravel quarries
sedimentation, nutrient recharge								freshwater plumes from river discharge, spring runoff events	



climate (based on HRV, present & projected trends)									
biotic community shifts (new seral or climax – new community equilibrium)					yes	incremental	yes	climate change; ecosystem resilience; invasive species; <i>uncertainty</i>	
shrub - grass/forb encroachment					yes	incremental	yes	climate change; ecosystem resilience; invasive species	
new spp assemblages: displacement or replacement					yes	unlikely	yes	climate change; ecosystem resilience; <i>uncertainty</i>	
phenological mismatch					yes	no	yes	climate change; shorebirds & insectivorous spp; foraging spp (caribou, sheep, muskox); <i>uncertainty</i>	
modified hydrological cycles – continental air mass (i.e., less precipitation/snowfall)					yes	no	yes	climate change;	
ecosystem process & functions (drivers & stressors)					yes	unlikely	yes	climate change; <i>uncertainty</i>	
disturbance regime					yes	incremental	yes	climate change; ecosystem resilience; <i>uncertainty</i>	
ecosystem resilience					yes	incremental	yes	climate change; <i>uncertainty</i>	
fire regime					yes	unlikely	yes	climate change; ecosystem resilience; invasive species	
storm events								climate change; hydrological cycle; temperature regime	
modified temperature regimes (x̄ seasonal high/low temperatures) – continental air mass								climate change; <i>uncertainty</i>	
rain-on-snow events					yes	no	yes	climate change; <i>uncertainty</i> ; forage availability for caribou, sheep, muskox	
beaver expansion into tundra (other boreal species?)					yes	unlikely	yes	climate change; <i>uncertainty</i> ; vegetation change; thermokarst; water temperature change; alteration of ecosystem resilience	consequences of beaver habitat alteration may affect industry capacity; affect native species/habitat natural disturbance regimes
industry-based effects									
oil & gas exploration	yes		yes		yes	incremental	yes	current industry standard: winter activity period only; 10 Dec-1 May annually, with staging activities beyond this window undefined; no surface occupation; ecosystem resilience; invasive species	
oil & gas development	yes	yes	yes	yes	yes	incremental	yes	current industry standard: surface occupation; ecosystem resilience; invasive species	
gravel & substrate									incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
oil & gas production	yes	yes	yes	yes	yes	incremental	yes	current industry standard: surface occupation; ecosystem resilience; invasive species	
gravel & substrate									incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
oil & gas transportation	yes	yes	yes	yes	yes	incremental	yes	current industry standard: surface occupation; ecosystem resilience; invasive species	
gravel & substrate									incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
oil & gas restoration & rehabilitation		yes		yes				current industry standard: frequently unsuccessful; <i>uncertainty</i> ; climate change may make restoration problematic; ecosystem resilience; invasive species	see below oilfield abandonment; restoration & rehabilitation
infrastructure development (roads or other ROWs, communication towers, fiber optics, waste sites, etc)					yes	incremental	yes	current industry standard: surface occupation	incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
increased human access					na	incremental	yes	some predictable, other increased activity uncertain	
other extraction development (locatable, leasable, salable; rare earths or precious minerals)	yes	yes	Yes	yes	na	incremental	yes	some predictable, others uncertain – market-economy driven: communications, fiber optics, public access, hunting pressure, staging area build-up, increased traffic (air, land, sea) ...	
industrial solid waste stream management									
industrial wastewater treatment incl reinjection									
effluent wastes with 1 <sup>o</sup> & 2 <sup>o</sup> treatment									
air quality									
ambient levels	--	--	--	--	--	--	--		



oil & gas exploration	yes	no	unlikely	no	no	unlikely	unlikely		
oil & gas development, production, transportation		yes	yes	yes	no	incremental	yes		
<b>contaminants &amp; spill contingency</b>								linked with subsistence resource use	
incident control & containment, preset staging of equipment					no	yes	yes	magnitude, duration-exposure, frequency, agent	
absorption, inhalation, ingestion of toxins or contaminants					no	yes	yes		
clean-up (standards & procedures)					no	yes	yes		
<b>acoustic environment</b>									
ambient levels	--	--	--	--	no	--	--		
thresholds of disturbance (spp tolerance & adaptability)					no	yes	yes		
<b>fisheries</b>								linked with climate change; subsistence resource use	
existing/projected overwinter habitat								climate change	incremental-industrial may positively affect overwinter habitat for fisheries through creation of new deep water pools of abandoned gravel quarries
anadromous spp									
fish passage (incl arthropod movement)									
<b>birds</b>								all: linked with climate change; industry activity; uncertainty; subsistence resource use	
raptors (emphasis Gyrfalcon, Golden Eagle, Bald Eagle breeding events)					yes		yes		
resident spp					yes		yes		
migratory birds (emphasis on breeding events)					yes		yes		
eidlers (Common Eider; King Eider; Spectacled Eider-listed; Steller's Eider-listed)					yes	incremental	yes		
waterfowl/water birds (Yellow-billed Loon; Snow Goose; Brant; Tundra Swan – waterfowl for consistency with historic evaluations)					yes	incremental	yes		
shorebirds (tundra plovers, Dunlin, Semipalmated Sandpiper)					yes	incremental	yes		
land birds (tundra ptarmigan; Smith's Longspur; Horned Lark-American Pipit for ease of monitoring)					yes	incremental	yes		
<b>caribou</b> (Central Arctic & Porcupine herds)								all: linked with climate change; uncertainty; subsistence resource use; international considerations	
movement corridors					yes	incremental	yes		
wintering habitat					yes	incremental	yes		
calving habitat – productivity/survivorship (incl plant phenology, nutrition value lactating ♀s)					yes	incremental	yes		
habitat forage quality					yes	incremental	yes		
insect-relief habitat					yes	incremental	yes		
predation (wolf, Golden Eagle)					unlikely	unlikely	unlikely	calf survival	
industry/human disturbance/displacement [population-level effects]					no	yes	yes	industry activity;	incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
<b>other wildlife issues</b>								all: linked with climate change; uncertainty; subsistence resource use	
human-subsidized predators (fox, raven, gull, etc)					no	yes	yes	industry activity; climate change; alternative prey resources; lemming population fluctuations; waterfowl & shorebirds;	incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
population outbreaks/irruptions									
disease vectoring/pathogen outbreaks									
Dall sheep									



muskox									
furbearers									
small mammal herbivory; population fluctuations; & effect on human-subsidized predators as alternative food resource					yes	incremental	yes	industry activity; climate change; <i>uncertainty</i> ; nutrient availability; human-subsidized predators; shorebirds/waterfowl; caribou foraging	
<b>polar bear</b>								linked with climate change; <i>uncertainty</i> ; international considerations	
denning habitat					yes	incremental	yes		
food & habitat resources					yes	incremental	yes		
coastal corridor & coastal area to denning site movement					yes	incremental	yes		
disturbance/avoidance					no	yes	yes	industry activity type	
incidental take & harassment (population-level effects)					no	yes	yes	industry activity type; <i>uncertainty</i> ;	Incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
<b>bowhead whale, ringed &amp; bearded seals</b>								linked with climate change; <i>uncertainty</i> ; subsistence resource use	
disturbance/avoidance					no	yes	yes		
<b>cultural resources</b> (archaeological, historical, cultural sites or affinity)									
concentrated sites or districts					na	??			
inadvertent discovery(s)					na	yes			
<b>paleontological resources</b>									
concentrated sites or districts					na	??			
inadvertent discovery(s)					na	yes			
<b>human dimensions</b>									
- national interest									
- local interest									
- international (Arctic Council; community of practice)									
- historical background	--	--	--	--	--	--	--		
- public use (access to resources)					yes	incremental	yes		
- subsistence use									
- visitor use									
- socioeconomics									
- public health					yes	incremental	yes	pathogen & disease vectoring; emerging epizootics linked with climate change; industry work schedules & personnel rollover	
- tourism									
<b>wilderness value</b>									
wilderness characteristics					unlikely	yes	yes		Incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
<b>oilfield abandonment; restoration &amp; rehabilitation</b>								linked with climate change; <i>uncertainty</i> ; subsistence resource use; human dimensions; wilderness values	
climate change preclusion to restoration of original state					yes	incremental	yes		> partial or incomplete restoration & rehabilitation; preclusions due to climate change > incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
invasive species displacement/replacement					yes	incremental	yes		Incremental-industrial most likely irreversible & irretrievable commitment of resources due to climate change factors
<b>notes</b> 1 May 2018 jwm 93 X									



**To:** Paul Leonard[paul\_leonard@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-06-13T17:35:39-04:00  
**Importance:** Normal  
**Subject:** FW: [EXTERNAL] RE: Current map of Oil Leasing on Alaska's North Slope?  
**Received:** 2018-06-13T17:35:56-04:00  
[Existing Oil Dev w Refuge.pdf](#)

FYI....

---

**From:** Sullender, Benjamin [mailto:[bsullender@audubon.org](mailto:bsullender@audubon.org)]  
**Sent:** Wednesday, June 13, 2018 12:49 PM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>  
**Subject:** RE: [EXTERNAL] RE: Current map of Oil Leasing on Alaska's North Slope?

Hi Wendy,

Sure thing. I don't have the date of lease acquisition for those, but I have the active leases and infrastructure.

I've attached the same active lease map as before, zoomed out to include the Refuge.

I've found that the Alaska DNR Division of Oil and Gas does a good job publishing PDF maps showing the latest activities. They publish a new map every couple months showing latest wells, permit applications, lease transfers, breaking news, announced discoveries, etc. The maps are posted under North Slope Maps->Activity Maps here: <http://dog.dnr.alaska.gov/Information/MapsAndGis>. It's a resource that I keep my eye on, and it might be a useful bookmark for your browser.

Best,  
-Ben

Benjamin Sullender  
**Spatial Ecologist** | Audubon Alaska  
[bsullender@audubon.org](mailto:bsullender@audubon.org)  
431 W. 7<sup>th</sup> Ave, Suite 101  
Anchorage, AK 99501  
(907) 276-7034

---

**From:** Wendy Loya [mailto:[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)]  
**Sent:** Wednesday, June 13, 2018 12:01 PM  
**To:** Sullender, Benjamin <[bsullender@audubon.org](mailto:bsullender@audubon.org)>  
**Subject:** RE: [EXTERNAL] RE: Current map of Oil Leasing on Alaska's North Slope?

Hey Ben,

Thanks for the prompt reply. I believe there are active leases along the border of the Arctic Refuge, if



so, would it be easy to include to the Canning? If not, these are great.

Cheers,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

---

**From:** Sullender, Benjamin [mailto:[bsullender@audubon.org](mailto:bsullender@audubon.org)]  
**Sent:** Wednesday, June 13, 2018 11:54 AM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>  
**Subject:** [EXTERNAL] RE: Current map of Oil Leasing on Alaska's North Slope?

Hi Wendy,

I've attached two maps from a recent analysis – these are current as of April. The analysis focused on the central and western Beaufort, so Point Thomson / the Refuge are clipped out of the frame.

Best,  
-Ben

Benjamin Sullender  
**Spatial Ecologist** | Audubon Alaska  
[bsullender@audubon.org](mailto:bsullender@audubon.org)  
431 W. 7<sup>th</sup> Ave, Suite 101  
Anchorage, AK 99501  
(907) 276-7034

---

**From:** Smith, Melanie A.  
**Sent:** Wednesday, June 13, 2018 11:34 AM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>; Sullender, Benjamin <[bsullender@audubon.org](mailto:bsullender@audubon.org)>  
**Subject:** RE: Current map of Oil Leasing on Alaska's North Slope?

Thank you Wendy.

We do have an updated map which is stewarded by Ben. He's copied here and will send you the latest.

Melanie



---

**From:** Wendy Loya [[mailto:wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)]  
**Sent:** Wednesday, June 13, 2018 11:07 AM  
**To:** Smith, Melanie A. <[masmith@audubon.org](mailto:masmith@audubon.org)>  
**Subject:** Current map of Oil Leasing on Alaska's North Slope?

Hi Melanie,

Congrats on your new role with Audubon. It sounds like a great way to scale up the work you have done in Alaska, but glad you will still be around to be a resource for Audubon Alaska.

I was wondering if you have a contemporary version of the Oil and Gas Leasing on AK's north slope map? This has always been a great visual resource for thinking about cumulative effects. Couldn't find one on the website...

Thank you,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

---

**From:** Smith, Melanie A. [<mailto:masmith@audubon.org>]  
**Sent:** Thursday, June 7, 2018 4:14 PM  
**To:** Smith, Melanie A. <[masmith@audubon.org](mailto:masmith@audubon.org)>  
**Subject:** [EXTERNAL] Moving to National Audubon

Dear Colleagues,

I am writing to let you know about my changing role with Audubon. I have accepted a position with National Audubon as a Program Director within the brand-new Migratory Bird Initiative. In this initiative we will synthesize what is known about bird migration, identify data gaps and fund research, and prioritize important sites for conservation action. I will oversee the creation of a migration atlas of North American birds.

While this move transitions me away from working solely on Alaska issues, I won't be disappearing. In August I will begin working in my new position while continuing to work for the Alaska office 25% time through the end of the year. The position I have is flexible in location and I am not leaving Alaska; I plan to keep working from the Anchorage office, getting to continue to spend time with my wonderful colleagues here. During the next several months I will be here to provide continuity during leadership transition and button up projects like the Arctic marine ecological hotspots and the Southeast Alaska Birding Trail.

After ten years at Audubon Alaska, I am sad to step away from the programs I have so much passion for, yet excited to start a new chapter and take on a new challenge with Audubon. I have been



grateful to work with each of you. Thank you for all you do for conservation in Alaska and beyond, and please keep in touch.

Sincerely,

Melanie

Melanie A. Smith  
Director of Conservation Science

Audubon Alaska  
431 West 7<sup>th</sup> Ave, Suite 101  
Anchorage, AK 99501  
(907) 276-7034 office  
(907) 440-1964 cell

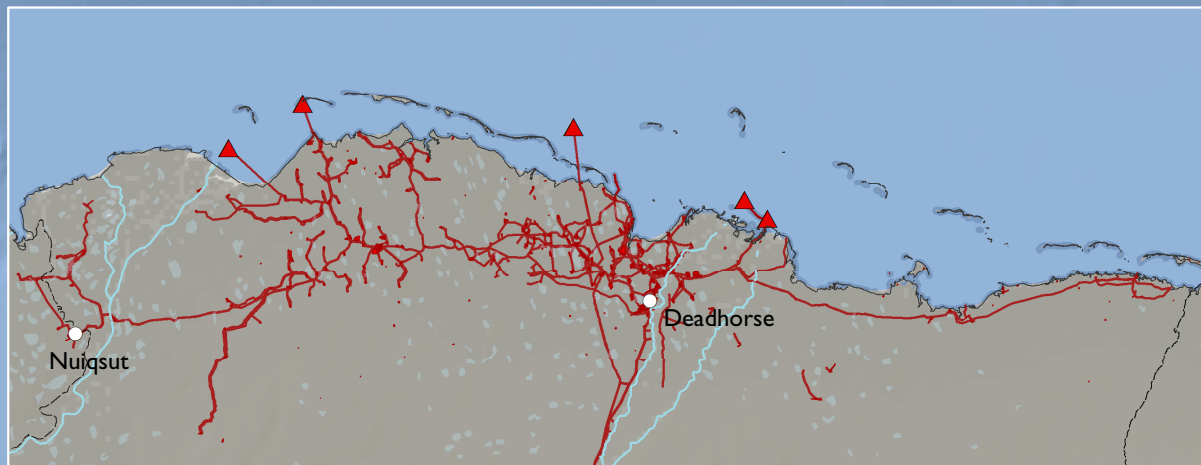




▲ Artificial Islands

— Pipelines and  
Gravel Roads

□ Active Oil and  
Gas Leases



Utqiagvik

Atqasuk

National Petroleum  
Reserve - Alaska

Teshkepuk  
Lake

See Infrastructure Inset

Nuiqsut

Deadhorse

Arctic  
National  
Wildlife  
Refuge

0 10 20 30  
Miles

Audubon ALASKA



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Colligan, Mary  
**Sent:** 2018-06-17T18:24:57-04:00  
**Importance:** Normal  
**Subject:** talking points for Greg  
**Received:** 2018-06-17T18:25:02-04:00  
[talking points for greg for EIS Alternatives in-house wkshop.docx](#)

Wendy - I assume for the pre-brief for Greg tomorrow he will want to run through the agenda for next week. You didn't send that yet did you? Just wanted to make sure I did not miss it since I was not on the original invite for the workshop.

Karen asked for some talking points for Greg. I put together the attached few points. Please take a look and let me know what you think.

Thanks

--

Mary Colligan  
Assistant Regional Director  
Fisheries and Ecological Services  
U.S. Fish and Wildlife Service, Alaska Region  
1011 E. Tudor Road, MS-361  
Anchorage, AK 99503  
907-786-3505  
cell: 907-223-5945



## FWS Workshop on Alternatives for Coastal Plan Leasing EIS – June 19-20, Fairbanks

### Opening Comments from Greg

- I would like to thank you all for all the time they have already invested in this effort and for your time over the next two days.
- The purpose of this meeting is to identify stipulations, best management practices and other leasing conditions to be applied to specific places that will help us achieve all of the purposes of the Arctic Refuge, from conservation of fish, wildlife, subsistence and water resources to the new purpose of an oil and gas program.
- This is a very important and critical time in this project and I know you have all been working hard within an aggressive timeline. I expect it to remain pretty time intensive now up until the workshop in July, where your input over the next two days will be presented to BLM.
- I want to step back a minute and recognize that the decision to add an oil and gas program as an additional purpose of the ANWR and to designate BLM as the lead for the program was, of course, a decision by Congress. It is our job to carry out that direction. I recognize that can be challenging at times.
- We all need to be the great professionals I know that you all are. We need to offer our technical and professional expertise in an unbiased manner and without personal opinion mixed in. We have a very specific and very important role in this process and it is our job to fulfill that to the best of our ability.
- It is critically important that FWS remain at the table and be given the opportunity to provide input and technical expertise to help inform the decisions BLM will have to make in the coming months. In order to maintain that seat, we have to be seen as adding value to the process and be viewed as a trusted and trustworthy partner.
- As you know, I attended a number of the EIS Scoping Hearings over the past few weeks and I wanted to share some of my observations and impressions.....



**To:** John Trawicki[john\_trawicki@fws.gov]; Drew Crane[drew\_crane@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]; Joanna Fox[joanna\_fox@fws.gov]; Stephanie Brady[stephanie\_brady@fws.gov]; Eric Taylor[eric\_taylor@fws.gov]; Mitch Ellis[mitch\_ellis@fws.gov]; Socheata Lor[socheata\_lor@fws.gov]; Doug Damberg[doug\_damberg@fws.gov]; Sara Boario[sara\_boario@fws.gov]; Mary Colligan[mary\_colligan@fws.gov]; Greg Siekaniec[greg\_siekaniec@fws.gov]; Karen Clark[karen\_clark@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-06-20T17:10:57-04:00  
**Importance:** Normal  
**Subject:** FW: [EXTERNAL] Coastal Plain Oil and Gas Leasing Program EIS: Affected Environment Kick-off  
**Received:** 2018-06-20T17:11:34-04:00  
[CoastalEIS AE kickoff-Agnda 20180620.pdf](#)  
[140L6318F0003 CoastalPlain\\_CH3Template USFWS.pdf](#)  
[Coastal-EIS Ch3-StartupPackage 20180620 for USFWS ID Team.pdf](#)  
[Coastal Plain EIS DataNeedsReport 20180615 USFWS.pdf](#)

Dear RDT and POCs,

I am not sure who all received this, so sending it to the 1002 leadership group. Attached are materials sent for the initiation of the EIS Affected Environment section. It will be combined with the Environmental consequences section in the DEIS.

**It will be helpful to the Leasing EIS process if we share the Draft Affected Environment Section for the Seismic EA when it is reviewed and approved by the RDT. Sharing that document will save significant staff time in sharing their expertise with BLM and the Contractor.**

Thank you,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

----- Forwarded message -----

**From:** Chad Ricklefs <[chad.ricklefs@empsi.com](mailto:chad.ricklefs@empsi.com)>  
**Date:** Mon, Jun 18, 2018 at 5:48 PM  
**Subject:** [EXTERNAL] Coastal Plain Oil and Gas Leasing Program EIS: Affected Environment Kick-off  
**To:** "[patrick\\_odell@fws.gov](mailto:patrick_odell@fws.gov)" <[patrick\\_odell@fws.gov](mailto:patrick_odell@fws.gov)>, "[joshua\\_rose@fws.gov](mailto:joshua_rose@fws.gov)" <[joshua\\_rose@fws.gov](mailto:joshua_rose@fws.gov)>, "[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)" <[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)>, "[edward\\_decleva@fws.gov](mailto:edward_decleva@fws.gov)" <[edward\\_decleva@fws.gov](mailto:edward_decleva@fws.gov)>, "[peter\\_butteri@fws.gov](mailto:peter_butteri@fws.gov)" <[peter\\_butteri@fws.gov](mailto:peter_butteri@fws.gov)>, "[tim\\_allen@fws.gov](mailto:tim_allen@fws.gov)" <[tim\\_allen@fws.gov](mailto:tim_allen@fws.gov)>, "[catherine\\_collins@fws.gov](mailto:catherine_collins@fws.gov)" <[catherine\\_collins@fws.gov](mailto:catherine_collins@fws.gov)>, "[randy\\_j\\_brown@fws.gov](mailto:randy_j_brown@fws.gov)" <[randy\\_j\\_brown@fws.gov](mailto:randy_j_brown@fws.gov)>, "[christopher\\_latty@fws.gov](mailto:christopher_latty@fws.gov)" <[christopher\\_latty@fws.gov](mailto:christopher_latty@fws.gov)>



"[eric\\_taylor@fws.gov](mailto:eric_taylor@fws.gov)" <[eric\\_taylor@fws.gov](mailto:eric_taylor@fws.gov)>, "[ryan\\_r\\_wilson@fws.gov](mailto:ryan_r_wilson@fws.gov)"  
<[ryan\\_r\\_wilson@fws.gov](mailto:ryan_r_wilson@fws.gov)>, "[stephen\\_arthur@fws.gov](mailto:stephen_arthur@fws.gov)" <[stephen\\_arthur@fws.gov](mailto:stephen_arthur@fws.gov)>,  
"[hollis\\_twitchell@fws.gov](mailto:hollis_twitchell@fws.gov)" <[hollis\\_twitchell@fws.gov](mailto:hollis_twitchell@fws.gov)>, "[carl\\_johnson@fws.gov](mailto:carl_johnson@fws.gov)"  
<[carl\\_johnson@fws.gov](mailto:carl_johnson@fws.gov)>, "[joshua\\_ream@fws.gov](mailto:joshua_ream@fws.gov)" <[joshua\\_ream@fws.gov](mailto:joshua_ream@fws.gov)>,  
"[susan\\_lakomski@fws.gov](mailto:susan_lakomski@fws.gov)" <[susan\\_lakomski@fws.gov](mailto:susan_lakomski@fws.gov)>, "[jennifer\\_reed@fws.gov](mailto:jennifer_reed@fws.gov)"  
<[jennifer\\_reed@fws.gov](mailto:jennifer_reed@fws.gov)>, "[angela\\_matz@fws.gov](mailto:angela_matz@fws.gov)" <[angela\\_matz@fws.gov](mailto:angela_matz@fws.gov)>,  
"[roger\\_kaye@fws.gov](mailto:roger_kaye@fws.gov)" <[roger\\_kaye@fws.gov](mailto:roger_kaye@fws.gov)>, "[john\\_brewer@fws.gov](mailto:john_brewer@fws.gov)"  
<[john\\_brewer@fws.gov](mailto:john_brewer@fws.gov)>, "[john\\_w\\_martin@fws.gov](mailto:john_w_martin@fws.gov)" <[john\\_w\\_martin@fws.gov](mailto:john_w_martin@fws.gov)>  
Cc: "Hayes, Miriam (Nicole)" <[mnhayes@blm.gov](mailto:mnhayes@blm.gov)>, Amy Lewis <[amy.lewis@empsi.com](mailto:amy.lewis@empsi.com)>

Please find the following items attached for the Chapter 3 kick-off call.

- Agenda
- Start-up Package
- Chapter 3 template
- Data Need

**Chad Ricklefs, AICP**

EMPSi Environmental Management and Planning Solutions, Inc.  
3005 Center Green Drive, Suite 205  
Boulder, CO 80301  
direct: 303-495-5129 main: 303-447-7160 fax: 866-625-0707  
[www.EMPSi.com](http://www.EMPSi.com) Twitter: EMPSInc Facebook: EMPSi

***Bringing clarity to the complex***™

GSA Contract GS10F-04125

Albuquerque    Denver    Portland    Reno    San Francisco    Santa Fe    Washington, DC

PLEASE NOTE: This message, including any attachments, may include privileged, confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.

--

Randy J. Brown  
Fishery Biologist  
U.S. Fish and Wildlife Service  
101 12th Ave., Room 110  
Fairbanks, Alaska 99701

Phone: (907) 456-0295

E-mail: <[randy\\_j\\_brown@fws.gov](mailto:randy_j_brown@fws.gov)>





**U.S. Department of the Interior  
Bureau of Land Management**

**Alaska State Office**

**Coastal Plain Oil and Gas Leasing Program  
Environmental Impact Statement**

---

**DATA NEEDS REPORT**

USFWS

**JUNE 2018**



USFWS



# TABLE OF CONTENTS

Section Page

<b>I.</b>	<b>DATA NEEDS REPORT .....</b>	<b>I-1</b>
I.1	Climate and Meteorology .....	I-1
I.1.1	Literature and Databases Reviewed.....	I-1
I.1.2	Proposed Data Sources for EIS.....	I-1
I.1.3	Data Needs .....	I-1
I.2	Air Quality.....	I-2
I.2.1	Literature and Databases Reviewed.....	I-2
I.2.2	Proposed Data Sources for EIS.....	I-2
I.2.3	Data Needs .....	I-2
I.3	Physiography .....	I-3
I.3.1	Literature and Databases Reviewed.....	I-3
I.3.2	Proposed Data Sources for EIS.....	I-3
I.3.3	Data Needs .....	I-5
I.4	Geology and Minerals .....	I-5
I.4.1	Literature and Databases Reviewed.....	I-5
I.4.2	Proposed Data Sources for EIS.....	I-5
I.4.3	Data Needs/Gaps.....	I-7
I.5	Petroleum Resources .....	I-7
I.5.1	Literature and Databases Reviewed.....	I-7
I.5.2	Proposed Data Sources for EIS.....	I-8
I.5.3	Data Needs .....	I-8
I.6	Paleontological Resources.....	I-9
I.6.1	Literature and Databases Reviewed.....	I-9
I.6.2	Proposed Data Sources for EIS.....	I-9
I.6.3	Data Needs .....	I-10
I.7	Soil Resources .....	I-10
I.7.1	Literature and Databases Reviewed.....	I-10
I.7.2	Proposed Data Sources for EIS.....	I-10
I.7.3	Data Needs .....	I-11
I.8	Sand and Gravel Resources.....	I-11
I.8.1	Literature and Databases Reviewed.....	I-11
I.8.2	Proposed Data Sources for EIS.....	I-11
I.8.3	Data Needs .....	I-11
I.9	Water Resources.....	I-12
I.9.1	Literature and Databases Reviewed.....	I-12
I.9.2	Proposed Data Sources for EIS.....	I-12
I.9.3	Data Needs .....	I-13
I.10	Solid and Hazardous Waste.....	I-13
I.10.1	Literature and Databases Reviewed.....	I-13
I.10.2	Proposed Data Sources for EIS.....	I-13
I.10.3	Data Needs .....	I-14
I.11	Vegetation.....	I-14
I.11.1	Literature and Databases Reviewed.....	I-14
I.11.2	Proposed Data Sources for EIS.....	I-14
I.11.3	Data Needs .....	I-15



1	I.12	Wetlands.....	I-16
2		I.12.1 Literature and Databases Reviewed.....	I-16
3		I.12.2 Proposed Data Sources for EIS.....	I-16
4		I.12.3 Data Needs .....	I-16
5	I.13	Wildland Fire .....	I-16
6		I.13.1 Literature and Databases Reviewed.....	I-16
7		I.13.2 Proposed Data Sources for EIS.....	I-16
8		I.13.3 Data Needs .....	I-17
9	I.14	Fish and Aquatic Species .....	I-17
10		I.14.1 Literature and Databases Reviewed.....	I-17
11		I.14.2 Proposed Data Sources for EIS.....	I-18
12		I.14.3 Data Needs .....	I-20
13	I.15	Birds.....	I-20
14		I.15.1 Literature and Databases Reviewed.....	I-20
15		I.15.2 Proposed Data Sources for EIS.....	I-20
16		I.15.3 Data Needs .....	I-21
17	I.16	Terrestrial Mammals.....	I-21
18		I.16.1 Literature and Databases Reviewed.....	I-21
19		I.16.2 Proposed Data Sources for EIS.....	I-21
20		I.16.3 Data Needs .....	I-22
21	I.17	Marine Mammals.....	I-22
22		I.17.1 Literature and Databases Reviewed.....	I-22
23		I.17.2 Proposed Data Sources for EIS.....	I-22
24		I.17.3 Data Needs .....	I-23
25	I.18	Special Status Species.....	I-25
26		I.18.1 Literature and Databases Reviewed.....	I-25
27		I.18.2 Proposed Data Sources for EIS.....	I-25
28		I.18.3 Data Needs .....	I-26
29	I.19	Special Designations.....	I-26
30		I.19.1 Literature and Databases Reviewed.....	I-26
31		I.19.2 Proposed Data Sources for EIS.....	I-26
32		I.19.3 Data Needs .....	I-27
33	I.20	Cultural Resources.....	I-27
34		I.20.1 Literature and Databases Reviewed.....	I-27
35		I.20.2 Proposed Data Sources for EIS.....	I-28
36		I.20.3 Data Needs .....	I-28
37	I.21	Subsistence.....	I-29
38		I.21.1 Literature and Databases Reviewed.....	I-29
39		I.21.2 Proposed Data Sources for EIS.....	I-29
40		I.21.3 Data Needs .....	I-30
41	I.22	Sociocultural Systems .....	I-31
42		I.22.1 Literature and Databases Reviewed.....	I-31
43		I.22.2 Proposed Data Sources for EIS.....	I-31
44		I.22.3 Data Needs .....	I-31
45	I.23	Environmental Justice.....	I-32
46		I.23.1 Literature and Databases Reviewed.....	I-32
47		I.23.2 Proposed Data Sources for EIS.....	I-32
48		I.23.3 Data Needs .....	I-32



I	I.24	Recreation .....	I-33
2		I.24.1 Literature and Databases Reviewed.....	I-33
3		I.24.2 Proposed Data Sources for EIS.....	I-33
4		I.24.3 Data Needs .....	I-34
5	I.25	Visual Resources.....	I-34
6		I.25.1 Literature and Databases Reviewed.....	I-34
7		I.25.2 Proposed Data Sources for EIS.....	I-35
8		I.25.3 Data Needs .....	I-35
9	I.26	Transportation .....	I-35
10		I.26.1 Literature and Databases Reviewed.....	I-35
11		I.26.2 Proposed Data Sources for EIS.....	I-36
12		I.26.3 Data Needs .....	I-37
13	I.27	Economy .....	I-37
14		I.27.1 Literature and Databases Reviewed.....	I-37
15		I.27.2 Proposed Data Sources for EIS.....	I-37
16		I.27.3 Data Needs .....	I-38
17			
18			

USFWS



I

This page intentionally left blank.

USFWS



**I. DATA NEEDS REPORT**

USFWS



---

USFWS



# DATA NEEDS REPORT

---

## I.1 CLIMATE AND METEOROLOGY

### I.1.1 Literature and Databases Reviewed

- Climate model projections in NPR-A Climate Change Analysis: An Assessment of Climate Change Variables in the National Petroleum Reserve in Alaska (Appendix C).
- The Alaska Climate Research Center (annual temperature trends (1949-2014) for 19 individual stations statewide. Web site: <http://climate.gi.alaska.edu/ClimTrends/Location>
- Western Regional Climate Center – (climate divisional plots of temperature and precipitation trends from 1895-2017). Web site: <https://wrcc.dri.edu/cgi-bin/divplot1.pl>

### I.1.2 Proposed Data Sources for EIS

- Climate model projections in NPR-A Climate Change Analysis: An Assessment of Climate Change Variables in the National Petroleum Reserve in Alaska (Appendix C).
- The Alaska Climate Research Center (annual temperature trends (1949-2014) for 19 individual stations statewide. Web site: <http://climate.gi.alaska.edu/ClimTrends/Location>
- Western Regional Climate Center – (climate divisional plots of temperature and precipitation trends from 1895-2017). Web site: <https://wrcc.dri.edu/cgi-bin/divplot1.pl>

### I.1.3 Data Needs

- No additional (fresh) climate data need to be collected for this EIS, as the historical records, plus modeling studies, should be adequate to assess trends and make findings regarding the extent or potential and likely climate change within the future period of interest.



## 1.2 AIR QUALITY

### 1.2.1 Literature and Databases Reviewed

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement
- BLM. 2012. National Petroleum Reserve-Alaska Final Integrated Activity Plan/Environmental Impact Statement. Appendix H, Dispersion Modeling Assessment of Potential Future Development in the NPR-A Air Quality Impact Assessments in Support of the Bureau of Land Management Integrated Activity Plan/Environmental Impact Statement Update.
- Do, B., L. Dayton, N. Hilliard, and P. Fields Simms. 2017. Arctic Air Quality Modeling Study – Final Near-Field Modeling Report. Prepared by Eastern Research Group, Incorporated for U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-029, 59 pp.
- EPA. 2018. Alaska Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants. Internet website: [https://www3.epa.gov/airquality/greenbook/anayo\\_ak.html](https://www3.epa.gov/airquality/greenbook/anayo_ak.html).
- Alaska Division of Air Quality. 2018 Proposed Air Monitoring Network. Internet website: <https://dec.alaska.gov/air/air-monitoring/monitoring-plans>.

### 1.2.2 Proposed Data Sources for EIS

- Reasonably Foreseeable Development Scenario well counts and surface disturbance estimates
- Existing regional air modeling reports

### 1.2.3 Data Needs

- Air monitoring data from BOEM/BLM/state sources (there are no Alaska Division of Air Resources air monitoring sites in or near the planning area) to assess baseline conditions
- Emissions inventory by alternative
- Description of future modeling requirements if not performed as part of this EIS
- Air modeling protocols for regional air modeling efforts to determine if drilling in the Arctic NWR was included in any of these efforts (both effects on the Arctic NWR and if drilling in the Arctic NWR was included in the emissions sources modeled)



### 1.3 PHYSIOGRAPHY

#### 1.3.1 Literature and Databases Reviewed

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the I002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- Wahrhaftig, Clyde. 1965. Physiographic divisions of Alaska: U.S. Geological Survey. Professional Paper 482. Plate I. Scale 1:2,500,000.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- OCS (Office of Coast Survey). 2015. Nautical Charts: 16045 Bullen Point to Brownlow Point. 16044 Camden Bay and Approaches, 16043 Barter Island and Approaches, 16042, Griffin Pt. and approaches, 16041 Demarcation Bay and approaches National Oceanic and Atmospheric Administration, Office of Coast Survey.. <http://www.charts.noaa.gov/OnLineViewer>.

#### 1.3.2 Proposed Data Sources for EIS

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- Select references cited within USFWS (2015) sections 4.2.1.1 Landforms and Geology Beaufort Sea Coastal Plain, 4.2.1.7 Landforms and Geology Coastal Marine System.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the I002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- USGS. 1996. Digital Map of Physiographic Divisions of Alaska U.S. Geological Survey EROS Alaska Field Office. <https://agdc.usgs.gov/agdc.html>.
- Wahrhaftig, Clyde, 1965, Physiographic divisions of Alaska: U.S. Geological Survey. Professional Paper 482. Plate I. Scale 1:2,500,000.



- Gibbs, A.E., and Richmond, B.M., 2015, National assessment of shoreline change—Historical shoreline change along the north coast of Alaska, U.S.–Canadian border to Icy Cape: U.S. Geological Survey Open-File Report 2015–1048, 96 p. <http://dx.doi.org/10.3133/ofr20151048>. And updated report: i. <https://pubs.er.usgs.gov/publication/ofr20171107> ii. GIS data: <https://www.sciencebase.gov/catalog/item/57e96bd2e4b09082500c91b0>.
- Erikson, L.H., Gibbs, A.E., Richmond, B.M., Storlazzi, C.D., Jones, B.M., Ohman, K.A., 2018, Changing Storm Conditions in Response to Projected 21st Century Climate Change Scenarios and the Potential Impact on an Arctic Barrier Island –Lagoon System: A Pilot Study for Arey Island and Lagoon, Eastern Arctic Alaska, U.S. Geological Survey Open File report, in press.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- 1998. Northeast National Petroleum Reserve-Alaska Final Integrated Activity Plan/Environmental Impact Statement. Anchorage, AK.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- Colonell, J.M. and A.W. Niedoroda. 1990. “Appendix B: Coastal Oceanography of the Alaska Beaufort Sea.” In *An Assessment of Marine Environmental Impacts of West Dock Causeway*, ed. J.M. Colonell and B.J. Gallaway, BI-B74. Prepared for Prudhoe Bay Unit Owners represented by ARCO Alaska, Inc., by LGL Alaska Research Associates, Inc. and Environmental Science and Engineering, Inc., Anchorage, AK. (cited in Point Thomson EIS)
- Jorgenson, M.T. and Y. Shur. 2007. “Evolution of Lakes and Basins in Northern Alaska and Discussion of the Thaw Lake Cycle.” *Journal of Geophysical Research* 112, F02S17. (cited in Point Thomson EIS)
- Sellman, P.V., J. Brown, R.I. Lewellen, H. McKim, and C. Merry. 1975. *The Classification and Geomorphic Implications of Thaw Lakes on the Arctic Coastal Plain, Alaska*. Research Report 344, Hanover, NH: U.S. Army Cold Regions Research and Engineering Laboratory. (cited in Point Thomson EIS)
- Rawlinson, S.E. 1993. Surficial Geology and Morphology of the Alaskan Central Arctic Coastal Plain. Report of Investigation 93-1, 172 p., 6 sheets, scale 1:63,360, Alaska Division of Geological & Geophysical Surveys. (cited in Point Thomson EIS)
- PND Engineers, Inc. 2009. *Point Thomson Project Coastal Engineering Assessment - DRAFT*. Prepared for ExxonMobil, Anchorage, AK by PND Engineers Inc., Anchorage, AK. (cited in Point Thomson EIS)



- OCS (Office of Coast Survey). 2015. Nautical Charts: 16045 Bullen Point to Brownlow Point. 16044 Camden Bay and Approaches, 16043 Barter Island and Approaches, 16042, Griffin Pt. and approaches, 16041 Demarcation Bay and approaches National Oceanic and Atmospheric Administration, Office of Coast Survey.. <http://www.charts.noaa.gov/OnLineViewer>.

### 1.3.3 Data Needs

- None identified.

## 1.4 GEOLOGY AND MINERALS

### 1.4.1 Literature and Databases Reviewed

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement. Sections 4.2.1.1, 4.2.1.2, 4.2.7, 4.2.8
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis.
- Houseknecht, D.W. et al. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012. USFS Fact Sheet 2012-3013.
- Attanasi, Emil D. and Philip A. Freeman. 2009. Economics of Undiscovered Oil and Gas in the North Slope of Alaska: Economic Update and Synthesis. USGS Open-File Report 2009-1112.
- Attanasi, E.D. 2005. Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: an economic update. USGS Open-File Report 2005-1217.

### 1.4.2 Proposed Data Sources for EIS

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement. Sections 4.2.1.1, 4.2.1.2, 4.2.7, 4.2.8
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge



in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

- Resource Data, Inc. (RDI), Alaska Earth Sciences, Inc. (AES), and U.S. Bureau of Mines (USBM). 1995. Mineral Terranes and Known Mineral Deposit Areas: Published by U.S. Bureau of Mines, metadata 5 p., plus Arc/INFO database.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis.
- Houseknecht, D.W. et al. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012. USFS Fact Sheet 2012-3013.
- Attanasi, Emil D. and Philip A. Freeman. 2009. Economics of Undiscovered Oil and Gas in the North Slope of Alaska: Economic Update and Synthesis. USGS Open-File Report 2009-1112.
- Attanasi, E.D. 2005. Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: an economic update. USGS Open-File Report 2005-1217.
- Plafker, G., and H.C. Berg. 1994. "The Geology of Alaska: Book and Plates." *The Geology of North America Volume G-1*. The Geological Society of America, 1056 p. available on ADNR website at <http://dggs.alaska.gov/pubs/id/22261>. (cited in Point Thomson EIS)
- Molenaar, C.M., K.J. Bird, and T.S. Collett. 1986. *Regional Correlation Sections Across the North Slope of Alaska*. U.S. Geological Survey Miscellaneous Field Study Map MF-1907. (cited in Point Thomson EIS)
- ADNR. 2006. "Right-of-Way Leasing Act AS 38.35.050 Application for Pipeline Right-of-Way Lease for the Eastern North Slope Gas Pipeline." State of Alaska, ROW lease application. Point Thomson DEIS Attachment C of Title Document: Eastern North Slope Gas Pipeline Design Basis. (cited in Point Thomson EIS)
- Combellick, R.A. 1994. *Geologic Hazards In and Near Proposed State of Alaska Oil and Gas Lease Sale 80 (Shaviovik)*. Division of Geological & Geophysical Surveys. U.S. Government Printing Office, 1994. Public Data File 94-98. (cited in Point Thomson EIS)
- Page, R.A., N.N. Biswas, J.C. Lahr, and H. Pulpan. 1991. "Seismicity of Continental Alaska." In *Neotectonics of North America*, ed. D.B. Slemmons, E.R. Engdahl, M.D. Zoback and D.D. Blackwell, 47-68. Geological Society of America. (cited in Point Thomson EIS)



- Pinney, D.S., and R.A. Combellick. 2000. *Geologic Hazards in and Near Proposed State of Alaska Oil and Gas Sale, North Slope Foothills*. Vol. 39. Alaska Division of Geological & Geophysical Surveys. (cited in Point Thomson EIS)
- Wesson, R.L., O.S. Boyd, C.S. Mueller, C.G. Bufe, A.D. Frankel, and M.D. Petersen. 2007. *Revision of Time-Independent Probabilistic Seismic Hazard Maps for Alaska*. Open file report 2007-1043, U.S. Department of the Interior, U.S. Geological Survey, Washington, D.C.: U.S. Government Printing Office. (cited in Point Thomson EIS)
- USGS. 2007. Earthquake Hazards Program Maps, Alaska. USGS web site: <https://earthquake.usgs.gov/hazards/hazmaps/ak/index.php#2007>.
- USGS and ADNR. Quaternary fault and fold database for the United States 2006. USGS web site: <https://earthquake.usgs.gov/hazards/qfaults/>.
- Beikman, H.M., compiler. 1980. Geologic map of Alaska: U.S. Geological Survey Map SG0002-IT and 2T, Scale 1:2,500,000.
- USGS. Alaska Resource Data Files. Descriptions of mines, prospects, and mineral occurrences. <https://ardf.wr.usgs.gov/index.php>.
- BLM. 2017. Alaska Minerals Information System database. <http://www.arlis.org/docs/vol2/mic-mas/MDIRA/MAS%20Scanned%20Images/>
- Flores, R.M., Stricker, G.D., and Kinney, S.A. 2004. Alaska Coal Geology, Resources, and Coalbed Methane Potential, U.S. Geological Survey, DDS-77.
- Stricker, G.D., Spear, B.D., Sprowl, J.M., Dietrich, J.D., McCauley, M.I., and Kinney, S.A., 2011, Coal database for Cook Inlet and North Slope, Alaska: U.S. Geological Survey Digital Data Series 599, 11 p.

#### I.4.3 Data Needs/Gaps

- None identified.

### I.5 PETROLEUM RESOURCES

#### I.5.1 Literature and Databases Reviewed

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Section 4.2.7
- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis.



- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998. Including Play Descriptions
- Attanasi. 2005. Economics of 1998 U.S. Geological Survey's 1002 Area Regional Assessment: An Economic Update. USGS Open File Report 2005-1359.
- USGS. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012.
- Attanasi, Emil D. and Philip A. Freeman. 2009. Economics of Undiscovered Oil and Gas in the North Slope of Alaska: Economic Update and Synthesis. USGS Open-File Report 2009-1112.
- Attanasi, E.D. 2005. Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: an economic update. USGS Open-File Report 2005-1217.
- Alaska Department of Natural Resources, Division of Oil and Gas. 2017. ANWR Revenue Model v1.0.

#### **I.5.2 Proposed Data Sources for EIS**

- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis.
- USGS. 1998. Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998. Including Play Descriptions
- Attanasi. 2005. Economics of 1998 U.S. Geological Survey's 1002 Area Regional Assessment: An Economic Update. USGS Open File Report 2005-1359.
- USGS. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012.
- Attanasi, Emil D. and Philip A. Freeman. 2009. Economics of Undiscovered Oil and Gas in the North Slope of Alaska: Economic Update and Synthesis. USGS Open-File Report 2009-1112.
- Attanasi, E.D. 2005. Undiscovered oil resources in the Federal portion of the 1002 Area of the Arctic National Wildlife Refuge: an economic update. USGS Open-File Report 2005-1217.

#### **I.5.3 Data Needs**

- A Reasonable Foreseeable Development Scenario (RFD) will be developed to predict future oil and gas development in the 1002 Area and support the EIS. The baseline scenario will be unconstrained and will depict estimates of the most likely general locations for development as well as estimated amounts of development. A scenario will also be prepared for each EIS alternative. The RFD will use existing data and will not generate any



new data. Specific key components of the RFD and how they will be developed include:

- Oil and gas occurrence and development potential – This will be developed based on available data sources, such as USGS 1998.
- Surface disturbance estimates from oil and gas exploration and development facilities – Estimates will be based on those used in nearby areas, such as NPR-A.
- Estimated exploration, drilling, and production activity by alternative – Estimates will be developed by overlaying the baseline unconstrained RFD scenario with management actions considered under each alternative. Allocations such as closures or major constraints (e.g., no surface occupancy stipulations) would result in a percentage reduction in development in areas where they are applied. Percentage reduction will be based on the development potential of the area as well as the type of allocation. Specific percentages will be developed using examples from other RFDs.
- Estimated economic outputs from oil and gas activities by alternative – Estimates will be developed using existing data, such as USGS 1998 and Alaska DNR 2017, as well as economic modeling tools.

## **I.6 PALEONTOLOGICAL RESOURCES**

### **I.6.1 Literature and Databases Reviewed**

- BLM, 2002. Final Environmental Impact Statement: Renewal of the Federal Grant for the Trans-Alaska Pipeline Right-of-Way.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

### **I.6.2 Proposed Data Sources for EIS**

- Alaska Paleontological Database, [www.alaskafossil.org](http://www.alaskafossil.org)



- BLM. In progress. Potential Fossil Yield Classification regarding the Arctic Plain 1002 area. (cited in USFWS 2018 Rapid-Response Resource Assessment)
- Mull, C.G., 1987, Kemik Sandstone, Arctic National Wildlife Refuge, northeastern Alaska, in Tailleur, I.L., and Weimer, Paul, eds., Alaskan North Slope geology; Volume I: Society of Economic Paleontologists and Mineralogists, Pacific Section, North Slope Seminar II, AAPG/SEPM/SEG Pacific Section annual meeting, Anchorage, AK, May 22-24, 1985, book 50, p. 405-431. Prepared by SEPM Pacific Section and Alaska Geological Society.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- USGS. 1987. Petroleum geology of the northern part of the Arctic National Wildlife Refuge, northeastern Alaska. U.S. Geological Survey Bulletin 1778.

#### **I.6.3 Data Needs**

- None identified.

### **I.7 SOIL RESOURCES**

#### **I.7.1 Literature and Databases Reviewed**

- Rapid Response Resource Assessment (Jorgenson, DNR)
- USFWS 2015 CCP
- Alaska DGGs Publications Search
- USGS
- DNR Tundra Travel modeling project

#### **I.7.2 Proposed Data Sources for EIS**

- DOT&PF geotechnical/soils reports for community facilities within project area (Northern Region)
- USACE geotechnical investigations
- Wahrhaftig 1965 Physiographic Subdivisions
- Nelson et al. 1998 *Active-layer thickness in north central Alaska*
- Osterkamp 2003 *Thermal history of permafrost in Alaska*
- Ping et al. 2004 *Characteristics of cryogenic soils along a latitudinal transect in Arctic Alaska*



- DGGs Barter Island & Demarcation Point & Mount Michelson Quadrangles resources (<http://dggs.alaska.gov/pubs/quad/barter-island>, <http://dggs.alaska.gov/pubs/quad/demarcation-point>)
  - DGGs SR 42
  - MP 49
  - MP 66
  - MP 95
- USGS Data
  - OF 86-334
  - I 1791

### **I.7.3 Data Needs**

- Updated SNAP climate data
- DOT&PF geotechnical reports
- USACE Geotechnical Reports

## **I.8 SAND AND GRAVEL RESOURCES**

### **I.8.1 Literature and Databases Reviewed**

- Rapid Response Resource Assessment (Jorgenson, DNR)
- USFWS 2015 CCP
- Alaska DGGs Publications Search
- USGS

### **I.8.2 Proposed Data Sources for EIS**

- DOT&PF geotechnical/soils reports for community facilities within project area (Northern Region)
- USACE geotechnical investigations
- DGGs Barter Island & Demarcation Point & Mount Michelson Quadrangles resources (<http://dggs.alaska.gov/pubs/quad/barter-island>, <http://dggs.alaska.gov/pubs/quad/demarcation-point>)
  - DGGs SR 42
  - MP 49
  - MP 66
  - MP 95

### **I.8.3 Data Needs**

- Updated SNAP climate data



- DOT&PF geotechnical reports
- USACE Geotechnical Reports

## **I.9 WATER RESOURCES**

### **I.9.1 Literature and Databases Reviewed**

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- USFWS. 2008. Water Resources Arctic national Wildlife Refuge, stream segments and lakes water rights applications filed. [https://www.fws.gov/alaska/water/arctic\\_water\\_rights.htm](https://www.fws.gov/alaska/water/arctic_water_rights.htm)
- USGS. 2018. Discharge data on the Canning, Tamayariak, and Hulahula Rivers for discharge (Hulahula still operational). <https://nwis.waterdata.usgs.gov/ak/nwis/sw>

### **I.9.2 Proposed Data Sources for EIS**

- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- USACE. 2012. Point Thomson Project Final Environmental Impact Statement.
- BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement.
- USFWS. 2008. Water Resources Arctic national Wildlife Refuge, stream segments and lakes water rights applications filed. [https://www.fws.gov/alaska/water/arctic\\_water\\_rights.htm](https://www.fws.gov/alaska/water/arctic_water_rights.htm)
- USGS. 2018. Discharge data on the Canning, Tamayariak, and Hulahula Rivers for discharge (Hulahula still operational). <https://nwis.waterdata.usgs.gov/ak/nwis/sw>



- Childers, J.M., C.E. Sloan, J.P. Meckel and J.W. Nauman. 1977, Hydrologic reconnaissance of the eastern North Slope, Alaska, 1975: U.S. Geological Survey Open-File Report 77-492, 65 p.
- Grunblatt J. and D. Atwood. 2014. Mapping lake for winter liquid water availability using SAR on the North Slope of Alaska Int. J. Appl. Earth Obs. Geoinformatics 27 63–9
- Lyons, S. M., and J. M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch Anchorage, AK. WRB 94-3.
- Trawicki, J. M., S. M. Lyons and G. V. Elliott. 1991. Distribution and quantification of water within lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. Alaska Fisheries Technical Report No. 10, U.S. Fish and Wildlife Service, Anchorage, AK.
- USFWS. 2012. Appendix I: Wild and Scenic River Review, Arctic NWR Comprehensive Conservation Plan. <https://www.fws.gov/home/arctic-ccp/>

### **I.9.3 Data Needs**

- Additional monitoring data on water resources will be essential prior to exploration and development, including lake recharge, stream low.
- Increased active layer will lower water table and result in drier surface conditions.

## **I.10 SOLID AND HAZARDOUS WASTE**

### **I.10.1 Literature and Databases Reviewed**

- Rapid Response Resource Assessment (Jorgensen, DNR)
- USFWS 2015 CCP
- DEC Contaminated sites program Database <http://dec.alaska.gov/spar/csp.aspx>
- DEC Prevention, preparedness, and response spills database <http://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch>
- EPA Environmapper <https://geopub.epa.gov/myem/efmap/index.html?ve=15.44.279221,-88.315926&pText=513%20Grand%20Ave,%20Little%20Chute,%20WI%2054140-1707>

### **I.10.2 Proposed Data Sources for EIS**

- BLM and State of Alaska Reserve Pits/Legacy Wells
- EDR report: searches datasets from;



- Federal Comprehensive Environmental Response, Compensation, and Liability Information System
- Federal Resource Conservation and Recovery Act
- Federal Emergency Response Notification System
- Alaska Department of Environmental Conservation Contaminated Sites Program
- EPA Brownfields Program
- Other ascertainable records related to either reserve pit closure of legacy wells
- Airforce studies
  - Phase I ESA/Phase II ESA
  - Spill reports
  - Contamination cleanup activities

### **I.10.3 Data Needs**

- Generators of solid or hazardous waste
- Are there baseline studies of natural background concentrations of heavy metals?
- Handling and disposal methods of solid and hazardous waste
  - BMPs

## **I.11 VEGETATION**

### **I.11.1 Literature and Databases Reviewed**

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I

### **I.11.2 Proposed Data Sources for EIS**

- Most references in the USFWS documents listed above will be data sources. Those listed below are of particular interest. All should be readily available.
- Alaska Exotic Plants Information Clearinghouse (AKEPIC) website. Alaska Center for Conservation Science, University of Alaska Anchorage, Anchorage AK. <http://accs.uaa.alaska.edu/invasive-species/non-native-plants/>



- RCCP (4.3.3.5) states that non-native plants are currently uncommon on the refuge. However, the reference cited is from 2000, so the information is likely outdated. The RCCP states correctly that the lack of non-native plants in the Refuge is likely to change in the near future. They cite Carlson and Shephard (2007) saying that non-native plants are spreading into natural ecosystems in Alaska at an accelerating rate.
- AKNHP Rare Plant Data Portal website. Alaska Center for Conservation Science, University of Alaska Anchorage, Anchorage, AK. <http://aknhp.uaa.alaska.edu/apps/rareplants/>
- Carlson, M. L. and M. Shephard 2007. The spread of invasive exotic plants in Alaska: is establishment of exotics accelerating? Pages 117–133 in T. B. Harrington and S. H. Reichard, editors. Meeting the Challenge: Invasive Plants in Pacific Northwestern Ecosystems. U.S. Forest Service, Pacific Northwest Research Station General Technical Report 694, Portland, OR.
- North Slope Rapid Ecoregional Assessment, 2013 (prepared for BLM by AKNHP, SNAP, and ISER). (Includes a list of non-native plants known to occur in the North Slope ecoregion)
- Homer et al. 2004 National Land Cover Database and map of ANWR land cover classes from Landsat 7.
- Jorgenson et al. 1994 field sampling of vegetation types and cover estimates for land cover classes. Also, the land-cover map will be needed.
- Martin et al. 2009 greenup dates advancing
- Verbyla 2008 showed increasing greenness on ACP.
- National Research Council. (2003). *Cumulative environmental effects of oil and gas activities on Alaska's North Slope*. National Academies Press.
- Reynolds, M. K., Walker, D. A., Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., & Webber, P. J. 2014. Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global Change Biology* 20: 1211-1224.

### I.11.3 Data Needs

- An updated vegetation map is needed prior to development. The most detailed vegetation map that exists for the area is from 1994; it is outdated and not accurate enough for planning purposes.
- A survey of non-native plants is needed to establish baseline
- A survey of rare plants may be needed prior to development.



## I.12 WETLANDS

### I.12.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

### I.12.2 Proposed Data Sources for EIS

- Most references in the USFWS documents listed above will be data sources. Those listed below are of particular interest. All should be readily available.
- U.S. Fish and Wildlife Service. May 2014. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington DC. <http://www.fws.gov/wetlands/>

### I.12.3 Data Needs

- A wetland map of the area is needed prior to development. The National Wetland Inventory (NWI) is currently the only wetland map of the area. It is not detailed or accurate enough for planning purposes.

## I.13 WILDLAND FIRE

### I.13.1 Literature and Databases Reviewed

- Tetlin NWR Fire Management Plan
- Yukon Flats NWR Fire Management Plan
- Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth 2 Development Project Draft Supplemental Environmental Impact Statement
- Alaska Interagency Wildland Fire Management Plan 2016
- Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement

### I.13.2 Proposed Data Sources for EIS

- BLM Alaska Fire Service (AFS)
- USGS Gap Analysis Program
- Protected Areas Database of the United States (PAD-US)
- Fire Effects Information System (FEIS)



- ANWR Fire Management Plan
- U.S. National Fire Danger Rating System
- Alaska Fire and Fuels (AKFF) Mesowest maps
- Alaska Interagency Coordination Center (AICC) Weather Database

### I.13.3 Data Needs

- Basic burnable vegetation types in project area (Acres)
  - Descriptions of each vegetation type including spatial data
- Fire fuels maps (from LANDSAT)
- Real Property and Values on Refuge
  - Include spatial data
- Historical and Cultural resources on refuge
- Fire history and frequency on Refuge
  - How many fires by year and acreage burned
    - Prescribed and wildland fires
      - Spatial data for historical fires
- Fuel models from National Forest Fire Laboratory National Fire Danger Rating System for each vegetation type
- Reports on wildlife, vegetation, air quality, soils, and socio-cultural resources
- Habitat management objectives and constraints on Refuge
- Fire management units on Refuge
  - Descriptions and spatial data
- Historical climate data

## I.14 FISH AND AQUATIC SPECIES

### I.14.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001



### I.14.2 Proposed Data Sources for EIS

- Most references contained in the USFWS documents listed above will be data sources. Those listed below are of particular interest. All should be readily available.
- Brackney 2008 for information on calculated area of streams and lakes in the refuge areas.
- Craig and McCart 1975 classification of North Slope streams and rivers as mountain, spring-fed, and tundra.
- Huryn et al. 2004 factors controlling invertebrate density in tundra streams.
- Unfrozen water exists in winter downstream from springs (Craig 1989, Childers et al. 1977, Craig 1989a), in deep pools or lakes (Trawicki et al. 1991, Lyons and Trawicki 1994, Ward and Craig 1974), and below ice hummocks (Elliot and Lyons 1990, Lyons and Trawicki 1994).
- As much as 50 percent of the annual flow may occur during break-up (Clough et al. 1987).
- Relative to the rest of the North Slope, glaciers (Nolan et al. 2011) and springs (Yoshikawa et al. 2007) contribute large volumes of water to a number of streams and rivers in the Refuge. contributions from glaciers may disappear completely in the next 50 years (Nolan et al. 2011)
- In the foothills, deepening of the active layer may lead to increased base flow at mid to lower elevation slopes (Martin et al. 2009). In the coastal plain, however, increased active layer depth will likely lower water tables and lead to an overall loss of water availability and instream connectivity at the surface.
- As the potential for groundwater storage in the active layer increases, a shift from surface-water dominated flows to groundwater dominated flows may occur (Frey and McClelland 2009).
- Although the density is low compared to the rest of the North Slope, there are over four thousand lakes covering over 37,000 ac in the Refuge. Most (73 percent) of the lakes are in the coastal plain ecoregion. Most lakes in this region are shallow, freeze to the bottom during winter (Trawicki et al. 1991), and are recharged by snowmelt, overbank flooding, and precipitation. Delta lakes include thaw, riverine, and tidal lakes and most are found in deltas of the Hulahula, Jago, Aichilik, and Canning rivers. Up to 80 percent of the winter water volume is in lakes in the Canning River delta
- Aufeis large reservoir of freshwater (Kane and Slaughter 1973).



- Loss of instream connectivity in dry seasons with negative effects on fish migration to overwintering habitat (Lyons and Trawicki 1994, Deegan and Peterson 1992).
- Glaciers and springs large contributors to a number of refuge streams (Nolan et al. 2011, Yoshikawa et al. 2007).
- Contributions by glaciers may disappear in next 50 years (Nolan et al. 2011).
- Lakes generally shallow, freeze to bottom (Trawicki et al. 1991).
- Species composition and distribution info from the CCP including references therein.
- Climate change effects from CCP and references therein.
- Lagoons support higher densities of inverts compared to streams and rivers, making anadromy an advantageous life history (Craig 1989).
- Surges of cold, saline marine water associated with these upwellings can contribute to destratification of nearshore waters, increasing salinity and decreasing temperature in the nearshore environment (Hale 1991)
- Substantial increases in air temperature and storm frequency, combined with decreases in summer sea ice in recent decades, have increased erosion along the southern Beaufort Sea coastline in recent decades (Wendler et al. 2010).
- McPhail and Lindsey 1970, Morrow 1980, Mecklenburg et al. 2002 fish taxonomy, presence/absence as well as other references listed for specific species
- Additional Dolly Varden work recently completed by USFWS in the Canning River (Dolly Varden tracking, Overwintering habitat-Randy Brown et al. 2014- present?)
- Nearshore fyke net surveys completed by USGS in 2017/2018 near Koktovik (Vanessa von Biela)
- Water lake depth surveys conducted by oil companies in deep lakes just outside the 1002 (Larry Moulton) – info may or may not be publicly available. May have to cite the EISs or permit applications in which the information is used.
- ADFG Anadromous Waters Catalog: Johnson, J. and B. Blossom. 2017. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Arctic Region, Effective June 1, 2017, Alaska Department of Fish and Game, Special Publication No. 17-01 Anchorage.



### I.14.3 Data Needs

- Pearce et al. 2018 (Summary of wildlife-related research on the Coastal Plain of the ANWR, AK, 2002–17.
- Evaluation of the efficacy, applicability and transferability of BMPs, permit stipulations and mitigation measures used in the NPR-A for use on the coastal plain, 1002 area (per National Research Council ([NRC] 2003) for all phases of industrial activity (seismic, exploration, development, restoration).

## I.15 BIRDS

### I.15.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

### I.15.2 Proposed Data Sources for EIS

- Douglas et al. 2002 distribution of Snow Geese. Also Kendall 2006.
- Species composition and distribution info from the CCP including references therein.
- Coastal Plain Breeding Bird Survey data (Larned et al. 2009 and more recent annual reports and datasets)—portions in ANWR.
- Common Eider survey data from ANWR (Dau and Taylor 2000 and more recent annual reports and datasets). Also ground-based surveys 2003–2004, and 2014–2017.
- Lagoon surveys for molting Long-tailed Ducks (Brackney et al. 1987, Lysne et al. 2004).
- Martin et al. 2009 impacts of climate change on NS birds.
- Stenhouse and Senner 2005, USFWS 2008a, Brown et al. 2001, Alaska Shorebird Group 2008
- Brown et al. 2007b
- NRC 2003.
- Garner and Reynolds 1986 and 1987
- Bart et al. 2013: no evidence of reduced density of birds near development in Prudhoe. Flint et al. 2003, Lacroix et al. 2003, Flint et al. 2016: no clear effect of seismic activity on foraging LTDU.



- Liebezeit et al. 2009: no effect of oil development on nesting success of shorebirds, some decline for passerines within 5 km.

### I.15.3 Data Needs

- Pearce et al. 2018 Summary of wildlife-related research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17.
- (RRA quote: "Much of the data from surveys and studies conducted in the 1002 Area are not widely available. The Refuge is working with FWS Science Applications to build a publically accessible database for the long-term dataset for the Canning River Delta tundra nesting bird project. Comparable efforts should follow for other projects to ensure appropriate storage and management of important data and allow for public data access to both contemporary and historical data.").

## I.16 TERRESTRIAL MAMMALS

### I.16.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

### I.16.2 Proposed Data Sources for EIS

- Mammal species composition and distribution information from the RCCP, including references therein.
- Wolf data from Delach and Matson 2011
- Golden Eagle distribution in relation to calving (Mauer 1987)
- Caribou papers and reports (Cameron et al. 2002, Griffith et al. 2002, Wertz et al. 2006, etc.)
- Citations from RRRA of particular interest:
  - Arthur, S. M., and P. A. Del Vecchio. 2017. Effects of grizzly bear predation on muskoxen in northeastern Alaska. *Ursus* 28: 81-91.
  - Boyle, B., D. Carlson, A. Johnson, and D. Sowards. 2001. Small mammal trapping on the coastal plain and Arctic Ocean coast, Arctic National Wildlife Refuge, 1999. Fairbanks, AK: U.S. Department of the Interior, Fish and Wildlife Service, Arctic National Wildlife Refuge, unpublished report.



### I.16.3 Data Needs

- Not in RCCP:
  - Caikoski, J. R. 2015. Units 25A, 25B, 25D, and 26C—Caribou. Chapter 15, Pages 15-1 through 15-24 in P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities, 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.
  - Lenart, E. A. 2015. Units 26B and 26C—Caribou. Chapter 18, Pages 18-1 through 18-38 in P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities, 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.
  - Russell, D. E., A. M. Martell, and W. A. C. Nixon. 1993. Range ecology of the Porcupine caribou herd in Canada. Rangifer, Special Issue No. 8. 167 pp.
- Caribou herd population estimates and seasonal ranges from Alaska Department of Fish and Game (updated since 2010).
- RCCP does not cover potential effects of oil and gas development. Other sources will be needed.
- Pearce et al. 2018 Summary of wildlife-related research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–2017.

## I.17 MARINE MAMMALS

### I.17.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

### I.17.2 Proposed Data Sources for EIS

- Polar bears were treated as terrestrial mammals in the RCCP, but are managed as marine mammals and are protected under the Marine Mammal Protection Act, as well as the Endangered Species Act.
- GIS layers of designated critical habitat units for polar bears.



- GIS layers of telemetry data showing onshore movements of collared polar bears.

### I.17.3 Data Needs

- NOTE: RCCP does not cover marine mammals except polar bears, so guidance is needed on inclusion of other marine mammal species in the EIS. The polar bear is listed as threatened under the ESA, so will it be discussed under marine mammals or special status species?
- GIS layers mapping suitable polar bear denning habitat (see Pearce et al. 2018).
- Pearce et al. 2018 Summary of wildlife-related research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–2017.
- Durner, G. M., and T. C. Atwood. 2018. A comparison of photograph-interpreted and IfSAR-derived maps of polar bear denning habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska. U.S. Geological Survey Open-File Report 2018-1083, 12 pp. doi:10.3133/ofr20181083.
- Pagano, A. M., G. M. Durner, K. D. Rode, T. C. Atwood, S. N. Atkinson, E. Peacock, D. P. Costa, M. A. Owen, and T. M. Williams. 2018. High-energy, high-fat lifestyle challenges an Arctic apex predator, the polar bear. *Science* 359: 568-572.
- Wilson, R. R., E. V. Regehr, M. St Martin, T. C. Atwood, E. Peacock, S. Miller, and G. Divoky. 2017. Relative influences of climate change and human activity on the onshore distribution of polar bears. *Biological Conservation* 214: 288-294. doi: 10.1016/j.biocon.2017.08.005
- McKinney, M. A., T. C. Atwood, S. J. Iverson, and E. Peacock. 2017. Temporal complexity of southern Beaufort Sea polar bear diets during a period of increasing land use. *Ecosphere* 8(1): e01633. doi:10.1002/ecs2.1633
- Olson, J. W., K. D. Rode, D. L. Eggett, T. S. Smith, R. R. Wilson, G. M. Durner, A. S. Fischbach, T. C. Atwood, and D. C. Douglas. 2017. Collar temperature sensor data reveal long-term patterns in southern Beaufort Sea polar bear den distribution on pack ice and land. *Marine Ecology Progress Series* 564: 211-224. doi: 10.3354/meps12000
- Atwood, T. C., B. G. Marcot, D. C. Douglas, S. C. Amstrup, K. D. Rode, G. M. Durner, and J. F. Bromaghin. 2016. Forecasting the relative influence of environmental and anthropogenic stressors on polar bears. *Ecosphere* 11(6): e01370. doi:10.1002/ecs2.1370



- Atwood, T. C., E. Peacock, M. A. McKinney, K. Lillie, R. R. Wilson, D. C. Douglas, S. Miller, and P. Terletzky. 2016. Rapid environmental change drives increased land use by an Arctic marine predator. *PLoS One* 11(6):e0155932. doi:10.1371/journal.pone.0155932
- Regehr, E. V., K. L. Laidre, H. R. Akçakaya, S. C. Amstrup, T. C. Atwood, N. J. Lunn, M. E. Obbard, H. Stern, G. W. Thiemann, and Ø. Wiig. 2016. Conservation status of polar bears (*Ursus maritimus*) in relation to projected sea-ice declines. *Biology Letters* 12: 0160556. doi:10.1098/rsbl.2016.0556
- Wilson, R. R., E. V. Regehr, K. D. Rode, and M. St. Martin. 2016. Invariant polar bear habitat selection during a period of sea ice loss. *Proceedings of the Royal Society B* 283(1836): 20160380. doi:10.1098/rspb.2016.0380
- Atwood, T. C., E. M. Peacock, M. A. McKinney, K. Lillie, R. R. Wilson, and S. Miller. 2015. Demographic composition and behavior of polar bears summering on shore in Alaska. Anchorage, AK: U.S. Department of the Interior, Geological Survey Administrative Report prepared under BOEM Interagency Award No. M09PG00025, AK-09-05B
- Atwood, T. C., B. G. Marcot, D. C. Douglas, S. C. Amstrup, K. D. Rode, G. M. Durner, and J. F. Bromaghin. 2015. Evaluating and ranking threats to the long-term persistence of polar bears. USGS Open-File Report 2014-1254, 114 p. doi:10.3133/ofr20141254
- Bromaghin, J. F., T. L. McDonald, I. Stirling, A. E. Derocher, E. S. Richardson, E. V. Regehr, D. C. Douglas, G. M. Durner, T. C. Atwood, and S. C. Amstrup. 2015. Polar bear population dynamics in the southern Beaufort Sea during a period of sea ice decline. *Ecological Applications* 25:634-651. doi:10.1890/14-1129.1
- Regehr, E. V., R. R. Wilson, K. D. Rode, and M. C. Runge. 2015. Resilience and risk—A demographic model to inform conservation planning for polar bears. USGS Open-File Report 2015-1029, 56 pp. doi:10.3133/ofr20151029
- Rode, K. D., C. T. Robbins, L. Nelson, and S. C. Amstrup. 2015. Can polar bears use terrestrial foods to offset lost ice-based hunting opportunities? *Frontiers in Ecology and the Environment* 13:138-145. doi:10.1890/140202
- Rogers, M. C., E. Peacock, K. S. Simac, M. B. O'Dell, and J. M. Welker. 2015. Diet of female polar bears in the southern Beaufort Sea of Alaska: evidence for an emerging alternative foraging strategy in response to environmental change. *Polar Biology*. doi:10.1007/s00300-015-1665-4



- Whiteman, J. P., H. J. Harlow, G. M. Durner, R. Anderson-Sprecher, S. E. Albeke, E. V. Regehr, S. C. Amstrup, and M. Ben-David. 2015. Summer declines in activity and body temperature offer polar bears limited energy savings. *Science* 349: 295-298. doi:10.1126/science.aaa8623
- Gleason, J. S., and K. D. Rode. 2009. Apparent shift in polar bear distribution and habitat association as a function of changing sea ice conditions during the fall open-water period in the Alaskan Beaufort Sea. *Arctic* 62: 405-417.
- Updated GIS data layers of maternal denning habitat mapped in study area, maternal den locations, and onshore movements of collared polar bears.

## I.18 SPECIAL STATUS SPECIES

### I.18.1 Literature and Databases Reviewed

- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement, January 2015
- Rapid-response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

### I.18.2 Proposed Data Sources for EIS

- RCCP lists all mammals in ANWR as species of special interest, BLM to confirm that the BLM list of special status species should be used instead
- “Of the 57 species known to regularly occur in the 1002 Area, 24 are USFWS Birds of Management Concern, 14 are USFWS Alaska Region Priority Species, and 10 are listed as Near Threatened or Vulnerable by the International Union for Conservation of Nature or are on the Audubon Red List. Two species listed under the provisions of the Endangered Species Act have been reported in the 1002 Area, although only spectacled eiders are known to currently reside and breed there.” — from RRRRA.
- Special species mentioned in RCCP: Yellow-billed Loon (listing precluded), Red-throated Loon, Arctic Tern, Short-eared Owl, Hoary Redpoll (Service 2008a), Audubon (Stenhouse and Senner 2005), and ADFG (ADFG 2006).
- 21 or 27 shorebird species in ANWR are of Moderate or High Conservation Concern by U.S. Shorebird Conservation Plan (Brown et al. 2001), Alaska Shorebird Conservation Plan (Alaska Shorebird



Group 2008, Service (2008a), or Audubon Alaska (Stenhouse and Senner 2005).

- PRISM study on shorebird abundance and habitat use (Brown et al. 2007b).
- Shorebird use of coastal habitats (Connors 1984, Taylor et al. 2010).
- ANWR study since 2005 on shorebird use of coastal areas.

### I.18.3 Data Needs

- Updated list of BLM Special Status Species is needed

## I.19 SPECIAL DESIGNATIONS

### I.19.1 Literature and Databases Reviewed

- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet website: <https://www.fws.gov/refuge/arctic/ccpwrsumfindings.html>.
- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USACE. 2012. Final Environmental Impact Statement. July 2012.
- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge, Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.

### I.19.2 Proposed Data Sources for EIS

- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet Website: <https://www.fws.gov/refuge/arctic/ccpwrsumfindings.html>.



- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USACE. 2012. Point Thomson Project EIS. Final Environmental Impact Statement. July 2012.
- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge, Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.

### I.19.3 Data Needs

- The following are not critical, but are needed to support impact analysis on opportunities for solitude in the Coastal Plain WSA and adjacent Mollie Beattie Wilderness (as outlined in the Rapid-Response Assessments):
  - Noise data
    - Baseline acoustic conditions
    - Acoustic characteristics of specific development-related noise sources
    - Modeled spatial predications of acoustic impacts
    - Disturbance-response information
    - Long-term acoustic monitoring
  - Updated Visitor Survey data

## I.20 CULTURAL RESOURCES

### I.20.1 Literature and Databases Reviewed

- Alaska Heritage Resources Survey (AHRs) database
- North Slope Borough (NSB) Traditional Land Use Inventory (TLUI) database will need to be consulted; request must go through Iñupiat History, Language and Culture (IHLC)
- North Slope Science Initiative (NSSI) website (Alaska Center for Conservation Science 2017)
- Bureau of Ocean Energy Management (BOEM) Alaska Shipwreck Inventory and National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and Obstruction Information System (AWOIS)
- RS-2477 Trail Inventory
- Cultural resource survey reports (e.g., (Grover and Ryder 2011, Hall 1982))



- Previous EISs (e.g., Point Thomson, Arctic National Wildlife Refuge)
- FWS Rapid Response Resource Assessment

### **I.20.2 Proposed Data Sources for EIS**

- Cultural resource survey reports within and adjacent to I002 area
- Cultural resource databases and inventories (e.g., AHRS, TLUI, Shipwreck)
- Cultural resource related information including projects, reports, and data available on NSSI website
- Technical and academic literature, studies, and research related to cultural resources including cultural chronologies, site investigations, and ethnographic resources (e.g., sacred sites, traditional cultural properties [TCPs], ethnographic landscapes)
- Geological/geomorphological studies related to coastal erosion and potential effects to the archaeological record
- Traditional Knowledge sources (including scoping) to identify local knowledge regarding culturally important places and potential effects to cultural resources

### **I.20.3 Data Needs**

- Download AHRS data for I002 area
- Download previous survey reports from AHRS system
- Identify RS-2477 Trails for I002 area
- Request TLUI data from NSB, IHLC for I002 area
- Review Alaska Shipwreck Inventory and AWOIS system vis-à-vis potential landing or dredging areas
- Identification-level surveys across a broad spectrum of landscapes to better characterize the distribution of sites, site types, and to inform and refine GIS models for Section I06 process
- Evaluate sites for NRHP eligibility for Section I06 process
- Identification and documentation of ethnographic resources including oral histories, place names, TCPs, cultural landscapes, and sacred sites. Information regarding these resources may be gleaned from previous studies and scoping testimony but will also likely require focused interviews and research with Iñupiaq and Gwich'in groups. Scoping comments received at the Arctic Village 5/24/18 scoping meeting indicated there are many documented and undocumented TCPs that could be potentially affected by the proposed project.



- GIS modeling of potential site locations to inform future survey priorities and leasing areas incorporating known site characteristics, landscape features, and/or theory driven approaches.

## **I.21 SUBSISTENCE**

### **I.21.1 Literature and Databases Reviewed**

- Alaska Department of Fish and Game (ADF&G) Community Subsistence Information System (CSIS) (ADF&G 2018a)
- ADF&G Fisheries, Subsistence, and Habitat Publications Searchable Database (ADF&G 2018b)
- North Slope Borough (NSB) subsistence reports (e.g., (Brower, Olemaun, and Hepa 2000, Bacon, Hepa, Brower, Pederson, Olemaun, George, and Corrigan 2009))
- North Slope Science Initiative (NSSI) website (Alaska Center for Conservation Science 2017)
- Bureau of Ocean Energy Management (BOEM) reports (e.g., (Impact Assessment Inc. 1990))
- Technical and academic reports (e.g., (Jacobson and Wentworth 1982, Dinero 2005))
- Publicly available scoping reports and transcripts for Point Thomson projects (2002-2003; 2009-2012) and current Coastal Plains EIS
- Arctic National Wildlife Refuge EIS
- FWS Rapid Response Resource Assessment

### **I.21.2 Proposed Data Sources for EIS**

- Harvest studies for Kaktovik, Arctic Village, and Venetie in the ADF&G CSIS
- Subsistence reports for Kaktovik, Arctic Village, and Venetie in ADF&G Fisheries, Subsistence, and Habitat Publications Searchable Database
- Kaktovik harvest data and use areas from NSB and BOEM subsistence reports
- Subsistence related information including projects, reports, and data available on NSSI website
- Kaktovik, Arctic Village, and Venetie subsistence reports available in technical and academic literature
- Kaktovik, Arctic Village, and Venetie traditional knowledge, comments, and concerns in publicly available scoping reports and transcripts for Point Thomson projects and current Coastal Plains EIS



- Oral Histories and Traditional Knowledge for Coastal Plain and related to migratory resources (e.g., caribou, birds, marine mammals).
- Tribal government or non-agency subsistence information (e.g., Council of Athabaskan Tribal Governments [CATG] studies)

### 1.21.3 Data Needs

- Subsistence Use Area Information
  - Data gaps for long-term subsistence use areas for potentially affected communities exist if the mapping information is greater than 10 years old. The most recent comprehensive (i.e., all resources), long-term use area mapping studies are available for Kaktovik (1996-2006 study period), Arctic Village (pre-1982 study period), and Venetie (pre-1982 study period). All three communities' use area information is greater than 10 years old. Subsistence use area mapping field studies would be required to address these data gaps in the three study communities.
- Harvest Information
  - Typically, lead agencies (state or federal) determine when harvest information is outdated, and in past projects these recommendations for updating harvest information have been given when the data are older than 3-5 years. The most recent comprehensive (i.e., all resources) harvest information are available for Kaktovik (2010-11) and Venetie (2009). Comprehensive harvest data are not available for Arctic Village although there are data available for birds (2000) and non-salmon fish harvests (2001-02, 2002-03). All three communities' harvest information is greater than 5 years old. Harvest survey field studies, including documentation of the cultural importance of caribou, would be required to address these data gaps in the three study communities.
  - Scoping comments received at the Arctic Village 5/24/18 scoping meeting indicated that the CATG has harvest information for potentially affected communities. Coordination with CATG is needed to determine the availability and suitability of these data for incorporation into the EIS.
  - Information on sharing practices in Kaktovik and Venetie has recently been updated (Kofinas, BurnSilver, Magdanz, Stotts, and Okada 2016); information on sharing practices, which could be affected if there are changes to migratory resources, is lacking for Arctic Village. Scoping comments received at the Arctic Village 5/24/18 also identified concerns regarding changes to sharing practices.



- Traditional Knowledge
  - Existing traditional knowledge related to the Coastal Plain, resources that migrate through the area, and potential effects needs to be compiled including documentation of the cultural importance of caribou to study community residents and their cultural identity. This would include a desktop review of scoping comments (including past projects) and traditional knowledge literature search. Subsistence use area mapping studies and/or harvest surveys (see above) would also be an avenue for documenting traditional knowledge regarding these topics.

## **I.22 SOCIOCULTURAL SYSTEMS**

### **I.22.1 Literature and Databases Reviewed**

- Previous EISs, EAs, and other studies relating to oil and gas development in the Alaska North Slope and containing baseline descriptions of and/or the potential for impacts to sociocultural systems of the North Slope, particularly in the domains of cultural values, social organization, and characteristics of the population.

### **I.22.2 Proposed Data Sources for EIS**

- Liberty Development and Production Plan Final EIS
- Northstar Final EIS
- Multiple Beaufort Sea and Chukchi Sea Planning Area Lease Sale EIS's
- Multiple MMS/BOEM Social and Economic Program Technical Studies encompassing North Slope communities
- Multiple Alaska Department of Fish and Game Subsistence Division technical papers encompassing North Slope communities
- NPR-A FINAL Integrated Activity Plan/ Environmental Impact Statement
- Greater Mooses Tooth I Final SEIS
- Greater Mooses Tooth II Modified NEPA Analysis Document

### **I.22.3 Data Needs**

- Description of sociocultural systems are available in the public domain.
- Impacts on sociocultural systems can be described using socioeconomic impact information that will be developed in the economy and subsistence sections of the EIS.



## **I.23 ENVIRONMENTAL JUSTICE**

### **I.23.1 Literature and Databases Reviewed**

- Previous EISs, EAs, and other studies relating to oil and gas development in the Alaska North Slope and containing baseline descriptions of and/or the potential for disproportionate high and adverse impacts to minority and/or low-income populations of the North Slope.

### **I.23.2 Proposed Data Sources for EIS**

- US Census data on race, ethnicity, and income, including poverty thresholds
- Alaska Department of Labor and Workforce Development (ADOLWD) income and employment data
- Multiple Beaufort Sea and Chukchi Sea Planning Area Lease Sale EIS's
- Multiple MMS/BOEM Social and Economic Program Technical Studies encompassing North Slope communities
- Multiple Alaska Department of Fish and Game Subsistence Division technical papers encompassing North Slope communities
- NPR-A FINAL Integrated Activity Plan/ Environmental Impact Statement
- Greater Mooses Tooth I Final SEIS
- Greater Mooses Tooth II Modified NEPA Analysis Document

### **I.23.3 Data Needs**

- Description of minority populations and low-income populations are available in the public domain.
- Disproportionate high and adverse impacts on minority and/or low-income populations can be described using socioeconomic impact information that will be developed in the sociocultural systems, economy, subsistence sections of the EIS, in addition to any other sections of the EIS analysis reporting environmental or human health impacts that could disproportionately accrue to relevant local populations.
- Information on potential concerns expressed during the EIS scoping process itself will also be screened for applicability to the Environmental Justice analysis.



## I.24 RECREATION

### I.24.1 Literature and Databases Reviewed

- Alaska Department of Fish and Game. 2018. Game Management Unit 26 Hunting Restrictions. <http://www.adfg.alaska.gov/index.cfm?adfg=huntingmaps.restrictionsbygmu&gmu=26>
- Alaska Department of Fish and Game. 2017. 2017-2018 Alaska Hunting Regulations.
- BLM. 2012. National Petroleum Reserve-Alaska. Final Integrated Activity Plan/Environmental Impact Statement. November 2012.
- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge, Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.
- USACE. 2012. Point Thomson Project EIS. Final Environmental Impact Statement. July 2012.
- USFWS. 2006. Refuge Management, Parts 603: National Wildlife Refuge System of Uses and Part 605: Wildlife-Dependent Recreation.
- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet website: <https://www.fws.gov/refuge/arctic/ccpwrsumfindings.html>.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

### I.24.2 Proposed Data Sources for EIS

- Alaska Department of Fish and Game. 2018. Game Management Unit 26 Hunting Restrictions. <http://www.adfg.alaska.gov/index.cfm?adfg=huntingmaps.restrictionsbygmu&gmu=26>
- Alaska Department of Fish and Game. 2017. 2017-2018 Alaska Hunting Regulations.
- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge,



Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.

- USACE. 2012. Point Thomson Project EIS. Final Environmental Impact Statement. July 2012.
- USFWS. 2006. Refuge Management, Parts 603: National Wildlife Refuge System of Uses and Part 605: Wildlife-Dependent Recreation.
- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet website: <https://www.fws.gov/refuge/arctic/ccpwrsumfindings.html>.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the I002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

#### **I.24.3 Data Needs**

- The following data are needed to support impact analysis on recreation opportunities:
  - Updated visitor use data
  - Updated animal harvest data for Game Management Unit 26C
  - A Reasonable Foreseeable Development Scenario (RFD) to predict future oil and gas development in the I002 Area and support the EIS. Necessary components of the RFD related to recreation include:
    - General location and extent of any new access roads, including ice roads and snow trails
    - General location and extent of any new sea or river ports
- General location and extent of any new air strips and helipads

### **I.25 VISUAL RESOURCES**

#### **I.25.1 Literature and Databases Reviewed**

- Arctic National Wildlife Refuge Comprehensive Conservation Plan and Final Environmental Impact Statement: Does not contain a visual resources discussion. Contains several general references to the overall scenery.



- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Final Environmental Impact Statement: Does not contain a visual resources discussion.
- Rapid Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program: Does not contain a visual resources discussion. Report states that the effects of highest concern on visitor opportunities and experiences include “reduced scenic opportunities due to changes to apparent naturalness by the addition of man-made structures.” Report recommends “viewscape baseline study (including visible pollution plume resulting from air quality affecting viewscape) to document visual resource conditions and potential future changes to existing undeveloped viewshed.”
- Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan Public Comments (May 2012)

#### **I.25.2 Proposed Data Sources for EIS**

- Level III ecoregions map: <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-10#pane-01>
- LANDFIRE maps: <https://www.landfire.gov/>
- USGS maps: <https://www.usgs.gov/products/maps/map-topics/overview>

#### **I.25.3 Data Needs**

- Landscape descriptions for topography, vegetation cover, water sources, human-made modifications, soil conditions, and geologic formations
- Public sensitivity (type of users, amount of use, public interest, adjacent land uses, and special areas)
- Sources of artificial light
- Broad landscape photos of proposed area, including from developed or settled areas and areas receiving frequent use by public

### **I.26 TRANSPORTATION**

#### **I.26.1 Literature and Databases Reviewed**

- BLM. 2012. National Petroleum Reserve-Alaska. Final Integrated Activity Plan/Environmental Impact Statement. November 2012.
- BLM. 2014. Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project. October 2014.



- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge, Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.
- USACE. 2012. Point Thomson Project EIS. Final Environmental Impact Statement. July 2012.
- USFWS. 2006. Refuge Management, Parts 603: National Wildlife Refuge System of Uses and Part 605: Wildlife-Dependent Recreation.
- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet website: <https://www.fws.gov/refuge/arctic/ccpwsumfindings.html>.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

#### **I.26.2 Proposed Data Sources for EIS**

- Christensen, N. and Christensen, L. 2009. Arctic National Wildlife Refuge Visitor Study: The Characteristics, Experiences, and Preferences of Refuge Visitors. Arctic National Wildlife Refuge, Aldo Leopold Wilderness Research Institute. <http://arctic.fws.gov/pdf/visitorstudy.pdf>.
- USFWS. 2006. Refuge Management, Parts 603: National Wildlife Refuge System of Uses and Part 605: Wildlife-Dependent Recreation.
- USFWS. 2010. Public Use Summary Arctic National Wildlife Refuge. April 2010.
- USFWS. 2015. Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan. Appendix H Wilderness Review. Appendix I Wild and Scenic River Review.
- USFWS. 2015. Internet website: <https://www.fws.gov/refuge/arctic/ccpwsumfindings.html>.
- USFWS. 2018. Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge



in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 2000I.

### I.26.3 Data Needs

- The following data are needed to support impact analysis on recreation opportunities:
  - A Reasonable Foreseeable Development Scenario (RFD) to predict future oil and gas development in the 1002 Area and support the EIS. Necessary components of the RFD related to transportation include:
    - General location and extent of any new access roads, including ice roads and snow trails
    - General location and extent of any new sea or river ports
    - General location and extent of any new air strips and helipads
  - Aircraft landings and takeoffs at nearby landing strips (lower priority)
  - Commercial watercraft (e.g., barge) landings annually at nearby locations (lower priority)

## I.27 ECONOMY

### I.27.1 Literature and Databases Reviewed

- Previous EISs, EAs, and other studies relating to oil and gas development in the Alaska North Slope
- Arctic National Wildlife Refuge Comprehensive Conservation Plan
- Arctic National Wildlife Refuge, 1002 Area, Petroleum Assessment, 1998, Including Economic Analysis
- NPR-A FINAL Integrated Activity Plan/ Environmental Impact Statement
- Greater Mooses Tooth I Final SEIS
- Greater Mooses Tooth II Modified NEPA Analysis Document

### I.27.2 Proposed Data Sources for EIS

- Data that describes the existing conditions of the local, regional, and state economy are available in the public domain:
  - i. *Employment and income data.* Alaska Department of Labor and Workforce Development (ADOLWD) employment data for North Slope communities, the North Slope Borough, Alaska (statewide);
  - ii. *Revenue data for the State of Alaska.* Revenue Sources Book published by the Alaska Department of Revenue.



- iii. *Local and regional economic data.* Alaska Local and Regional Information (ALARI) published by ADOLWD provides data on population, number of resident workers by industry, worker characteristics, and others. The 2015 North Slope Borough Economic Profile and Census Report also provides detailed socioeconomic and demographic data for all the communities in the NSB region.
- iv. *NPR-A Impact Mitigation grants to communities.* Data on funds/grants received by North Slope communities from the NPR-A Impact Mitigation Program which is funded by royalties received from oil and gas activities in federal lands in the NPR-A.
- v. *Community Information.* Alaska Department of Commerce and Community Development (ADCCED) community database provides data on local public infrastructure (facilities and amenities), incorporation type, history and culture, public organizations.
- vi. *Local Government Audited Financial Statements/Budget documents.* ADCCED publishes financial statements and budget documents from Alaska local and regional governments.
- vii. *Information on Alaska Native Organizations.* Published data on Alaska native/tribal organizations in the North Slope.
- Potential data sources for the environmental consequences section include previous EISs/EAs of oil and gas development in the North Slope, the MAG-PLAN Alaska model, the revenue model developed by the ADNDR Division of Oil and Gas, the ADNDR cash flow model that provides metrics for economic viability of oil and gas field development in the North Slope, and previous onshore and offshore petroleum development economic impact studies conducted by Northern Economics.

### I.27.3 Data Needs

The following data will be needed for determining potential economic impacts of oil and gas development:

- *Description of potential oil and gas activities and timeframes under each alternative.* This will include scenarios or assumptions regarding exploration, development, and production activities (i.e., road/ice road construction, on-shore pipelines, processing facilities, camps, etc.) This will be the basis for quantifying the magnitude and scale of economic impacts. [Information will be developed by the Project team based on geological prospects, examples of scenarios from previous EISs/EAs in the North Slope, and subject matter experts]



- *Production volumes by year.* This data will be used to calculate potential royalty payments and other State and the Federal government tax payments. [Information will be developed by the Project team]
- *Oil price forecasts.* This information will be used to quantify potential royalty payments and other fiscal effects of the proposed project. Oil price projections can be obtained from the Alaska Department of Revenue (ADOR Revenue Sources) and from the Energy Information Administration (EIA) Annual Outlook. Alternatively, a constant price scenario could be adopted by the Project team.
- *Construction costs (CAPEX) and construction schedule.* This information will be used to calculate indirect (or multiplier) effects of construction spending as well as potential government revenues including oil and gas property taxes and state corporate income taxes. This data can also be used to estimate direct employment requirements associated with the construction activities. The MAG-PLAN model and data from previous oil and gas development studies in the North Slope can be used to develop rough-order of magnitude cost estimates.
- *Annual operations and maintenance costs of the facilities.* This information will be used to calculate indirect (or multiplier) effects of O&M spending as well as potential government revenues including state corporate income taxes. This data can also be used to estimate direct employment requirements associated with the operations phase (if direct jobs data are not available). The MAG-PLAN model and data from previous oil and gas development studies in the North Slope can be used to develop rough-order of magnitude cost estimates.
- *Tariffs and transportation costs.* This information will be used to calculate netback prices which are the bases for calculating royalty payments. Data on existing tariffs and transportation costs are published by the Alaska Department of Revenue (Revenue Sources Book).
- *Land ownership.* This will be used to determine potential royalty and right-of-way payments that would accrue to the landowners.
- *Gravel sources and quantities.* The data will be used to determine potential revenues to local/regional entities that would benefit from construction/development activities associated with the proposed project. If data are not available, gravel royalties/sales will be identified as a potential revenue source but will not be quantified.



I

This page intentionally left blank.

USFWS



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**Cc:** Mitch Ellis[mitch\_ellis@fws.gov]; Eric Taylor[eric\_taylor@fws.gov]; Sara Boario[sara\_boario@fws.gov]  
**From:** Colligan, Mary  
**Sent:** 2018-06-21T13:33:41-04:00  
**Importance:** Normal  
**Subject:** Re: Note to Reviewer: Coastal Plain Seismic EA Draft Affected Environment Chapter and Specialist Reports  
**Received:** 2018-06-21T13:33:46-04:00  
[DRAFT\\_Seismic\\_EA\\_Chapter\\_3\\_Existing\\_Condition\\_06182018 MAC\(1\).docx](#)

I have attached my comments and suggested edits. I don't know if others have already completed their reviews or if they want to add to this. I have the note to reviewer so can sign that and note I submitted comments electronically.

If others let me know where they are in their review I can move the note to reviewer accordingly.

Thanks

On Mon, Jun 18, 2018 at 4:10 PM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Hi Mary, Mitch, Eric and Sara,

Attached is a draft of the Coastal Plain Seismic EA Draft Affected Environment Chapter and Specialist Reports requested by BLM Arctic Field Office in anticipation of a seismic application from SAE.

It was agreed that this would go out for concurrent review to all ARDs in order to meet the rapid timeline. The desired date to BLM was set as 6/22 so that BLM Arctic Field office staff can use it as a basis to start identifying issue and environmental consequences. However, FWS has not been notified by BLM that a complete application for a seismic permit has been submitted, so deadline is primarily based off "intent to keep things moving." I will check in on Thursday afternoon to get your feedback on timeline.

I will send the original note to reviewers down to Anchorage with Mary this week.

Thank you,

Wendy

Dr. Wendy M. Loya,



Arctic Program Coordinator

Office of Science Applications, US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

Mary Colligan

Assistant Regional Director

Fisheries and Ecological Services

U.S. Fish and Wildlife Service, Alaska Region

1011 E. Tudor Road, MS-361

Anchorage, AK 99503

907-786-3505

cell: 907-223-5945



## DRAFT Arctic Refuge Coastal Plain Seismic EA

Chapter 3 Affected Environment

Prepared by the US Fish and Wildlife Service

### Oil and Gas Resources

USGS Open File Report 2009-1112 (Attanasi and Freeman 2009) provided an update of the economics of undiscovered oil and gas resources in the North Slope of Alaska, including the Arctic Refuge coastal plain. The study estimated there was a 95% probability the Arctic Refuge coastal plain contained at least 5.92 billion barrels of technically recoverable oil, and a 5% probability the technically recoverable volume of oil could be 15.16 billion barrels. The mean estimate of technically recoverable oil for the Arctic Refuge coastal plain was 10.35 billion barrels. Of this, 80 to 90 percent was estimated to be economically recoverable at \$42/barrel. The threshold price to initiate exploration was estimated to be from \$20 to \$21 per barrel. The current price of West Coast crude is around \$75/barrel. The current price of West Texas Intermediate crude is around \$65/barrel. The U.S. Energy Information Agency forecasts the price of crude oil to steadily rise to over \$85 per barrel over the next 10 years (U.S. Energy Information Agency, 2018).

The USGS study projected that oil deposits are expected to occur in 10 areas (rather than a single large accumulation), which would require dispersed drilling sites to develop all the recoverable oil resources. Most of the oil deposits (over 80%) are thought to lie in the western Arctic Refuge coastal plain (eg. in the area known as the “undeformed area” west of the Marsh Creek anticline).

The USGS report did not include estimates related to the production of natural gas from the Arctic Refuge coastal plain.

### Air Quality

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, air quality monitoring occurs in the active oil fields of Pt. Thomson, Badami, Endicott and Prudhoe Bay. Data available from these sites confirm that pollutant concentrations in the study area are in compliance with the respective [National Ambient Air Quality Standards \(NAAQS\)](#) and [Alaska Ambient Air Quality Standards \(AAAQS\)](#) according to the Pt. Thomson EIS (U.S. Department of Defense 2012). With prevailing winds from the northeast, it is likely that air quality on the Arctic Refuge Coastal Plain would generally experience less impacts from existing industrial emissions from development to the west, except during instances when winds come from the west.

### Climate

The climate of the Arctic Refuge coastal plain is characterized by short and cool summers, and long, cold winters. The growing season lasts from June to August, although extending earlier and later over time. Subfreezing temperatures and snow may occur at any time during the year. The coastline and barrier islands experience more frequent cloudiness and fog with higher winds. Clear skies are more common,

Deleted:

Commented [CMA1]: Do you think Greg would want this reordered consistent with how he wanted our scoping comments? Or does it need to be aligned with the outline BLM presented during the call yesterday?

Commented [CMA2]: How is this consistent with the first sentence saying there is no data?



winds are variable, and summers are warmer and less cloudy with increasing distance from the coast. At Barter Island, temperatures average 40 °F in July (warmest month) and -20 °F in February (coldest month) (Table 4–2). Temperatures to the south on the coastal plain and in the northern foothills of the Brooks Range are more similar to those measured at weather stations at Kuparuk and Toolik Lake, ranging from means of 47 to 53 °F in July and -18 to -6 °F in February.

Snowfall measurements date back to 1949 on Barter Island, but the monitoring site was taken out of service in 1989, resulting in a discontinuous record of snow climatology. In 2000, three meteorological stations were established (Urban and Clow 2017) as part of the Global Terrestrial Network for Permafrost (DOI/GTN-P) in remote parts of the Arctic National Wildlife Refuge coastal plain. The limited data available from these stations are the only modern continuous record of snow accumulation in this region of Alaska. The average annual water equivalent of all precipitation is less than 10 inches, most of which falls as summer rainfall, but includes 32 to 46 inches of snowfall. Evaporation rates are low due to low temperatures and a short growing season. The length of the snow season impacts the timing of winter exploration activities as well as the breeding phenology of flora and fauna. In addition, the snowpack in the Brooks Range, and glacier mass, affect water availability in rivers and lakes for fish and wildlife habitat, as does the presence of frozen masses of emergent groundwater known as *aufeis*.

Surface winds along the Arctic coast average 9 to 15 miles per hour (mph), with occasional intense storms generating winds exceeding 70 mph. Winds are predominantly from the northeast, although the strongest winds come from the west. September and October are the windiest months on the coast, probably due to maximum amounts of open water (Wendler et al. 2010). During winter, winds are a major force affecting the distribution and amount of snow cover on the coastal plain. Higher, rolling terrain is often blown clear, or nearly so, while dense snow drifts accumulate in sheltered areas along stream banks.

## Water Resources

Ninety-nine percent of the Arctic Refuge coastal plain is considered wetlands; however, lakes are scarce and account for less than two percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre, and ninety percent are less than 12 acres. During winter, most waterbodies on the Arctic Refuge coastal plain freeze solid as they are typically not as deep as the depth of freeze (approximately 7 ft; Trawicki et al. 1991; Lyons and Trawicki 1994). Small pockets of unfrozen water occur in lakes with depths that exceed ice growth. By the end of the winter season, the volume of liquid water in these lakes has been estimated to be reduced by ninety-eight percent (Craig 1989b). Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. Up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer (Bowling et al. 2003), with the remainder coming from direct precipitation.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed



reaches. During spring, snowmelt begins in the foothills and proceeds to the coastal plain providing as much as 50% of the annual flow to rivers (Clough et al. 1987, Sloan 1987).

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a). Spring systems on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakturak springs.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands.

## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented and all are characterized by a cold temperature regime: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristels, Typic Haplogelepts, and Typic Histoturbels (Soil Survey Staff 2014, 2016). Soil texture varies across topographic features. Uplands slope gently northward and are generally composed of silt, rocky silt and peat with some glaciated uplands containing a broader range of particle sizes. Lowlands such as the plains and floodplains have coarser textured soils composed of sand, gravel and peat. The majority of uplands are located in the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, uplands are primarily located along the southern boundary and extend approximately one-third of the way to the coast.

Permafrost is any soil that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces in the region and as much as 88% of the **planning area** is underlain by ice rich permafrost (>50% water). Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Permafrost on the coastal plain is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

Commented [CMA3]: Arctic Refuge coastal plain?



The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). Nearly all the biological activity in soils of the far north takes place within this zone and it is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018).

## Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west. The varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

The three major ecoregions in the Arctic Refuge coastal plain are the coast, coastal plain, and foothills. The coast has bays and inlets, lagoons with barrier islands, exposed peat bluffs, drained breached lake basins, and deltas. The Beaufort Coastal Plain ecoregion is a smooth treeless plain rising gradually from the Arctic Ocean to the foothills of the Brooks Range. This ecoregion is mainly undulating coastal plains and vast floodplains, with a small proportion of thaw lake plains. The dominant vegetation along the coast and within the coastal plain is mainly Moist sedge-willow or Moist sedge-Dryas tundra; however, salt marshes are found in coastal depressions along the coast while wet graminoid occupy basins on the coastal plain. Permafrost-related features include extensive networks of ice-wedge polygons, beaded streams, oriented lakes, peat ridges, and frost boils. On the southern end of the Arctic Refuge coastal plain, the Brooks Range Foothills ecoregion has rolling hills and plateaus, with better defined drainages and fewer lakes than in the Coastal Plain. The foothills reach north all the way to the coast along 10 miles of the coast in the western half of the Arctic Refuge coastal plain. Permafrost features are common. Vegetation in the foothills is mainly Moist tussock tundra. There are few if any known non-native or invasive species within the coastal plain.

## Fisheries

The Arctic Refuge coastal plain hosts few species of fish due to limited availability of freshwater habitats. Common species present in freshwater lakes and rivers within the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius*. Round whitefish and burbot are present in the Canning River, but nowhere else in the Arctic Refuge coastal plain (Frugé and Palmer 1994).



Dolly Varden occur as two forms: anadromous populations that rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; and dwarf populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs (Craig and McCart 1974; Fruge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

The lagoons are very productive environments for marine and anadromous species during summer. Lagoons become hypersaline and very cold environments under ice. As winter approaches and the lagoons begin freezing, anadromous fishes return to freshwater and marine fishes retreat to offshore environments. Common anadromous species that occur in the nearshore marine environments adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, and rainbow smelt *Osmerus mordax*. (Craig 1984; Fruge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Arctic cisco, broad whitefish, humpback whitefish, least cisco, and rainbow smelt feed along the coast but have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species are thought to be strays from southern Chukchi or northern Bering Sea populations (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009).

While there are numerous marine species in the Beaufort Sea, only four are abundant in the nearshore marine environments adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species migrate along shore in the southern Beaufort Sea, marine species migrate towards shore during summer and away from shore during winter (Craig 1984).

## Birds

The Arctic Refuge Coastal Plain and adjacent marine waters are recognized as Important Bird Areas by the American Bird Conservancy, Audubon, and Birdlife International. In the Arctic Refuge's northern foothills, coastal plain, and adjacent marine waters, at least 158 species of migratory birds have been recorded, (U.S. Fish and Wildlife Service 2015a). At least 57 species regularly occur as breeding, non-breeding, or both in the Coastal Plain (summarized in Pearce et al. 2018).

Although some Arctic Refuge Coastal Plain bird species have been fairly well studied [e.g., Golden Eagles (*Aquila chrysaetos*) and Snow Geese (*Chen caerulescens*), Douglas et al. 2002], distribution and abundance data are incomplete for many and contemporary information is lacking for most. Of the 57 species known to regularly occur in the Coastal Plain, nine are U.S. Fish and Wildlife Birds of Conservation Concern and nine are listed as Near Threatened by the International Union for Conservation of Nature or are on the Audubon Alaska Red List (Table 1, IUCN 2017; U.S. Fish and Wildlife Service 2008; Warnock 2017). The only bird species known to occur in the Coastal Plain listed under the Endangered Species Act ([ESA](#)) are the threatened Alaska-breeding population of the Steller's eider



(*Polysticta stelleri*) and threatened spectacled eider (*Somateria fischeri*). Both species primarily occur west of Arctic Refuge with Steller's eider listed as a "rare visitor" and spectacled eider as a "rare breeder" in the Coastal Plain (U.S. Fish and Wildlife Service 2015a) and will be addressed under section 7 consultation pursuant to the ESA.

## Terrestrial Mammals

The Arctic Refuge coastal plain provides habitat for many species of terrestrial mammals, including caribou, muskoxen, moose, grizzly bears, wolves, foxes, wolverines, and a variety of rodents and other small mammals. Muskoxen were reintroduced to the region in 1969 and 1970. The population increased and spread across the coastal plain through about 1998, then declined steeply through 2006. Currently, few muskoxen reside within the Refuge year-round (U.S. Fish and Wildlife Service 2015a) but populations are stable or increasing in nearby areas to the east and west. Moose on the coastal plain are largely restricted to patches of woody vegetation along streams during winter, but moose spread out across the area during summer. Moose populations in the Arctic Refuge increased rapidly during the 1980s, then declined during the 1990s. More recently, moose abundance has increased along the northwestern part of the Refuge, but not along most of the coastal plain east of the Canning River (U.S. Fish and Wildlife Service 2015a). Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Some grizzly bears den on the coastal plain during winter, but bear abundance in the area is highest in early summer during caribou calving. Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Arctic fox abundance cycles in response to changes in lemming abundance, which has pronounced effects on alternate prey species, such as ground-nesting birds. Little is known about the abundance, distribution, and species composition of small mammal communities in northeastern Alaska. Of the more common species, arctic ground squirrels have a patchy distribution on the coastal plain because denning habitat is limited. Microtine rodents, particularly brown lemmings, are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many predators in years when they are abundant.

## Caribou

Caribou are the most abundant large mammal in the Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters in Arctic Village, Venetie, Stevens Village, Beaver, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for grizzly bears and wolves. The two caribou herds most commonly occurring in the Arctic Refuge are the Porcupine and Central Arctic herds. The Porcupine herd is one of the 2 largest herds in North America. In 2017 this herd was estimated to comprise 219,000 caribou (Alaska Department of Fish and Game 2017b). The Porcupine herd ranges over 130,000 square mi (337,000 square km) in northeastern Alaska and northwestern Canada (Lenart 2007). The Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou in many years (Griffith et al. 2002), and some caribou are found there during winter. The Central Arctic herd currently numbers about 23,000 caribou (2016 estimate; Alaska Department of Fish and Game 2017a). The annual range of this herd overlaps that of the Porcupine caribou herd in the western part of the Refuge. Most calving by Central Arctic caribou occurs on State lands west of the Refuge, but the western coastal plain of the Refuge is often used by the



Central Arctic herd during post calving, summer, and fall. Some caribou from this herd and the neighboring Teshekpuk herd occasionally use the Refuge coastal plain during winter.

## Threatened and Endangered Species

Alaska-breeding Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), and polar bear (*Ursus maritimus*) are listed as threatened pursuant to the ESA of 1973, as amended. All three of these species may occur in the Arctic Refuge coastal plain, although listed eiders are not present during the winter months and the Arctic Refuge is at the eastern edge of their current range.

The proposed action is within the range of the Southern Beaufort Sea (SBS) subpopulation of polar bear, a species globally listed as threatened under the federal ESA in addition to being protected under the Marine Mammal Management Protection Act (MMPA). The SBS subpopulation had an estimated population size of approximately 900 bears in 2010. This estimate represents a significant reduction from previous estimates of approximately 1,800 in 1986, and 1,526 in 2006. Although there was some evidence in the 2010 estimate that the population might be beginning to increase, analyses of over 20 years of data on the size and body condition of bears in this subpopulation demonstrated declines for most sex and age classes.

Declining sea ice conditions in the Beaufort Sea have led to an increase in the proportion of the subpopulation coming onshore in summer and autumn (from 5.8% during 1986-1999 to 20% during 2000-2014) and a 30 day increase in time spent on land. Bears in the SBS subpopulation are drawn to bowhead whale remains from subsistence harvest, particularly adjacent to the community of Kaktovik, Alaska, where ~60% of bears coming onshore will reside in late summer/fall.

The Arctic Refuge coastal plain has also been documented to be an important area for denning by polar bears and will likely increase in importance as the percent of bears denning on land increases with sea ice loss. Designated critical denning habitat overlaps with 77% of the 1002 area of the Arctic National Wildlife Refuge. The Arctic Refuge coastal plain contains 38% more denning habitat than the region immediately west of the refuge. Polar bears have been shown to den in the Arctic Refuge coastal plain area with greater frequency than expected based on available habitat, with 22% of identified dens for bears from 2000-2010 in the SBS subpopulation occurring within the area.

## Prehistoric and Historic Cultural Resource Sites

Knowledge of prehistoric and historic cultural resource sites in the study area is mostly derived from investigations conducted in the latter half of the 20<sup>th</sup> Century. From the most relevant studies (Solecki et al. 1973, Hall 1982, Jacobson and Wentworth 1982, Wilson 1991, and Grover and Laughlin 2012), it is understood that human use of the area north of the Brooks Range has been occurring for more than 10,000 years. An examination of the Alaska Heritage Resource Survey database (Office of History and Archaeology 2018), indicates there are 70 recorded sites located on lands managed by the U.S. Fish and Wildlife Service within the Arctic Refuge coastal plain (Table 1).



Cultural Period	Location:			Total
	Coastal	Inland adjacent to rivers and creeks	Inland on elevated dry ground	
Prehistoric	1	23	3	27
Historic	28	14		42
Multi-Component		1		1
Total	29	38	3	70

Table 1. Cultural Resource Sites within the Arctic Refuge coastal plain.

As indicated above, these sites are predominantly located along river corridors and the coast of the Beaufort Sea. All of the recorded sites are exposed and most, especially those along the coast, are subject to active erosion caused by sea storms.

Prehistoric sites generally consist of stone tent rings and lithic scatters (or artifacts) embedded and partially exposed in the tundra. Tent ring sites, with or without surface-distributed artifacts, are generally located on well drained, stable river banks or occasionally on higher bluffs near water courses. Sites characterized solely by the presence of artifacts generally consist of small amounts of lithic debris from stone tool manufacture and utilization. The known artifact sites occur in two major settings: the tops of rises (such as ridges and knolls) which give a good view of the surrounding terrain; and in blowouts in stabilized sand dunes near river mouths.

Historic sites consist of standing structures or above-ground tangible evidence of such structures. These sites include log cabins, sod houses, graves, ice cellars, drying racks, and remnant features associated with Cold War Era Distant Early Warning line sites. The majority of the historic sites are located immediately adjacent to the Beaufort Sea coast, although a few have been found on river courses several miles inland.

## Subsistence



One of the purposes of the Arctic Refuge is to provide the opportunity for continued subsistence uses by local residents in a manner consistent with the purposes of conserving fish and wildlife populations and habitats and fulfilling international treaty obligations with respect to fish and wildlife. Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes (U.S. Fish and Wildlife Service 2015a, 2015b). The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010). Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl and fish return to the Refuge and coastal plain in abundance for another season.

The communities of Arctic Village and Kaktovik rely heavily on the Arctic Refuge, including the nearshore marine environment, for subsistence resources due to their close proximity within or adjacent to the Refuge boundaries. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys came primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on Porcupine caribou, the Gwich'in people consider the herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988). Other important species include whitefish, pike, lake trout, Dall Sheep and ducks.

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea which is heavily dependent on subsistence harvest of marine and terrestrial animals and fish. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35-68). Dall sheep and caribou are harvested which contributes 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs mostly in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resource. Kaktovik residents harvest Arctic cisco, Dolly Varden, sculpin, Arctic cod, arctic flounder, grayling, and chum salmon, which accounted for 11 percent of the estimated total edible pounds in 1994-1995 (Brower et al. 2000:37).

## **Recreation**

Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the Marsh Fork-Canning, main stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen.



The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were recommended to Congress for inclusion in the Wild and Scenic River System in 2015 because of their recreation and cultural values.

Visitor use monitoring has not been conducted, although calculated averages of known visitation based on commercial operator reports between 2001 and 2009 was determined to be 1,126 people annually. These reports showed that 77% of commercially-supported visitor use occurs north of the Brooks Range. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary.

The recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. Since 2011, polar bear viewing in the lagoons surrounding Kaktovik has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017). No visitor use numbers for other emerging uses on the Coastal Plain such as spring caribou hunting, fat tire biking and aurora-watching are known.

## Acoustic Environment

Little data on the acoustic qualities of the Arctic Refuge coastal plain are available, with the exception of short-term data collected in the extreme northwest corner in support of the Point Thomson EIS (U.S. Army Corps of Engineers 2012). Natural sound levels were found to be low, and they dominated the sound environment in both winter and summer. These sounds include atmospheric/meteorological phenomena, water features, insects, birds, and other animals. Natural sound levels were greater in summer due to the influence of water features such as the Canning River. Natural sound levels were found to be "lower than typical residential noise environments and comparable to an unoccupied building." Sections of the Arctic Refuge coastal plain that are away from the windy coastline and running water would be expected to be even quieter, with the predominance of natural sounds coming from wildlife and insects.

Both natural quiet and natural sound are intrinsic elements of the wilderness characteristics of the area and of the adjacent designated Wilderness. As such, their perpetuation is important for meeting the Refuge's purposes, goals, objectives, and special values. Noise from human activities in the Arctic Refuge coastal plain is essentially absent, with the exception of high altitude jet aircraft and occasional single and twin engine aircraft overflights.

Resources within the Arctic Refuge coastal plain that may be particularly sensitive to noise include polar bears, especially during denning, caribou, especially during calving and post-calving activities, and migratory birds, especially during breeding and brood-rearing activities. People who may be adversely affected by noise in the area include residents of Kaktovik, especially those engaged in subsistence



activities on the coastal plain beyond the village itself, and recreational visitors, most of whom seek a wilderness experience free of noise.

## Wilderness Characteristics and Values

The Arctic Refuge, including the coastal plain, was initially proposed by the National Park Service as “The Last Great Wilderness” (Kaye 2006), and Public Land Order 2214 (1960) which established the original Arctic Range and identified three purposes of preservation of wilderness values, wildlife and recreational values and is still applicable to Refuge management. ANILCA section 101(b) outlines the intent “to preserve in their natural state extensive unaltered arctic tundra...ecosystems; and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on free flowing rivers....” Further, ANILCA 304(g)(2)(B) requires the Secretary of the Interior to identify and describe “the special values of the refuge, as well as...wilderness value of the refuge” when developing plans. Consistent with the purpose and ANILCA, the Refuge’s 2015 Comprehensive Conservation Plan recommend the Arctic Refuge coastal plain for Wilderness designation because it exemplifies wilderness qualities.

Studies of Refuge visitors (Christensen and Christensen 2009) and the broader national public’s values and interests related to the Refuge (Bengston et al. 2010) show that these wilderness qualities are highly prominent in the public’s perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge’s Special Values (U.S. Fish and Wildlife Service 2015a) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain’s wilderness purpose and its function within the larger Refuge. Wilderness associated values include ecological, scientific, wildlife, aesthetic, recreational, and symbolic values.

Landres et al. (2015) defined the four primary qualities of Wilderness described in the Wilderness Act as: (1) undeveloped - free from roads, structures, and other evidence of modern human occupation or improvements, where the land essentially retains its original character and ecological function; (2) untrammeled - essentially unrestricted and free from modern human control or manipulation; (3) natural - when ecological systems are substantially free from the effects of modern civilization; and (4) primitive or unconfined recreation in wilderness settings - characterized by freedom from management restrictions on visitor behavior. Refuge management in the coastal plain has been consistent with these qualities. There are no roads, structures or improvements on Refuge lands within the coastal plain, natural processes are allowed to play out unfettered by management actions, and opportunities for solitude, primitive and unconfined recreation exist across the entire area.

## Wild and Scenic Rivers

The Wild and Scenic Rivers Act mandates protections for rivers that are designated rivers of the National Wild and Scenic River System (NWSRS), and for those that are recommended for inclusion in the NWSRS. A river’s preliminary Classification (either Wild, Scenic, or Recreational; based on level of infrastructure) and Wild and Scenic Values (free flowing condition; water quality at time the river was



found Eligible; and Outstandingly Remarkable Values (ORV) for each river segment) must be maintained. Numerous rivers bisecting the Coastal Plain were found to be Eligible during the Wild and Scenic River Review completed as part of the 2015 Revised Refuge CCP (See CCP Table 3-1. Eligible Rivers). Protections are required once a river or river segment is found eligible, but once an eligible river is found non-suitable, there is no legal mandate to protect the values that made the river Eligible. The Atigun, Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be suitable.

**Commented [CMA4]:** Is "eligible" supposed to be capitalized or only when used like "Eligible River"?

**Deleted:** All of the Eligible rivers studied for inclusion were found non-suitable except t

The recommendation for inclusion of these four rivers in the NWSRS was carried forward to Congress in 2015. Recommended rivers potentially affected by the proposed action include the Hulahula River (Recreational and Cultural ORVs); and may include the Marsh Fork-Canning if its Recreational ORV is affected by downstream exploration activities on the Canning River; and possibly the Kongakut, since its Recreational, Scenic, and Geologic ORVs may be tied to the coastal lagoons currently mapped within the exploration area. All of the Recommended rivers were given a preliminary classification of "Wild", meaning their condition at the time of Eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted.

Permanent structures generally are not allowed, with the exception of historic and cultural resources and, in certain limited circumstances, subsistence or administrative cabins and associated structures. Cabins, temporary structures, and hardened sites should not be visible from the river; where this is impractical, facilities and structures are to be rustic or unobtrusive in appearance. Public use facilities would provide opportunities for low-impact, backcountry recreation experiences.

**Commented [CMA5]:** Is there a distance prohibition here?

## Other Special Land Designations

### Marine Protected Areas

**Policy Framework:** Executive Order 13158 on Marine Protected Areas 13158 (2000) is intended to strengthen and expand the nation's system of MPAs. MPAs are defined as "...any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The Arctic National Wildlife Refuge meets the US criteria for a "marine protected area" or MPA.

**National System of MPAs:** In 2005, the Refuge was nominated by DOI and subsequently accepted for inclusion in the national system of MPAs: a voluntary association of federal, state, territorial and tribal MPAs coordinated by NOAA and DOI as part of their partnership under EO13158. Membership status in the national system does not currently convey any additional protections or restrictions beyond the Refuge's current management authorities. Some parts of the Refuge fall within designated wilderness, while others are outside of the wilderness boundary. The current management approach ensures the integrity of this area.

**Commented [CMA6]:** These seems out of place in the MPA discussion?

**Spatial Extent:** All marine waters located within Refuge boundaries, approximately 100,000 acres of marine waters and lagoons located off the northern coast of the Refuge, are listed as part of the National MPA System (see MPA Inventory page of NOAA's National Marine Protected Areas Center website). Shifting shorelines and marine-freshwater boundaries at river mouths create some variability in the



acreage estimate for the Refuge's contribution to the national system of MPAs, on the order of plus or minus several hundred acres.

## Land Status

The Alaska Native Claims Settlement Act of 1971 (ANCSA) and ANILCA determined the current land ownership patterns in and surrounding Arctic Refuge. ANCSA authorized the formation of Alaska Native village and regional corporations, enabling northeast Alaska's Native Iñupiat and Athabascan peoples to select and gain title to Federal lands that were originally part of their ancestral homelands. Map XX shows, by general ownership, the approximate area of non-Refuge lands within the coastal plain.

## Submerged Lands

In 1997 the Supreme Court ruled that submerged lands (including tidally influenced lands) within the Arctic Range boundary did not transfer to the State of Alaska at statehood (*United States v. Alaska*, No. 84 Original). The Court's decision recognized that the application to create the Arctic Range (which predated statehood) clearly intended these submerged lands, including rivers, lakes, and lagoons, to be included as part of the Range. Arctic Refuge, therefore, contains navigable and non-navigable waters. Submerged lands within the boundaries of the original Arctic Range, including river beds, were retained in Federal ownership on the date Alaska was granted statehood.

## Chapter 3 Affected Environment References

- Attanasi, E.D., and Freeman, P.A., 2009, Economics of undiscovered oil and gas in the North Slope of Alaska: economic update and synthesis: U.S. Geological Survey Open-File Report 2009-1112, 59 p. available only online.
- Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellatum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.  
<http://www.nativefederation.org/frames/subsistence.html>.
- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaaf.edu/pages/scientific.html>. Accessed July 27, 2012
- Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. *International Journal of Wilderness*. 16: 13-20.



- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brower, H.K., T.P. Olemaun, and T.R. Hepa. 2000:37. North Slope Borough subsistence harvest documentation project: data for Kaktovik. Department of Wildlife, North Slope Borough, Barrow, Alaska.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416. doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Craig, P.C. 1977. Arctic char in the Sadlerochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 35:48-52.
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. *Transactions of the American Fisheries Society* 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. *Biological papers of the University of Alaska* 24:131-152.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. *Arctic*. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 In P.C. Craig (ed.), Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Douglas, D., P. Reynolds, and E. Rhode. 2002. Arctic refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.
- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362-378.
- Fruge, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994-1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.



- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature*: 1973.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), *Arctic Refuge coastal plain terrestrial wildlife research summaries*. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Grover, Margan Allyn and Erin Laughlin. 2012. *Archaeological Survey of the Mid-Beaufort Sea Coast: An Examination of the Impacts of Coastal Changes on Cultural Resources*. Prepared for the Kaktovik Tribal Partnership Program. U.S. Army Corps of Engineers, Alaska District.
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution).  
<http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Hall, Edwin S., Jr. 1982. *Preliminary Archaeological and Historic Resource Reconnaissance of the Coastal Plain Area of the Arctic National Wildlife Refuge, Alaska*. Technical Memorandum # 1, Edwin S. Hall and Associates, Brockport, N.Y.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. (1991). Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110. doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009. Salmon in the Arctic and how they avoid lethal low temperatures. *North Pacific Anadromous Fish Commission Bulletin*. 5:39-50.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. In Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kane, D.L., Slaughter, C.W. 1973. Seasonal regime and hydrological significance of stream icings in central Alaska. *The Role of Snow and Ice in Hydrology: proceedings of the Banff Symposia*, Volume 1:528-540.
- Kaye, R. 2006. *Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge*. University of Alaska Press, Fairbanks, Alaska.
- Landres, Peter; Barns, Chris; Boutcher, Steve; Devine, Tim; Dratch, Peter; Lindholm, Adrienne; Merigliano, Linda; Roeper, Nancy; Simpson, Emily. 2015. Keeping it wild 2: an updated interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 114 p.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 in Harper, editor. *Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006*. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.



- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 30:1215–1220.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- Office of History and Archaeology. 2018. Alaska Heritage Resource Survey database, State of Alaska, Department of Natural Resources.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleux and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Soil Survey Staff. (2014). *Keys to soil taxonomy* (12th ed.). Washington DC: USDA-Natural Resources Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*. Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Solecki, Ralph S., Bert Salwen, and Jerome Jacobson. 1973. *Archaeological Reconnaissances: North of the Brooks Range in Northeastern Alaska*. Department of Archaeology, University of Calgary, Occasional Papers No. 1.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. *Arctic* 59:37–46.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- Urban, F.E., and Clow, G.D., 2017, DOI/GTN-P Climate and active-layer data acquired in the National Petroleum Reserve–Alaska and the Arctic National Wildlife Refuge, 1998–2015: U.S. Geological Survey Data Series 1021, 546 p., <https://doi.org/10.3133/ds1021>.
- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.



- U.S. Energy Information Agency. 2018. Annual Energy Outlook 2018: Table 12: Petroleum and Other Liquids Prices, Reference case. Retrieved from [https://www.eia.gov/outlooks/aeo/tables\\_ref.php](https://www.eia.gov/outlooks/aeo/tables_ref.php)
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska
- Wendler, G., M. Shulski, and B. Moore. 2010. Changes in the climate of the Alaskan North Slope and the ice concentration of the adjacent Beaufort Sea. *Theoretical and Applied Climatology* 99(1-2):67-74.
- Wilson, Curtis James. 1991. *An indigenous Nineteenth-Century Settlement/Subsistence System in the Area of Demarcation Bay, Alaska*. Ph.D. dissertation, Department of Anthropology, State University of New York at Binghamton.



DRAFT

Specialist Reports/Appendices

**Commented [CMA7]:** In many cases, there is complete duplication in the specialist report with text in the summary section – I have highlighted where I see duplication



## Air Quality

Air quality includes air pollutant concentrations and air quality-related values, such as atmospheric deposition and visibility. Air pollutant concentration usually refers to the mass of pollutant present in a volume of air. EPA has set National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants, and are described in the NPRA IAP/FEIS (DOI 2012).

**Commented [CMA8]:** Not sure what this adds

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, Air Quality occurs at Pt. Thomson, Badami, Endicott and Prudhoe Bay where oil and gas infrastructure operates in active developments. The available data confirm that pollutant concentrations in the study area are in compliance with the respective NAAQS and AAAQS according to the Pt. Thomson EIS (USDOD 2012). With prevailing winds from the north east in the Arctic Refuge Coastal Plain, it is likely that air quality would generally experience less impacts from existing industrial emissions from north slope development to the west except during instances when winds come in from the west.

**Commented [CMA9]:** Air Quality occurs?

**Formatted:** Highlight

**Formatted:** Highlight

**Commented [CMA10]:** How is this consistent with the first sentence saying there is no data?

**Formatted:** Highlight

**Formatted:** Highlight

The North Slope is subject to a condition known as "arctic haze." Arctic haze is a condition of reduced visibility in arctic regions. Arctic haze peaks in the spring and is most severe when stable, high-pressure systems produce clear, calm weather (NSIDC 2011). Sources of pollutants creating haze have been attributed to industrial pollutants (sulfur compounds and black carbon particles-the products of iron, nickel and copper smelters and inefficient coal-burning plants) from Eurasia, soot from forest fires and burning of farm fields in Eurasia, and submicron organic particles sampled have shown characteristics of emissions from northern Asia, Siberia, and, to a lesser extent, interior regions of Alaska and Canada (U.S. Department of Defense 2012). The haze is worse in spring due to stagnant air and the lack of precipitation. Conditions improve in the summer as the atmosphere mixes more and precipitation washes the pollutants from the air.

**Commented [CMA11]:** Not sure this edit is correct, but the sentence reads a little weird

## Air Quality References

- US Department of the Interior (DOI), Bureau of Land Management. 2012. National Petroleum Reserve-Alaska Final Integrated Activity Plan/ Environmental Impact Statement. Anchorage, AK.
- NSIDC (National Snow and Ice Data Center). 2011. Arctic Climatology and Meteorology Website. University of Colorado Boulder. [http://nsidc.org/arcticmet/quickfacts/arctic\\_haze.html](http://nsidc.org/arcticmet/quickfacts/arctic_haze.html). (Accessed June 15, 2018)
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.

## Water Resources

Aquatic habitats on the Arctic Refuge coastal plain are underlain by permanently frozen ground and fed by precipitation, snowmelt, groundwater springs, and meltwater from overflow ice and glaciers (Lyons and Trawicki 1994, Childers et al. 1997). These habitats include lagoons and bays; mountain, tundra, and spring-fed streams and rivers; riparian corridors; lakes; wet meadow zones; and other wetlands.



Ninety-nine percent of the Arctic Refuge coastal plain is considered wetland; however, lakes are very scarce (less than two percent of the land surface area) compared to the eastern NPR-A where lakes cover approximately twenty percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre and ninety percent are less than 12 acres. Most lakes are surrounded by extensive wet meadow zones that are important to several species of water birds (Bayha 1996). A study of 115 of the largest lakes indicated most lakes are shallow and freeze to the bottom during winter (Trawicki et al. 1991). The estimated volume of liquid water in these lakes is 1.1 billion gallons by the end of the winter season. Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. The recharge capacity of many lakes is generally limited to snowmelt and direct precipitation in the vicinity of the lake.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed reaches.

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a), an important subsistence fish. Springs on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the coastal plain of the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakturuk springs.

Tall willow shrublands grow along the riparian corridors of rivers, streams, and spring-fed reaches. Vegetation along riparian corridors provides stream bank stability, delivers organic matter to aquatic habitats, provides cover and nesting habitat to numerous bird species, and supports exceptionally high species diversity in a relatively species-poor arctic environment. During winter, riparian vegetation provides denning habitat for polar bears and grizzly bears, and forage and cover for caribou, moose and muskox.

Sixteen lagoons and bays line the coast and support numerous invertebrate species (Dunton et al. 2012), nineteen marine fish species, and twelve anadromous species. During winter, liquid water below ice in lagoons tends to be hyper saline unless fed by groundwater.



With the exception of spring-fed systems, the hydrology of the Arctic Refuge's aquatic habitats is strongly influenced by the climate, which is characterized by extremely low winter temperatures; short, cool summers; and exceptionally low year-round precipitation (averaging 6.3 inches per year). Fish and wildlife use of aquatic habitats on the Arctic Refuge coastal plain is tightly intertwined with the harsh constraints and abundant benefits imposed by seasonal hydrology.

Winter is the harshest and most critical time for species relying on aquatic habitats, but unique features of these habitats allow for sustenance of life. Shortened daylight hours and extreme cold temperatures cause most waterbodies on the Arctic Refuge coastal plain to freeze solid (Lyons and Trawicki 1994), reducing the volume of liquid water by ninety-eight percent (Craig 1989a). As ice growth continues throughout the winter, dissolved oxygen concentrations decrease while ion concentrations increase. Small pockets of unfrozen water only occur in lakes that are more than seven-feet deep, small isolated pools beneath riverine ice hummocks, spring-fed river reaches (Lyons and Trawicki 1994), and below ice covering coastal lagoons and bays. Fish and other aquatic organisms are constrained to these isolated pockets of liquid water for the next several months until temperatures warm and ice breakup occurs in late May and June (Craig 1989a).

The spring season brings about major shifts in hydrology that recharge aquatic habitats and enhance fish migration. Snowmelt starts earliest in the foothills and then proceeds to the coastal plain. During this time, sheets of snowmelt water flow over frozen ground, as much as 50% of the annual flow of rivers takes place (Clough et al. 1987, Sloan 1987), extensive fields of aufeis play an important role directing river flow paths over land and into new channels, and snowmelt and flood waters create ephemeral connections between aquatic habitats and recharge floodplain lakes and wet meadow zones. On the North Slope, up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer and immediately following snowmelt, surface waters are at their maximum extent (Bowling et al. 2003). Meanwhile, fish take advantage of the elevated water levels to begin migrating to summer feeding habitats and migratory water birds arrive to take advantage of the abundant food sources and nesting habitats in the wet meadow zones surrounding lakes and shallow ponds. Within two weeks of snowmelt, overland flow ceases and many hydrologic systems become disconnected (Bowling et al. 2003).

During the short Arctic summer, aquatic habitats are teeming with life and provide habitat for millions of water birds, twelve species of marine fish, eighteen species of anadromous and freshwater fish (U.S. Fish and Wildlife Service 2015), and numerous invertebrate species that are important to upper trophic levels. A lack of precipitation and relatively high evapotranspiration causes flow to cease in some streams and rivers (Lyons and Trawicki 1994), thaw of frozen soils and evapotranspiration leads to significant drawdown of lakes and wetlands (Bowling et al. 2003), water birds and fish begin migrating to critical overwintering habitats, and aquatic invertebrates move to deeper water or burrow down into sediments to avoid freezing.

### Water Resources References

Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellatum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.

**Commented [CMA12]:** Different numbers than on the bottom of the previous page



- Bayha, Keith D. 1996. Criteria for instream water rights for selected 1002 area lakes, Arctic National Wildlife Refuge. Water Resources Branch, U.S. Fish and Wildlife Service. Anchorage, Alaska. WRB 96-05.
- Bowling, L.C., D.L. Kane, R.E. Gieck, L.D. Hinzman, D.P. Letternmaier. 2003. The role of surface water storage in a low-gradient Arctic watershed. *Water Resources Res.* 39(4).
- Childers, J.M., C. E. Sloan, J.P. Meckel, and J.W. Nauman. 1977. Hydrologic reconnaissance of the eastern north slope, Alaska, 1975. U.S. Geological Survey Open-File Report 77- 492 U.S. Geological Survey, Anchorage, Alaska, USA.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.
- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleux and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.



## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Carter et al. 1986; Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristsels, Typic Haplogelepts, Typic Histoturbels (Soil Survey Staff 2016). Climate is the dominant soil-forming factor in coastal plain soils. The cold climate inhibits certain soil-forming processes such as weathering by removal of calcium components and movement of clay downward through the soil (Tedrow 1977), while organic matter accumulation is heightened due to the reducing conditions caused by saturation, slowed decomposition in the cold, wet conditions, and churning of the surface organic materials to the lowest parts of the active layer and upper permafrost (Ovenden 1990; Ping et al 2004; Ping et al 2008).

Soil texture varies by physiographic feature across three ecoregions, Brooks foothills, Beaufort coastal plain, and the Beaufort Sea coast (Carter et al. 1986; Jorgenson et al. 2015). The Brooks foothills dominate the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, the foothills are primarily located along the southern boundary and extend approximately one-third of the way to the coast. Physiographic features include uplands, glaciated uplands, floodplains, and lowlands. Uplands generally contain fine grain soils composed of silt or peat and rocky silt. Glaciated uplands contain a broader range of particles sizes with peat, silt, and diamicton. Lowland and floodplain soils in the foothills are coarser textured and composed of peat, sand and gravel or silt, sand, and gravel respectively.

The Beaufort coastal plain is the dominant ecoregion in the east and the major physiographic features are coastal plain and floodplain. Soils here are coarser and similar to the NPR-A. Coastal plain features are generally composed of peat and pebbly silty sand or peat sand and gravel. Floodplains are similar to the foothills and are composed of silt, sand, and gravel.

The Beaufort Sea coast lies across the northern margin of the coastal plain and includes the barrier islands. A wide range of soil textures can be encountered here and range from mud to sand and gravel. River deltas along the coast are classified as floodplains and have finer grain soils than the inland floodplains. Soils of coastal floodplains are composed of peat, silt, and sand

Permafrost is any ground (soil, rock or sediment) that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces in the region and is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). Increases in permafrost thickness and extent are driven by climatic cooling, maturation of vegetation, increased albedo (reflectance), and decreased snow cover. Climatic warming, removal or compaction of vegetation, and mass wasting will decrease the thickness or extent of the permafrost (U.S. Army Corps of Engineers 2012). As much as 88% of the planning area is underlain by ice rich permafrost (>50% water) which occurs as pore, segregated, and massive ice. Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Ice wedges are the most common type of massive ice and polygonal ground is the common surface feature across the coastal plain (Clough et al. 1987; Kanevskiy et al. 2013). In areas of silty soils, volumetric ice content can be as high as 89% with 50% as ice wedges and no surface formation of polygonal ground (Kanevskiy et al. 2013).



The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). The cold climate results in a lack of weathering and infiltration of organic acids that results in reduced the nutrient availability (Everett 1979; Everett and Brown 1982); however, nearly all the biological activity in soils of the far north takes place within this zone. The active layer is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018). Additionally, some studies have shown that nonacidic soils tend to have a deeper active layer than acidic soils (Nelson et al. 1998; Walker et al. 2003) and that there is a strong soil pH-vegetation relationship (Walker et al. 2003).

### Soils and Permafrost References

- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416.  
doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Carter, L. D., Ferrians Jr, O. J., & Galloway, J. P. 1986. *Engineering-geologic maps of northern Alaska coastal plain and foothills of the Arctic National Wildlife Refuge* (86-334). Retrieved from <http://pubs.er.usgs.gov/publication/ofr86334>
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Everett, K.R. 1979. Evolution of the Soil Landscape in the Sand Region of the Arctic Coastal Plain as Exemplified at Atkasook, Alaska. *Arctic* 32(3):207-223.
- Everett, K.R., and J. Brown. 1982 Some Recent Trends in the Physical and Chemical Characterization and Mapping of Tundra Soils, Arctic Slope of Alaska. *Soil Science Society Journal* 133(5):264-280.
- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature*: 1973.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. 1991. Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110. doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*.



- U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kanevskiy, M., Shur, Y., Jorgenson, M. T., Ping, C. L., Michaelson, G. J., Fortier, D., Stephani, E., Dillion, M., and Tumskey, V. 2013. Ground ice in the upper permafrost of the Beaufort Sea coast of Alaska. *Cold Regions Science and Technology*, 85, 56-70.  
doi:<https://doi.org/10.1016/j.coldregions.2012.08.002>
- Nelson, F.E., K.M. Hinkel, N.I. Shiklomanov, G.R. Mueller, L.L. Miller, and D.A. Walker. 1998. Active-layer Thickness in North-Central Alaska: Systematic Sampling, Scale, and Special Autocorrelation. *Journal of Geophysical Research-Atmospheres* 103:28,963-28,973.
- Ovenden, L. 1990. "Peat Accumulation in Northern Wetlands." *Quaternary Research* 13:377-386
- Ping, C.L., H.M. Clark, and D.K. Swanson. 2004. "Cryosols in Alaska." In *Cryosols: Permafrost-Affected Soil*, ed. J.M. Kimble. Berlin: Springer-Verlag
- Ping, C.L., G.J. Michaelson, J.M. Kimble, V.E. Romanovsky, Y.L. Shur, D.K. Swanson, and D.A. Walker. 2008. "Cryogenesis and Soil Formation along a Biogradient in Arctic North America." *Journal of Geophysical Research* 113:GO3S12.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*. Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Tedrow, J.C.F. 1977. *Soils of the Polar Landscapes*. New Brunswick, NJ: Rutgers University Press.
- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- Walker, D.A., G.J. Jia, H.E. Epstein, M.K. Reynolds, F.S. Chapin III, C. Copass, L.D. Hinzman, J.A. Knudson, H.A. Maier, G.J. Michaelson, F. Nelson, C.L. Ping, V.E. Romanovsky, and N. Shiklomanov. 2003. "Vegetation-Soil-Thaw-Depth Relationships along a Low-Arctic Bioclimate Gradient, Alaska: Synthesis of Information from the ATLAS Studies." *Permafrost and Periglacial Processes* 14:103-123.



## Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west (Figure 1). The more varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types more sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

Foothills of the Brooks Range cover 45% of the area (Walker et al. 1982). Broad uplands are dissected by north-flowing rivers. Hilly coastal plains cover 22% of the area and have gently undulating tundra with small thaw lakes. Flat thaw lake plains with large lakes cover 3% of the area. River floodplains cover 25% of the area. Vegetation is a nearly continuous, highly interspersed mosaic of plants less than 0.5 m tall, mainly sedges, low shrubs, and mosses. Shrubs are taller along drainages. Soil texture and moisture are important determinants of the different tundra vegetation types (Table 1), which were based on Walker et al. (1982).

Table 1. Vegetation types of the coastal plain of the Arctic NWR, Alaska, USA, based on Walker et al. (1982). From Jorgenson et al. 2010.

Type	Description
Wet sedge tundra (13% of area)	Low-lying flats and drainages with the sedges <i>Carex aquatilis</i> and <i>Eriophorum angustifolium</i> and little moss or shrub cover. The poorly drained soils are saturated throughout the summer and have a thick, fibrous organic horizon.
Sedge–willow tundra (30%)	Low-lying flats and gentle slopes with the sedges <i>Eriophorum angustifolium</i> and <i>Carex aquatilis</i> and the willows <i>Salix pulchra</i> and <i>S. reticulata</i> . Mosses include <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Aulacomnium</i> spp., <i>Sphagnum</i> spp., and <i>Campylium stellatum</i> . On fine-grained retransported, laciofluvial, and abandoned floodplain deposits. Soils have moderately thick organic layer and are saturated at intermediate depths but generally free of surface water.



Sedge–Dryas tundra (13%)	Moderately well-drained sites dominated by the dwarf shrub <i>Dryas integrifolia</i> and the sedge <i>Carex bigelowii</i> , with the willows <i>Salix richardsonii</i> , <i>S. phlebophylla</i> , and <i>S. reticulata</i> and mosses such as <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Distichium capillaceum</i> , and <i>Ditrichum flexicaule</i> . Forbs (e.g., <i>Lupinus arcticus</i> ), lichens (e.g., <i>Cetraria</i> spp.), and horsetails (e.g., <i>Equisetum variegatum</i> ) are common. Found on moist calcareous slopes and pebbly glacial and marine sediments. Notable for a hummocky surface topography, patches of exposed mineral soil, and extremely variable organic horizons resulting from active and stabilized frost boils.
Tussock tundra (28%)	Moderately well-drained slopes dominated by the tussock-forming sedge <i>Eriophorum vaginatum</i> , with shrubs <i>Salix pulchra</i> , <i>Betula nana</i> , <i>Ledum palustre</i> ssp. <i>decumbens</i> , and <i>Vaccinium vitis-idaea</i> . Bryophytes include <i>Hylocomium splendens</i> , <i>Sphagnum</i> spp., <i>Aulacomnium turgidum</i> , <i>Ptilidium ciliare</i> , and <i>Tomenthypnum nitens</i> . Occurs on deposits of loess or colluvial material on top of coarser, residual materials or glacial drift.
Shrub tundra (5%)	Dominated by low and dwarf shrubs, with <i>Betula nana</i> or <i>Salix pulchra</i> and understory species similar to tussock tundra. In the study area, occurs only on raised areas with high-centered polygon surface morphology.
Riparian shrubland (2%)	Willow shrublands on river floodplains and stream banks, dominated by <i>Salix alaxensis</i> , <i>S. glauca</i> , and <i>S. richardsonii</i> , commonly with a forb understory. Willows have an average height of 0.5 m and maximum of about 1.5 m. Occurs on both young floodplain deposits with mixed gravel and fine-grained material, and older terraces with a thin, fine-grained alluvium layer over gravel.
Dryas terrace (3%)	Infrequently flooded river terraces with <i>Dryas integrifolia</i> and other dwarf shrubs, forbs, horsetails, mosses, and lichens similar to sedge–Dryas tundra. Well-drained soils with a very thin organic mat over river deposits.



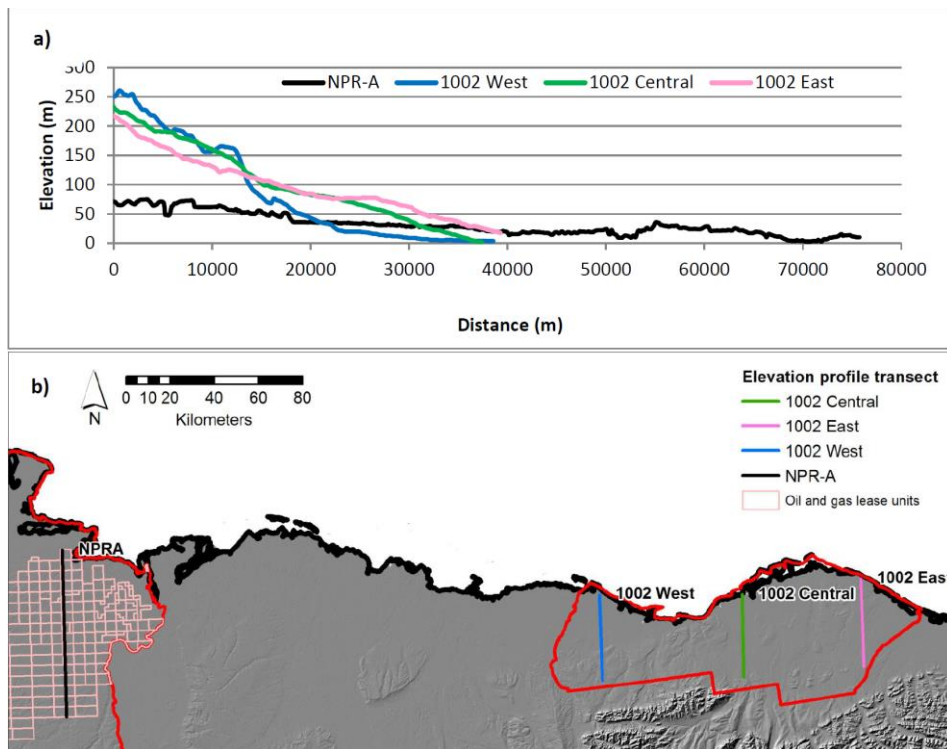


Figure 1: a) Hillslope profiles and b) transect locations within the coastal plain and NPR-A. Hillslope profiles derived from 30m digital elevation model.

### Vegetation References

- Jorgenson, J.C., J.M. Ver Hoef, and M.T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications* 20(2): 205-221.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Walker, D. A., K. R. Everett, W. Acevedo, L. Gaydos, J. Brown, and P. J. Webber. 1982. Landsat-assisted environmental mapping in the Arctic National Wildlife Refuge, Alaska. CRREL Report 82-27. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, USA.



## Fisheries

### Overview

The eastern North Slope in Alaska is endowed with limited freshwater options for fish. As a result, there are only a few species that occupy the freshwater habitats that are available. Lake density is very low in the Arctic Refuge coastal plain, east of the Canning River drainage, but increases progressively to the west (White et al. 2008; Arp and Jones 2009). Several mountain streams cross the Arctic Refuge coastal plain between the Canning and Aichilik rivers (Craig and McCart 1975). These streams flow during summer with snowmelt, rainfall, perennial springs, and for some streams, melting glaciers (Craig and McCart 1975; Rabus and Echelmeyer 1998; Kane et al. 2013), however, only the perennial springs provide flow during winter (Craig and McCart 1975). Craig (1989a) estimated that winter habitat in the area was only about 5% of what was available for fishes during summer.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons are very productive environments for marine and anadromous species during summer. In winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, some lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.

Freshwater species present in the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius* (Fruge and Palmer 1994). Round whitefish and burbot are present in the Canning River but nowhere else in the Arctic Refuge coastal plain (Craig 1977c; Fruge and Palmer 1994). Dolly Varden are present in three life history forms: anadromous populations in which most members rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; residual dwarf males of the anadromous populations that choose to stay in freshwater rivers rather than migrate to sea; and dwarf resident populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977c; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs that are used for overwintering habitat (Craig and McCart 1974; Fruge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

Anadromous species known to occur in or adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, and rainbow smelt *Osmerus mordax* (Craig 1984; Fruge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Dolly Varden are known to migrate long distances along the coast during their summer feeding forays, east to the Mackenzie River and west to the Colville River or beyond (Kruger et al. 1999), and some individuals

Commented [CMA13]: Summary talks about 2 life forms



migrate into offshore waters as well (Courtney et al. 2018). Arctic cisco have natal origins in the Mackenzie River but disperse as juveniles to coastal habitats including the Colville River delta, where many overwinter in brackish environments (Galloway et al. 1983; Fechtelmann et al. 2007). Rearing Arctic cisco make annual feeding migrations along shore during summer and eventually return to the Mackenzie River to spawn. Broad whitefish, humpback whitefish, and least cisco that are encountered in nearshore environments adjacent to the Arctic Refuge coastal plain have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species that occur in nearshore waters adjacent to the Arctic Refuge coastal plain or in rivers within the Arctic Refuge coastal plain are thought to be strays from southern Chukchi or northern Bering Sea populations, although some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage (Stephenson 2006; Irvine et al. 2009). Rainbow smelt are known to spawn in the Mackenzie and Colville rivers as well as in the Kuk River drainage farther west (Craig 1984). Dolly Varden and Arctic cisco are the primary food fishes for people in north east Alaska (Craig 1989b; Pederson and Linn 2005).

There are about 12 species of marine fishes that are commonly encountered in nearshore brackish environments adjacent to the Arctic Refuge coastal plain, only four of which are relatively abundant during the summer season (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species tend to migrate along shore in the southern Beaufort Sea, marine species are thought to follow a very different migratory pattern; moving towards shore and into shallow water during summer and away from shore and into deeper water during winter (Craig 1984). It is not uncommon to find these four common marine species in brackish environments during summer, or even in the very lower reaches of the rivers in the area.

### Species accounts

Some of the fish species of ecological and/or subsistence value in or adjacent to the Arctic Refuge coastal plain are discussed below. Information about distribution, life history characteristics, and subsistence use is presented when available.

**Broad whitefish** *Coregonus nasus* are large, primarily benthic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They are present but uncommon in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Broad whitefish populations may exhibit either anadromous or freshwater resident life histories (Reist and Bond 1988; Chudobiak 1995; Brown et al. 2007). Because rivers flowing through the Arctic Refuge coastal plain do not support spawning or overwintering habitats for broad whitefish, they spawn and overwinter in aquatic habitats in the lower Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, all broad whitefish encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the Beaufort Sea and occasionally in the lower reaches of the larger rivers (Ward and Craig 1974; Craig 1984; Brown 2008).

Age at maturity for broad whitefish ranges from about five years old for the earliest maturing populations, such as those in the Peel (VanGerwen-Toyne et al. 2008) and Yukon (Carter 2010) rivers, to about eight years old for the latest maturing populations, such as those in the Selawik River in western Alaska (Brown 2004) and in the Teshekpuk Lake region in northern Alaska (Moulton et al. 2007). Broad whitefish spawn in flowing water over gravel in late October and November (Chang-Kue and Jessop



1997; Shestakov 2001; Carter 2010), which is three to four weeks later than other whitefish species. They survive spawning and may spawn multiple times during their lives. Once mature, spawning may be annual (Tallman et al. 2002) or less frequently (Prasolov 1989; Brown 2004). Broad whitefish are capable of living for 20 years or more (Brown 2004; VanGerwen-Toyne et al. 2008), and the oldest individuals in a population may exceed 30 years (Bond and Erickson 1985; Reist and Bond 1988). Broad whitefish are a very good food fish (McPhail and Lindsey 1970; Morrow 1980) and are harvested at times in nearshore waters adjacent to the Arctic Refuge coastal plain (Pedersen and Linn 2005).

**Humpback whitefish** *Coregonus clupeaformis* are medium size, primarily benthic-feeding whitefish that are widely distributed in rivers, lakes, and estuaries of northern North America (McPhail and Lindsey 1970). Many similar forms have been described across North American and Asia and substantial taxonomic debate continues regarding appropriate species designations (Lindsey 1963; Alt 1979; Bodaly et al. 1988; Bernatchez and Dodson 1994). McPhail and Lindsey (1970) considered humpback whitefish to be part of a complex of three species that included *C. clupeaformis*, *C. pidschian*, and *C. nelsoni*, distinguished based on slight differences of modal gill raker counts on the first gill arch. A recent meristic, morphometric, and genetics analysis of the three humpback whitefish forms across North America concluded that the complex should be considered a single species, *C. clupeaformis*, differentiated at the subspecies level (McDermid et al. 2007). Humpback whitefish encountered in Alaska have traditionally been classified as *C. pidschian* in interior (Alt 1979) and Arctic habitats (Craig 1984), while in Canada they have been classified as *C. clupeaformis* (Bryan 1973; Craig 1984; Reist and Bond 1988). All humpback whitefish forms are referred to here as *C. clupeaformis*, per McDermid et al. (2007).

Humpback whitefish are rare in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Similar to the situation with broad whitefish, spawning and overwintering habitats of humpback whitefish are in the lower Sagavanirktok River and farther west and in the Mackenzie River and farther east, so humpback whitefish encountered in or near the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea.

Age at maturity for humpback whitefish range from about age 5 for the earliest maturing populations, such as those in southern Hudson Bay in eastern Canada (Morin et al. 1982) and in the Kuskokwim River (Harper et al. 2007), to age 11 for a much later maturing population in Dease Inlet in western Arctic Alaska (Moulton et al. 1997). River spawning humpback whitefish spawn in flowing water over gravel in late September and early October (Stein et al. 1973; Alt 1979; Brown 2006; Harper et al. 2009). Lake resident populations spawn over rock, gravel, and sand substrates between mid-October and late December, much later than river spawning populations (Bidgood 1974; Bryan and Kato 1975; Anras et al. 1999). Humpback whitefish in some populations may spawn two or more years in a row (Brown 2006, 2009), while in other populations alternate year spawning may be more common (Lambert and Dodson 1990; Moulton et al. 1997). Humpback whitefish are capable of living for 20 years or more (Moulton et al. 2007; Harper et al. 2007; VanGerwen-Toyne et al. 2008) and the oldest individuals within a population often exceed 30 years (Barnes and Power 1984; Howland et al. 2001; Brown and Fleener 2001). Humpback whitefish are considered to be a good food fish. They have been exploited in commercial food fisheries in North America more than any other whitefish species (Bodaly 1986; Ebener 1997; Tallman and Friesen 2007) and are routinely harvested in subsistence fisheries in Alaska and northwestern Canada (Corkum and McCart 1981; Georgette and Shiedt 2005).



**Least cisco** *Coregonus sardinella* are relatively small, pelagic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They have been documented in estuaries, rivers, and lakes from various locations in Alaska and northwest Canada (Alt 1980; Mann and McCart 1981; Reist and Bond 1988; Moulton et al. 1997; Seigle 2003). Because rivers within the Arctic Refuge coastal plain do not support spawning or overwintering habitats for least cisco, they spawn and overwinter in aquatic habitats in the Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, least cisco encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea (Craig 1984; Brown 2008).

Age at maturity for least cisco varies throughout Alaska, with interior and Kuskokwim River fish maturing as early as age 3 (Brown and Fleener 2001; Harper et al. 2007; Brown 2009), age 5 in the Selawik region (Brown 2004), and age 7 in Arctic Alaska (Moulton et al. 1997). Least cisco as old as 25 years or more have been reported (Mann 1974; Moulton et al. 1997). Least cisco are known to undertake extensive spawning migrations from lower drainage or estuarine rearing habitats to spawning habitats that may be several hundred kilometers upstream (Reist and Bond 1988; Brown et al. 2007). Spawning is thought to be either annual (Brown 2004) or less frequent (Mann 1974; Moulton et al. 1997), taking place from late September to early October (Kepler 1973; Mann 1974; Alt 1980). Eggs are broadcast in flowing water over gravel for riverine populations (Alt 1980, 1983; Brown 2009). Isolated populations in lakes are evidently capable of spawning in the absence of flowing water (Doxey 1991), however, actual spawning habitats within lakes have not been identified. Least cisco are harvested in subsistence fisheries as human or dog food, but they are generally captured incidentally to other larger whitefish species (Georgette and Shiedt 2005; Moulton and Seavey 2005).

**Arctic cisco** *Coregonus autumnalis* are relatively small, pelagic-feeding whitefish, with a near circumpolar distribution in Arctic waters (McPhail and Lindsey 1970; Moskalenko 1971). Populations have been documented in several large rivers in northern Europe and Asia, and in the Mackenzie River in northwestern Canada. All evidence indicates that Arctic cisco observed in Alaskan waters originate in the Mackenzie River drainage in Canada (Galloway et al. 1983; Fechhelm et al. 2007; Zimmerman et al. 2013), where several spawning populations have been identified (McLeod and O'Neil 1983; Dillinger et al. 1992). Juveniles disperse throughout the Beaufort Sea coastal waters of northwest Canada and Alaska for rearing and feeding (Fechhelm and Fissil 1988; Fechhelm and Griffiths 1990; Fechhelm et al. 2007). Overwintering habitats include brackish environments in the Sagavanirktok and Colville River deltas in the west and the Mackenzie and Anderson River deltas in the east (Craig 1984; 1989a; Fechhelm et al. 2007). Arctic cisco encountered in nearshore habitats adjacent to the Arctic Refuge coastal plain are either foraging or if mature, are migrating from overwintering habitats in the Colville River delta back to the Mackenzie River to spawn (Craig 1989a; Fechhelm et al. 2007; Brown 2008).

Arctic cisco are fully anadromous and are not known to exist as freshwater residents (Reist and Bond 1988). Age at maturity, based on minimum ages of Arctic cisco sampled from spawning migrations in the Mackenzie River drainage, has been estimated at seven to eight years (Stein et al. 1973; Van Gerwen-Toyne et al. 2008). Arctic cisco are capable of spawning more than once and some may live for as long as 20 years or so (Reist and Bond 1988; Van Gerwen-Toyne et al. 2008). The spawning migration into the Liard River, in the upper Mackenzie River drainage, entails an upstream migration of over 2,000 km (McLeod and O'Neil 1983). During summer, Arctic cisco are one of the most abundant species in nearshore waters of the Beaufort Sea, including areas adjacent to the Arctic Refuge coastal plain (Craig



1984; Brown 2008), and one of the primary species taken in the Kaktovik subsistence fishery (Griffiths et al. 1977; Pedersen and Linn 2005).

**Round whitefish** *Prosopium cylindraceum* are a relatively small, primarily benthic-feeding whitefish common in northern North America and northeastern Asia (McPhail and Lindsey 1970). While anadromous populations of round whitefish exist in certain coastal drainages (Morin et al. 1982), most round whitefish populations are freshwater resident forms, occupying freshwater rivers and lakes (Morrow 1980; Stewart et al. 2007). Round whitefish are present in several drainages and lakes on the North Slope of Alaska (McCart et al. 1972; Alt 1976), but within the Arctic Refuge coastal plain they occur only in the Canning River and not farther east (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983).

Age at maturity for round whitefish ranges from as young as age 3 for early maturing populations, such as those in southeast Canada (Morin et al. 1982), to age 8 or older for later maturing populations such as those in the northeast Asia (Gudkov 1999) and in the upper Chandalar River drainage (Craig and Wells 1975). Spawning for riverine round whitefish takes place in flowing water over gravel in late September and October (Craig and Wells 1975; Zyus'ko et al. 1993). Lake resident populations spawn over a mixed substrate composed of rocks, gravel, and mud in November or December (Normandeau 1969; Bryan and Kato 1975; Haymes and Kolenosky 1984). Round whitefish may spawn every year following maturity, as suggested by Craig and Wells (1975), but most reports suggest that spawning takes place less frequently (Jessop and Power 1973; Zyus'ko et al. 1993; Gudkov 1999). Round whitefish are capable of living for 20 years or more (Craig and Wells 1975; Plumb 2006) and the oldest individuals within a population may exceed 30 years (Gudkov 1999). Round whitefish have been exploited as a food fish for many years in the Laurentian Great Lakes (Mraz 1964; Fleischer 1992). They are occasionally harvested in subsistence fisheries in Alaska, but are usually a minor component of the catch (Pedersen and Linn 2005).

**Dolly Varden** (*Salvelinus malma*) is a coldwater species distributed on the Arctic coast of North America from the Mackenzie River west and south through Alaska to British Columbia and on the western side of the Pacific from the Chukotsk Peninsula of Russia south to Japan and Korea (Scott and Crossman 1973; Reist et al. 1997; DeCicco 1997). Previous to 1997, Dolly Varden in northern Alaska were often referred to as Arctic char (*Salvelinus alpinus*), although for many decades there has been an understanding that there were morphological differences between char to the east of the Mackenzie River and those to the west (McCart 1980). Reist et al. (1997) conducted detailed morphology and genetics analyses and formally established anadromous char in northern Alaska and northwest Canada as Dolly Varden.

Dolly Varden are widely distributed within the northern part of the Arctic NWR and several rivers flowing through the Arctic Refuge coastal plain support spawning populations including the Canning (Craig 1977c), Hulahula (Daum et al. 1984; Brown et al. 2014), and Aichilik (Craig and McCart 1974; West and Wiswar 1985) rivers. In addition, several isolated resident populations have been documented in springs and lakes in the Canning (McCart and Craig 1973; Craig 1977c), Sadlerochit (Craig 1977b; Wiswar 1994), and Jago (Daum et al. 1984) River drainages. It should be noted that it isn't clear at this point whether the lake resident char in the Jago River valley (Daum et al. 1984) are Dolly Varden or Arctic char.

Resident and anadromous forms of Dolly Varden exhibit a number of distinct life history characteristics (Craig and McCart 1974; McCart 1980). Resident fish rarely achieve seven years of age and typically do

Commented [CMA14]: Different from Chukotka peninsula?



not exceed 250 mm in length (Craig 1977b; Craig 1978; Armstrong and Morrow 1980). Resident fish primarily feed on dipteran larvae and other macroinvertebrates, achieve sexual maturity between the ages of two and four, and with few exceptions, utilize spring habitat exclusively for all life history stages (Craig 1977b; McCart 1980). Alternatively, anadromous fish may live to 10 years of age or more and grow to over 800 mm in length (Armstrong and Morrow 1980; Craig and Haldorson 1981; Underwood et al. 1996). Sexual maturity may be attained as early as 4 years for certain precocious individuals, although the majority of anadromous fish don't mature until 6 or 8 years at lengths of 400 mm or greater (McCart 1980; Underwood et al. 1996). First migration to sea occurs between the ages of 2 and 5 years, with the majority of individuals migrating at 3 to 4 years (Yoshihara 1973; McCart 1980; Underwood et al. 1996). In late spring or early summer, Dolly Varden migrate to brackish, nearshore coastal areas of the Beaufort Sea from overwintering habitats in deep pools and spring-fed areas in coastal rivers (Craig 1989a; Fechhelm et al. 1997; Jarvela and Thorsteinson 1997). While at sea, individuals move extensively along the Arctic coast within mixed-stock aggregates feeding heavily upon mysid shrimp and amphipods with some incidence of piscivory (Craig 1984, 1989a; Krueger et al. 1999). Additionally, recent satellite telemetry data indicate that at least some Dolly Varden migrate as much as 60 km or more offshore, a migratory phenomenon that was previously unknown (Courtney et al. 2018). Anadromous Dolly Varden return to freshwater in late summer or early fall to spawn and overwinter (Craig 1984; Craig 1989a). Catch data indicate that the majority of returning spawners are female, suggesting different rates of mortality among the sexes. However, because virtually all individuals of the anadromous populations that remain resident are male (Furniss 1975; Craig 1978; McCart 1980), and those residual males can be very numerous on spawning grounds, it is thought that they account for the proportional differences between males and females observed returning from the sea. Spawning is thought to occur most often in non-consecutive years with mature females building redds within spring-fed areas of tributary streams and rivers where males compete for access (Furniss 1975; McCart 1980). Genetic structure within drainage systems indicates that spawning fish display a high level of fidelity to natal drainages (Everett et al. 1997; Krueger et al. 1999; Crane et al. 2005). Some individuals are known to overwinter in non-natal drainages during nonspawning years (McCart 1980; Brown et al. 2014). Fry emerge from nests under ice cover in May and June and are believed to remain in close proximity to spawning beds throughout the first year of life (McCart 1980).

Anadromous Dolly Varden are the primary species caught in subsistence fisheries by residents of Kaktovik, in a winter fishery at Fish Hole 2 on the Hulahula River and in coastal areas during the summer (Craig 1989b; Pederson and Linn 2005). There is also evidence of recreational use and harvest on some of the more popular rivers that flow through the Arctic Refuge coastal plain (Arvey 1991; Jennings et al. 2010).

**Arctic char** (*Salvelinus alpinus*) inhabit freshwater and marine habitats and exhibit a circumpolar distribution within the Holarctic (Johnson 1980; Reist et al. 1997). While both anadromous and freshwater-resident forms are present within Alaska, only lake-resident populations exist within the Arctic NWR (Reist et al. 1997). Within North Slope drainages, populations have been documented in a few lakes within the upper Canning and Sagavanirktok River drainages (McCart et al. 1972; Craig 1977c) and in Peters and Schrader lakes in the upper Sadlerochit River drainage (Ward and Craig 1974; Craig 1977c). It is also possible that isolated lake-resident char in the Jago River drainage are Arctic char, but meristic data necessary to make that determination is not available (Daum et al. 1984). At this time, Arctic char have not been documented in waterbodies within the Arctic Refuge coastal plain.



Arctic char body size and growth varies dramatically among areas, but in general, lake-resident Arctic char are smaller and grow at slower rates relative to anadromous forms (Craig 1977c). For example, lake-resident Arctic char in Big Lake, located in the headwaters of the Canning River, were found not to exceed 190 mm in length, while populations in adjacent lakes reached sizes upwards of 400 mm (Craig 1977c). Sexual maturity is attained between the ages of 3 and 8 with maximum ages greater than 10 years (Craig 1977c). Spawning is thought to occur during fall in deeper portions of lacustrine habitats to avoid ice scouring (Armstrong and Morrow 1980). Individuals feed non-selectively on insect larvae, amphipods, planktons, and fish where available (Craig 1977c; Armstrong and Morrow 1980). No data regarding abundance or harvest are currently available.

**Lake trout** (*Salvelinus namaycush*) inhabit deep, coldwater lakes and are widely distributed throughout northern North America from the Alaskan peninsula east across Canada to Nova Scotia and south to northern New York (Scott and Crossman 1973). Within the Refuge, lake trout are present in some coastal and headwater lakes where suitable overwintering habitat exists (Scott and Crossman 1973). On the North Slope, lake trout have been documented in Elusive Lake in the Sagavanirktok River drainage, two unnamed coastal lakes in the Canning River drainage, and Okpilak, Wahoo, Peters, and Schrader lakes (Ward and Craig 1974; Daum et al. 1984; Bendock and Burr 1985; West and Fruge 1989). At this time, Lake trout have not been documented in waterbodies within the Arctic Refuge coastal plain.

Lake trout are long-lived (40+ years) and can reach sizes upwards of 1,000 mm fork length (Furniss 1974; Craig and Wells 1975; Morrow 1980). Individuals feed on invertebrates early in life, eventually shifting to a piscivorous diet as gape expands with increasing body size. Forage likely consists of any co-occurring fish species, with documented consumption of Arctic char, ninespine stickleback, slimy sculpin, Arctic grayling, and whitefish (*Coregonus* spp.) in Alaska (Burr 1990; McDonald and Hershey 2006; Swanson et al. 2010). Lake trout become sexually mature between the ages of 5 and 13 with the majority of individuals maturing at 7 or 8 years (Craig and Wells 1975; Morrow 1980). In general, lake trout spawn in the fall over large boulder or rubble substrate at depths less than 13 m (Scott and Crossman 1973). Time of and length at emergence varies depending on habitat conditions with eggs typically requiring a 4 to 5 month incubation period (Martin 1957).

The Schrader Lake population of lake trout was estimated to contain roughly 7,000 individuals in 1995, with the majority of fish ranging between 390 and 500 mm in length (Lubinski et al. 1999). Lake trout from Peter and Schrader lakes are harvested in subsistence fisheries by residents of Kaktovik (Craig 1989b; Pederson and Linn 2005). Elusive Lake, located in the Ribdon River drainage supports a small lake trout sport fishery, however no specific sport harvest data could be found for Refuge waters (Bendock and Burr 1985; Jennings et al. 2010).

**Chum salmon** (*Oncorhynchus keta*) are distributed on the western coast of North America from southern California to the Arctic and in Asia from Siberia south to Japan (Scott and Crossman 1973). Chum salmon are semelparous and anadromous, with adults typically ranging between 550 and 650 mm in length (Horne-Brine et al. 2009). Fry emerge from gravel nests in early spring and shortly thereafter begin to disperse to the marine environment. At sea, juveniles prey upon various copepods and amphipods until growth permits the consumption of fish (Salo 1991). Individuals return to freshwater to spawn in natal tributaries beginning in summer and fall between the ages of two and six, with the majority of fish returning as four and five year olds (Gilk et al. 2009; Horne-Brine 2009). On the spawning grounds, females construct gravel nests where eggs are deposited and subsequently covered with gravel (Morrow 1980).



Within North Slope waters of the Arctic NWR, chum salmon have been captured in low numbers in the Sadlerochit, Sagavanirktok, and Canning rivers as well as nearshore coastal areas (Smith and Glesne 1983; Craig and Haldorson 1986; Brown 2008). Some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage while others consider all encountered in the Beaufort Sea to be strays originating from more southerly drainages (Craig and Haldorson 1986; Irvine et al. 2009b). Residents of Kaktovik infrequently harvest chum salmon in subsistence fisheries in nearshore areas surrounding Barter Island in the southern Beaufort Sea (Pedersen and Linn 2005).

**Chinook salmon** (*Oncorhynchus tshawytscha*) are distributed along the west coast of North America from southern California to Point Hope, Alaska and in Asia from Siberia south to Japan (Scott and Crossman 1973). Within the northern part of the Arctic NWR, Chinook salmon are rarely encountered in nearshore environments and have not been captured in any of the rivers, despite occasional catches in the Colville River to the west and Mackenzie River to the east (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009a). Chinook salmon are anadromous, semelparous, and the largest of the Pacific salmon species. Adults commonly reach lengths of 430 to 860 mm, but may grow to upwards of 1000 mm on occasion (Horne-Brine et al. 2009). Fry emerge in spring and usually spend the first year of life in freshwater habitats feeding on aquatic and terrestrial invertebrates (Wipfli 2009). Smolts migrate to sea in spring where growth rates subsequently increase as individuals shift to a primarily piscivorous diet (Bradford et al. 2009). In the ocean, the majority of Chinook salmon occupy habitats in the southern Bering Sea where they spend between one and five years before returning to natal freshwater streams to spawn in mid-July to late August (Healey 1991). On the spawning grounds, females construct gravel nests in flowing water where eggs are deposited and covered with substrate.

**Arctic grayling** (*Thymallus arcticus*) reside in lakes and rivers of northern North America from Hudson Bay to the western shores of Alaska and in Asia from Siberia to North Korea (Scott and Crossman 1973). In Beaufort Sea drainages of the Arctic NWR, including those flowing across the Arctic Refuge coastal plain, Arctic grayling are widespread and abundant (Garner and Reynolds 1986; Craig and Wells 1975). Sexual maturity is attained between the ages of four and eight with individuals typically reaching 300 to 350 mm in length and between 450 and 750 grams in weight (McCart et al. 1972; Craig and Poulin 1975; Morrow 1980). Spawning occurs annually shortly after break up in early spring in small river and lake tributaries over areas of sandy gravel (Bishop 1971). When stream habitat is not available, spawning may also occur in larger substrates in rivers and lakes (Scott and Crossman 1973). Males are territorial on the spawning grounds, however no nest is constructed (Kratt and Smith 2006). The incubation period is relatively short and juvenile fish emerge from the substrate roughly 9 to 21 days following spawning, depending on water temperature (Morrow 1980; Kratt and Smith 1977). Adults feed on aquatic and terrestrial invertebrates and may undertake extensive inter- and intra-drainage movements between overwintering sites (deep pools, lakes, spring-fed areas) and summer feeding habitats following reproduction (Craig and Poulin 1975; West et al. 1992). Arctic grayling are, at least for short periods, tolerant of saline conditions, as individuals are sometimes captured in estuarine waters during inter-drainage movements in coastal systems (West et al. 1992). Additional biological information regarding Arctic grayling inhabiting North Slope rivers and lakes within the Arctic NWR are present in a number of publications (Furniss 1975; Garner and Reynolds 1986; Deschermeier et al. 1986; Wiswar 1991, 1992, 1994; West et al. 1992). Recreational harvest is likely to occur throughout the Refuge, although, no specific data are available (Jennings et al. 2010).



**Burbot** (*Lota lota*) inhabit deep areas of rivers and lakes of the circumpolar north extending south into some temperate areas of Europe, Asia, and North America (Morrow 1980). Within North Slope waters of the Arctic NWR, burbot have been documented in lakes and main-stem areas of the Canning River, including the segment along the western boundary of the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983) and in the Sagavanirktok River but not in any other rivers or lakes within the Arctic Refuge coastal plain (Bendock 1980; Bendock and Burr 1985). Burbot are rarely observed in nearshore environments (Craig 1984).

Burbot typically reach lengths of 400 to 550 mm and weigh between 0.5 and 1 kg, however, individuals greater than 1,500 mm and weighting over 30 kg have been reported (Chen 1969; Evenson 1990). Most individuals are sexually mature by the age of seven (earlier in southern latitudes) and spawn under the cover of ice between the months of November and February (Chen 1969). Spawning may not be an annual event and generally takes place over gravel and sand substrate in relatively shallow areas of rivers and lakes (Chen 1969; Breaser et al. 1988). Eggs and sperm are released simultaneously by a mating pair with fertilized eggs settling into spaces in the substrate and developing over the next one to two months without parental care. Juvenile burbot feed on insect larvae and other invertebrates until roughly the third or fourth year after which they feed primarily on fish (Chen 1969). Seasonal movements ranging from a few kilometers to over 250 kilometers have been reported within riverine populations most likely associated with the connection of spawning and foraging habitats (Percy 1975; Breaser et al. 1988; Evenson 1990).

**Ninespine stickleback** (*Pungitius pungitius*) are distributed in North America from Cook Inlet, Alaska, north to the Arctic Ocean and southeast through Canada terminating on the Atlantic Coast of New England (Scott and Crossman 1973; Morrow 1980). Within North Slope waters of the Arctic NWR, ninespine stickleback are present in the lower reaches of most of the major drainages including those that flow through the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977a; Wilson et al. 1977; Bendock and Burr 1985). Furthermore, ninespine stickleback are commonly found in coastal brackish lagoons (Griffiths et al. 1977; West and Wiswar 1985; Wiswar et al. 1995; Brown 2008) and coastal lakes where they are often the only species present (West and Fruge 1989; Trawicki et al. 1991; Wiswar 1994).

Ninespine stickleback are tolerant of salinities < 20 ppt and may move between fresh and saltwater throughout the year as access and conditions permit (Wootton 1984). Individuals attain sexual maturity by the age of two, seldom live beyond the age of five, and typically reach 65 mm in length with some as large as 90 mm (Scott and Crossman 1973; Heins et al. 2003). Spawning occurs in freshwater between the months of May and July in shallow areas containing aquatic vegetation (Wootton 1984). Males construct nests from algae and small debris where females deposit eggs. After fertilization, males protect nesting areas from predators and fan oxygenated water over the clutch of eggs. Young emerge roughly a week to a month later at which time males continue to provide care by preventing them from straying from nursery areas. Little is known regarding seasonal movements, however, spawning individuals likely move from shallow (littoral, tributary, or slough habitat) to deep (river deltas, coastal areas, lake bottoms) areas in fall (Wootton 1984). Ninespine stickleback prey on aquatic insects and small crustaceans and are an important prey item of predatory fish and birds (Palmer 1962; Morrow 1980). Additional biological data on ninespine stickleback are available in numerous publications (Yoshihara 1972; Ward and Craig 1974; Craig 1977a; Griffiths et al. 1977; Wilson et al. 1977; Bendock and Burr 1985; West and Wiswar 1985; West and Fruge 1989; Trawicki et al. 1991; Wiswar et al. 1995; Jarvela and Thorsteinson 1999;



Brown 2008). While they are commonly found in most North Slope coastal habitats of the Refuge, catch rates vary dramatically among areas and years.

**Arctic cod** (*Boreogadus saida*) is a marine species distributed throughout the entire northern polar basin, around Greenland and Iceland, into Hudson Bay, and in the North Bering Sea (Cohen et al. 1990). Arctic cod are commonly encountered and sometimes abundant in nearshore coastal areas adjacent to the Arctic NWR in the southern Beaufort Sea (Craig et al. 1982; Brown 2008).

Arctic cod prefer cold (0-6°C), saline (20-30 ppt) habitats, but are at least temporarily tolerant of fluctuating temperatures, salinities, and turbidities as they are found in both in- and off-shore marine areas, estuaries, and occasionally in the lower reaches of coastal rivers (Lowry and Frost 1981; Craig et al. 1982; Cohen et al. 1990). Adults typically range between 60 and 170 mm in length with some individuals reaching 250 mm (Craig et al. 1982). Sexual maturity is attained between the ages of two and three with maximum ages of six to seven years (Lear 1979; Craig et al. 1982). During late summer and fall, Arctic cod may aggregate into large schools and move into nearshore coastal areas that are transitioning from estuarine to marine conditions (Craig et al. 1982; Hop et al. 1997). Seasonal movements and schooling behavior may be associated with spawning, foraging, predator avoidance, or habitat availability as Arctic cod are often found associated with the edges of pack ice (Welch et al. 1993; Hop et al. 1997). Spawning occurs under ice between the months of November and March, presumably close to shore (Lowry and Frost 1981; Craig et al. 1982). Arctic cod prey on amphipods, copepods, and mysid shrimp and are an important prey item for many species of marine mammals, birds, and fish (Palmer 1962; Craig et al. 1982; Craig et al. 1984; Frost and Lowry 1984).

Arctic cod may be the most abundant and widely distributed fish species in the Beaufort Sea (Lowry and Frost 1981; Craig et al. 1982; Craig 1984). Catch data suggest Arctic cod are more abundant in coastal areas west of the Arctic NWR with one estimate, during the summer of 1978 in Simpson lagoon, numbering in the millions (Craig et al. 1982; Jarvela and Thorsteinson 1999). Within waters adjacent to the Arctic NWR, catch rates of Arctic cod are variable within and among years and areas, but tend to increase during late summer and fall (Griffiths et al. 1977; Fruge et al. 1989; West and Fruge 1989; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). There is some evidence that Arctic cod are harvested in subsistence fisheries in Kaktovik and Jago lagoons by residents of Kaktovik (Griffiths et al. 1977).

**Saffron cod** (*Eleginus gracilis*) is a marine species distributed throughout the North Pacific from the Yellow Sea in Asia to Southeast Alaska and north in the Arctic Ocean from eastern Siberia to northwestern Canada (Morrow 1980; Cohen et al. 1990). Saffron cod are widely distributed in the Beaufort Sea including coastal areas adjacent to the Arctic NWR (Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008).

Saffron cod inhabit both in- and off-shore marine and estuarine areas and are occasionally found in the lower reaches of coastal rivers (Morrow 1980). Average adult lengths range between 250 and 350 mm, with some individuals reaching up to 500 mm (Craig and Haldorson 1981). Sexual maturity is attained between the ages of two and three, with maximum ages reported between 10 and 12 years old (Cohen et al. 1990). Fish tend to move inshore in fall and winter to spawn, then move offshore in spring and summer to feed in deeper habitats (Morrow 1980). Forage consists of mysid shrimp, amphipods, and decapods, with larger individuals ingesting fish (Ellis 1962; Craig and Haldorson 1981).



Biological data pertaining to saffron cod are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths 1984, Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008) and in other locations (Bendock 1977; Craig et al. 1985; Griffiths et al. 1998; Fechem et al. 2006). Catch rates vary substantially among years and areas.

**Fourhorn sculpin** (*Myoxocephalus quadricornis*) is a marine species distributed throughout the circumpolar north from the Baltic Sea, east across northern Siberia to the Arctic coast of Canada and south to Norton Sound, Alaska (Andriyashev 1954; Morrow 1980). Fourhorn sculpin are often abundant in nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008).

Fourhorn sculpin rarely descend below 15-20 meters in depth and inhabit cold nearshore marine and estuarine coastal areas year-round, occasionally moving into the lower reaches of coastal streams and rivers (Griffiths et al. 1977; Morrow 1980). Adults typically reach 280 mm in length but may grow to 365 mm and live to 14 years of age (Andriyashev 1954; Percy et al. 1974; Griffiths et al. 1975). Sexual maturity is attained between the ages of three and nine with the majority of fish mature by the age of six (Griffiths et al. 1975; Griffiths et al. 1977). Spawning is thought to occur in winter, although evidence of summer spawning also exists (Goldberg et al. 1987), with males excavating shallow depressions in soft substrate where females deposit eggs (Westin 1969). After fertilization, males remain in close proximity to the nest site, cleaning and fanning oxygenated water over the eggs. Young emerge two to three months later, depending on water temperature, and move into shallow waters close to shore (Westin 1970). Seasonal on- and off-shore movements by adults may be common with individuals feeding on invertebrates such as mysids, amphipod, isopods, and occasionally small fish (Griffiths et al. 1975; Griffiths et al. 1977).

Biological data pertaining to fourhorn sculpin are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008) and in other locations (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999). While catches vary among years and areas, fourhorn sculpin are typically one of the most abundant marine species in nearshore areas of the Arctic NWR.

**Arctic flounder** (*Pleuronectes glacialis*) is a marine species distributed from Queen Maude Gulf in Arctic Canada west along the coast of North America to Siberia and south to Bristol Bay, Alaska (Andriyashev 1954; Morrow 1980). Fishbase (Froese and Pauly 2017), a world-wide, web-based, fish taxonomy guide, classifies Arctic flounder as *Liopsetta glacialis* while the American Fisheries Society classifies the species as *Pleuronectes glacialis* (Page et al. 2013). We use the American Fisheries Society classification here. Arctic flounder are found throughout nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Jarvela and Thorsteinson 1999; Brown 2008).

Arctic flounder typically remain close to shore, inhabiting shallow brackish water habitats and river deltas, occasionally entering rivers and delta lakes (Craig 1977c; Wilson et al. 1977). Adults range between 150 and 250 mm in length, attain sexual maturity between the fourth and fifth years, and generally live to between 9 and 12 years of age, however, specimens as old as 19 have been reported (Andriyashev 1954; Griffiths et al. 1975; Griffiths et al. 1977; Bendock 1979; Morrow 1980). Spawning



is thought to occur in coastal areas between January and March but possibly as late as May in some areas (Andriyashev 1954; Morrow 1980). Young emerge roughly 40 days after fertilization depending on water temperature (Aronovich et al. 2003). Seasonal on- and off-shore movements are thought to occur with forage consisting mainly of amphipods, mollusks, crustaceans, and small fish (Griffiths et al. 1975; Morrow 1980; Wiswar 1986).

Relative to Arctic cod and fourhorn sculpin, Arctic flounder are less frequently captured, but still common in nearshore areas of the Beaufort Sea coast (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999; Fechem et al. 2006), including areas adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Underwood et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). In addition, Arctic flounder are infrequently captured in subsistence fisheries by the residents of Kaktovik in waters surrounding Barter Island (Pedersen and Linn 2005).

### Fisheries References

- Alt, K.T. 1976. Sport Fish Investigations of Alaska: Inventory and cataloging of North Slope waters. Alaska Fish and Game, Division of Sport Fish, Annual Performance Report. Project F-9-8, Vol. 17, G-I, Juneau (pages 129-150).
- Alt, K.T. 1979. Contributions to the life history of the humpback whitefish in Alaska. Transactions of the American Fisheries Society 108: 156-160.
- Alt, K.T. 1980. A life history study of sheefish and whitefish in Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1980-1981, Project F-9-12, Vol. 21, R-II, Juneau (pages 1-31).
- Alt, K.T. 1983. Inventory and cataloging of sport fish and sport fish waters of western Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1982-1983, Project F-9-15, Vol. 24, G-I-P-B, Juneau (pages 34-78).
- Andriyashev, A.P. 1954. Fishes of the northern seas of the U.S.S.R. keys to the fauna of the U.S.S.R. No. 53, 617p. Israel Program for Scientific Translations.
- Anras, M.L.B., P.M. Cooley, R.A. Bodaly, L. Anras, R.J.P. Fudge. 1999. Movement and habitat use by lake whitefish in a boreal lake: Integrating acoustic telemetry and geographic information systems. Transactions of the American Fisheries Society 128: 939-952.
- Armstrong, R.H., and J.E. Morrow. 1980. The Dolly Varden char, *Salvelinus malma*. Pages 99-140 in U.K. Balon (ed.) Charrs: Salmonid Fishes of the Genus *Salvelinus*. Dr. W. Junk bv Publishers.
- Aronovich, T.M., S.I. Doroshev, L.V. Spectorova, and V.M. Makhotin. 2003. Egg incubation and larval rearing of navaga (*Eleginus navaga* Pall.), polar cod (*Boreogadus saida* lepechin) and arctic flounder (*Liopsetta glacialis* Pall.) in the laboratory. Aquaculture, 6:233-242.
- Arp, C.D., and B.M. Jones. 2009. Geography of Alaska lake districts: identification, description, and analysis of lake-rich regions of a diverse and dynamic state. U.S. Geological Survey, Scientific Investigations Report 2008-5215.
- Arvey, W.D. 1991. Stock status of anadromous Dolly Varden in waters of Alaska's North Slope. Alaska Department of Fish and Game. Fishery Manuscript Number 91-3.
- Barnes, M.A., and G. Power. 1984. A comparison of otolith and scale ages for western Labrador lake whitefish, *Coregonus clupeaformis*. Environmental Biology of Fishes 10: 297-299.



- Bendock, T. 1977. Beaufort Sea estuarine fishery study. Final Report of the Principal Investigators, Outer Continental Shelf Environmental Assessment Program, Volume 4. National Oceanic and Atmospheric Administration, Anchorage.
- Bendock, T. 1979. Beaufort Sea estuarine fishery study. Final report. Pages 670-729 in Environmental assessment of the Alaskan continental shelf. BLM/NOAA, OCSEAP. No. 4. 804 p.
- Bendock, T. 1980. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1979-1980, Project F-9-12, Vol. 21, G-I-I, Juneau.
- Bendock, T. N., and J. M. Burr. 1985. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1984-1985, Project F-9-17, Vol. 26, G-I-I, Juneau.
- Bernatchez, L., and J.J. Dodson. 1994. Phylogeographic relationships among Palearctic and Nearctic whitefish (*Coregonus* sp.) populations as revealed by mitochondrial DNA variation. Canadian Journal of Fisheries and Aquatic Sciences 51 (Supplement 1): 240-251.
- Bidgood, B.F. 1974. Reproductive potential of two lake whitefish (*Coregonus clupeaformis*) populations. Journal of the Fisheries Research Board of Canada 31: 1631-1639.
- Bishop, F.G. 1971. Observations on spawning habits and fecundity of the Arctic grayling. The Progressive Fish Culturist. 33:12-19.
- Bodaly, R.A. 1986. Biology, exploitation and culture of coregonid fishes in Canada. Advances in Limnology 22: 1-30.
- Bodaly, R.A., J.W. Clayton, and C.C. Lindsey. 1988. Status of the Squanga whitefish, *Coregonus* sp., in the Yukon Territory, Canada. Canadian Field-Naturalist 102(1): 114-125.
- Bond, W.A., and R.N. Erickson. 1985. Life history studies of anadromous Coregonid fishes in two freshwater lake systems on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences Number 1336. 71p.
- Bradford, M.J., A.V. Vinster, and P.A. Milligan. 2009. Freshwater life history, habitat, and the production of Chinook salmon from the upper Yukon Basin. Pages 19-38 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Breaser, S.W., D.F. Stearns, M.W. Smith, R.L. West, and J.B. Reynolds. 1988. Observations of movements and habitat preferences of burbot in an Alaskan glacial river system. Transactions of the American Fisheries Society. 117:506-509.
- Brown, R.J. 2004. A biological assessment of whitefish species harvested during the spring and fall in the Selawik River Delta Selawik National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 77, Fairbanks, Alaska.
- Brown, R.J. 2006. Humpback whitefish *Coregonus pidschian* of the upper Tanana River drainage. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 90, Fairbanks, Alaska.
- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brown, R.J. 2009. Distributions and demographics of whitefish species in the upper Koyukuk river drainage, Alaska, with emphasis on seasonal migrations and important habitats of broad whitefish and humpback whitefish. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 104, Fairbanks, Alaska.



- Brown, R.J., N. Bickford, and K. Severin. 2007. Otolith trace element chemistry as an indicator of anadromy in Yukon River drainage Coregonine fishes. *Transactions of the American Fisheries Society* 136: 678-690.
- Brown, R.J., and C. Fleener. 2001. Beaver dam influence on fish in lentic and lotic habitats in the Black River drainage, Alaska. U.S. Fish and Wildlife Service, Study No. FIS-00-004.
- Brown, R.J., M.B. Loewen, and T.L. Tanner. 2014. Overwintering locations, migrations, and fidelity of radio-tagged Dolly Varden in the Hulahula River, Arctic National Wildlife Refuge, 2007–09. *Arctic* 67:149–158.
- Bryan, J.E. 1973. The influence of pipeline development on freshwater fishery resources of northern Yukon Territory, aspects of research conducted in 1971 and 1972. Pacific Region Department of the Environment, Northern Operations Branch Fisheries Service, Task Force on Northern Oil Development Report No. 73-6 (Information Canada Catalog No. R72-9773).
- Bryan, J.E., and D.A. Kato. 1975. Spawning of lake whitefish, *Coregonus clupeaformis*, and round whitefish, *Prosopium cylindraceum*, in Aishihik Lake and East Aishihik River, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 32: 283-288.
- Burr, J.M. 1990. Stock assessment and biological characteristics of lake trout populations in interior Alaska, 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-33. 59p.
- Carter, W.K. 2010. Life history and spawning movements of broad whitefish in the middle Yukon River. Master's Thesis, University of Alaska Fairbanks, Fairbanks, AK.
- Chang-Kue, K.J.T., and E.F. Jessop. 1997. Broad whitefish radiotagging studies in the lower Mackenzie River and adjacent coastal region, 1982-1993. Pages 117-146 in R.F. Tallman, and J.D. Reist, editors. The proceedings of the broad whitefish workshop: the biology, traditional knowledge and scientific management of broad whitefish (*Coregonus nasus* (Pallas)) in the lower Mackenzie River. Canadian Technical Report of Fisheries and Aquatic Sciences 2193, Winnipeg.
- Chen, L. 1969. The biology and taxonomy of the burbot *Lota lota*, in interior Alaska. Biological Papers of the University of Alaska. No. 11.
- Chudobiak, D. H. 1995. An examination of lacustrine and estuarine populations of Mackenzie broad whitefish (*Coregonus nasus* Pallas): the role of migration and commercial exploitation on life history variation. M. Sc. Thesis, Univ. Manitoba, Winnipeg. 135 pp.
- Cohen, D.M., T. Inada, T. Iwamoto, and N. Scialabba. 1990. FAO species catalogue. Vol. 10. Gadiform fishes of the world. An annotated and illustrated catalogue of cods, hakes, grenadiers, and other gadiform fishes known to data. FAO Fisheries Symposium Number 125, Vol. 10. 442 pp.
- Corkum, L.D., and P.J. McCart. 1981. A review of the fisheries of the Mackenzie delta and nearshore Beaufort Sea. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1613, Winnipeg.
- Courtney, M.B., B. Scanlon, R.J. Brown, A.H. Rikardsen, C.P. Gallagher, and A.C. Seitz. 2018. Offshore ocean dispersal of adult Dolly Varden *Salvelinus malma* in the Beaufort Sea. *Polar Biology* (<https://doi.org/10.1007/s00300-017-2246-5>).
- Craig, P.C. 1977a. Fisheries investigations in the Shaviovik River drainage, Alaska, with emphasis on Arctic char in the Kavik River (Chapter 3). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1977b. Arctic char in the Sadlerochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska



with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.

- Craig, P.C. 1977c. Ecological studies of anadromous and resident populations of Arctic char in the Canning river drainage and adjacent coastal waters of the Beaufort Sea, Alaska. Pages 1-116 (Chapter 1) In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. Journal of the Fisheries Research Board of Canada 35:48:52
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. Transactions of the American Fisheries Society 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. Biological Papers of the University of Alaska 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. Biological papers of the University of Alaska 24:131-152.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1982. Ecological studies of Arctic cod (*Boreogadus saida*) in Beaufort Sea coastal waters, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 39:395-406.
- Craig, P.C., W.B. Griffiths, S.R. Johnson, and D.M. Schell. 1984. Trophic dynamics in an Arctic lagoon. Pages 347-380 in The Alaskan Beaufort Sea: ecosystems and environments. P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1985. Distributional patterns of fishes in an Alaskan Arctic lagoon. Polar Biology 4:9-18.
- Craig, P.C., and L. Haldorson. 1981. Fish. In Beaufort Sea Barrier Island-Lagoon Ecological Process Studies: Final Report, Simpson Lagoon, Part 4. Environmental Assessment of the Alaskan Continental Shelf, Final Report of Principal Investigators Vol. 8: Biological Studies. Boulder, Colorado: National Oceanic and Atmospheric Administration, Outer Continental Shelf Environment Assessment Program, and Bureau of Land Management. 384-678.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. Arctic. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 In P.C. Craig (ed.), Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Craig, P. C., and P. J. McCart. 1975. Classification of stream types in Beaufort Sea drainages between Prudhoe Bay, Alaska, and the Mackenzie Delta, N.W.T., Canada. Arctic and Alpine Research 7:183-198.
- Craig, P.C., and V.A. Poulin. 1975. Movements and growth of Arctic grayling (*Thymallus arcticus*) and juvenile Arctic char (*Salvelinus alpinus*) in a small arctic stream, Alaska. Journal of the Fisheries Research Board of Canada. 32: 689-697.
- Craig, P.C., and J. Wells. 1975. Fisheries investigations in the Chandalar River region, northeast Alaska. Pages 1-114 (Chapter 1) In P.C. Craig (ed.), Fisheries Investigations in a Coastal Region of the Beaufort Sea, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 34.



- Craig, P.C., and J. Wells. 1976. Life history notes for a population of Slimy Sculpin (*Cottus cognatus*) in an Alaskan Arctic stream. *Journal of the Fisheries Research Board of Canada* 33:1639–1642.
- Crane, P., T. Viavant, and J. Wenburg. 2005. Overwintering patterns of Dolly Varden *Salvelinus malma* in the Sagavanirktok River in the Alaskan North Slope inferred using mixed-stock analysis. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report Number 84.
- Daum, D., P. Rost, and M.W. Smith. 1984. Fisheries studies on the North Slope of the Arctic National Wildlife Refuge, 1983. In G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1983 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage. 66p.
- DeCicco, A.L. 1997. Movements of postsmolt anadromous Dolly Varden in Northwest Alaska. *American Fisheries Society Symposium*. 19:175-183.
- Deschermeier, S.J., T.M. Stevens, D.W. Wiswar, and R.L. West. 1986. Fisheries investigations in the Kongakut River, Arctic National Wildlife Refuge, Alaska, 1985. In G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Dillinger, R.E., T.P. Birt, and J.M. Green. 1992. Arctic cisco, *Coregonus autumnalis*, distribution, migration and spawning in the Mackenzie River. *The Canadian Field-Naturalist* 106(2): 175-180.
- Doxey, M. 1991. A history of fisheries assessments and stocking programs in Harding Lake, Alaska, 1939-1989. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Manuscript Number 91-2, Anchorage.
- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362–378.
- Ebener, M.P. 1997. Recovery of lake whitefish populations in the Great Lakes. *Fisheries* 22(7): 18-20.
- Ellis, D.V. 1962. Observations on the distribution and ecology of some Arctic fish. *Arctic*, 15:179–189.
- Evenson, M.J. 1990. Movement, abundance, and length composition of burbot in rivers of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-3. 33p.
- Everett, R.J., R.L. Wilmont, and C.C. Krueger. 1997. Population genetic structure of Dolly Varden from Beaufort Sea drainages of Northern Alaska and Canada. *American Fisheries Society Symposium*. 19:240-249.
- Fechhelm, R.G., J.D. Bryan, W.B. Griffiths, and L.R. Martin. 1997. Summer growth patterns of northern Dolly Varden (*Salvelinus malma*) smolts from the Prudhoe Bay region of Alaska. *Canadian Journal of Fisheries and Aquatic Sciences*. 54:1103-1110.
- Fechhelm, R.G., G.B. Buck, and M.R. Link. 2006. Year 24 of the long-term monitoring of nearshore Beaufort Sea fishes in the Prudhoe Bay region, 2006. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska. 82 p.
- Fechhelm, R.G., and D.B. Fissel. 1988. Wind-aided recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into Alaskan waters. *Canadian Journal of Fisheries and Aquatic Sciences*. 45:906-910.
- Fechhelm, R.G., and W.B. Griffiths. 1990. Effect of wind on the recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into the central Alaskan Beaufort Sea. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 2164-2171.



- Fechhelm, R.G., B. Streever, and B.J. Gallaway. 2007. The arctic cisco (*Coregonus autumnalis*) subsistence and commercial fisheries, Colville River Alaska: a conceptual model. *Arctic* 60(4): 421-429.
- Froese, R. and D. Pauly. Editors. 2017. FishBase. World Wide Web electronic publication. [www.fishbase.org](http://www.fishbase.org), version (10/2017).
- Fleischer, G.W. 1992. Status of coregonine fishes in the Laurentian Great Lakes. *Polish Archives of Hydrobiology* 39: 247-259.
- Frost, K.J., and L.F. Lowry. 1984. Trophic relationships of vertebrate consumers in the Alaskan Beaufort Sea. Pages 381–401 in P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Fruge, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994–1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.
- Fruge, D.J., D.W. Wiswar, L.J. Dugan, and D.E. Palmer. 1989. Fish population characteristics of Arctic National Wildlife Refuge coastal waters, summer 1988. Progress Report. U.S. Fish and Wildlife Service, Fairbanks.
- Furniss, R.A. 1974. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-6. 45p.
- Furniss, R.A. 1975. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-7. 45p.
- Galloway, B.J., W.B. Griffiths, P.C. Craig, W.J. Gazey, and J.W. Helmericks. 1983. An assessment of the Colville River delta stocks of Arctic cisco – migrants from Canada? *Biological Papers of the University of Alaska* 21: 4-23.
- Garner, G.W., and P.E. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. final report; baseline study of the fish, wildlife, and habitats. U.S. Fish and Wildlife Service, Anchorage.
- Georgette, S., and A. Shiedt. 2005. Whitefish: traditional ecological knowledge and subsistence fishing in the Kotzebue Sound region, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper Number 290, Juneau.
- Gilk, S.E., D.B. Molyneaux, T. Hamazaki, J.A. Pawluk, and W.D. Templin. 2009. Biological and genetic characteristics of fall and summer chum salmon in the Kuskokwim River, Alaska. Pages 161-179 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Goldberg, S.R., W.T. Yasutake, and R. West. 1987. Summer spawning in the fourhorn sculpin, *Myoxocephalus quadricornis*, from Alaska. *Canadian Field-Naturalist* 101:457
- Griffiths, W.B. 1984. Fish. Chapter three in J.C. Truett editor. Environmental characterization and biological use of lagoons in the eastern Beaufort Sea. Outer Continental Shelf Environmental Assessment Program Final reports of Principal Investigators Vol. 24. U.S. Department of Commerce, Anchorage Alaska.
- Griffiths, W.B., P.C. Craig, G. Walder, and G. Mann. 1975. Fisheries investigations in a coastal region of the Beaufort Sea (Nunavut Lagoon, Yukon Territory). In P.C. Craig, editor. Fisheries investigations in a coastal region of the Beaufort Sea. Biological Report Series, Volume 34. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W.B., J.K. DenBeste, and P.C. Craig. 1977. Fisheries investigations in a coastal region of the Beaufort Sea (Kaktovik Lagoon, Alaska). In P. McCart, editor. Fisheries investigations along



- the North Slope from Prudhoe Bay, Alaska to the Mackenzie Delta, N.W.T. Biological Report Series, Volume 40. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W. B., R.G. Fechhelm, B.J. Gallaway, L.R. Martin, and W.J. Wilson. 1998. Abundance of selected fish species in relation to temperature and salinity patterns in the Sagavanirktok delta, Alaska, following construction of the Endicott Causeway. *Arctic* 51:94–104.
- Gudkov, P.K. 1999. Relict population of round whitefish *Prosopium cylindraceum* from the eastern Chukotski Peninsula. *Journal of Ichthyology* 39(4): 294–300.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Harper, K.C., F. Harris, R.J. Brown, T. Wyatt, and D. Cannon. 2007. Stock Assessment of Broad Whitefish, Humpback Whitefish and Least Cisco in Whitefish Lake, Yukon Delta National Wildlife Refuge, Alaska, 2001–2003. U. S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 88. Kenai, AK.
- Harper, K.C., F. Harris, S.J. Miller, and D. Orabutt. 2009. Migration timing and seasonal distribution of broad whitefish, humpback whitefish, and least cisco from Whitefish Lake and the Kuskokwim River, Alaska, 2004 and 2005. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 105. Kenai, AK.
- Haymes, G.T., and Kolenosky, D.P. 1984. Distribution and characteristics of spawning round whitefish in Lake Ontario, 1976–1981. Ontario Fisheries Technical Report 14: ii + 9 pp.
- Healey, M.C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 311–3394 in C. Groot and L. Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia.
- Heins, D.C., J.M. Johnson, and J.A. Baker. 2003. Reproductive ecology of the ninespine stickleback from south-central Alaska. *Journal of Fish Biology* 63:1131–1143.
- Hop, H., H.E. Welch, and R.E. Crawford. 1997. Population structure and feeding ecology of Arctic cod schools in the Canadian high Arctic. American Fisheries Society Symposium 19:68–80.
- Horne-Brine, M.M., J. Bales, and L. DuBois. 2009. Salmon age and sex composition and mean lengths for the Yukon River Area, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 09-26, Anchorage.
- Howland, K.L., M.A. Treble, and R.F. Tallman. 2001. A biological analysis and population assessment of northern pike, inconnu and lake whitefish from the Mackenzie River delta exploratory fishery, 1989–1993. Canadian Technical Report of Fisheries and Aquatic Sciences 2330.
- Irvine, J.R., E. Linn, K. Gillespie, C. McLeod, and J.D. Reist. 2009a. Pacific salmon in Canada's Arctic draining rivers, with emphasis on those in British Columbia and the Yukon. Pacific Fisheries Resource Conservation Council. Vancouver, B.C.
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009b. Salmon in the Arctic and how they avoid lethal low temperatures. North Pacific Anadromous Fish Commission Bulletin. 5:39–50.
- Jarvela, L.E., and L.K. Thorsteinson. 1997. Movements and temperature occupancy of sonically tracked Dolly Varden and Arctic ciscoes in Camden Bay, Alaska. American Fisheries Society Symposium. 19:165–174.



- Jarvela, L.E., and L.K. Thorsteinson. 1999. The epipelagic fish community of Beaufort Sea coastal waters, Alaska. *Arctic* 52:80-94.
- Jennings, G.B., K. Sundet, and A.E. Bingham. 2010. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2008. Alaska Department of Fish and Game, Fishery Data Series No. 10-22, Anchorage.
- Jessop, B.M., and G. Power. 1973. Age, growth, and maturity of round whitefish (*Prosopium cylindraceum*) from the Leaf River, Ungava, Quebec. *Journal of the Fisheries Research Board of Canada* 30: 299-304.
- Johnson, L. 1980. The Arctic charr, *Salvelinus alpinus*. Pp. 19-98 in E.K. Balon, ed. Charrs: salmonid fishes of the genus *Salvelinus*. Dr. W. Junk. The Hague.
- Kane, D.L., K. Yoshikawa, and J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrogeology Journal* 21:41-52.
- Kepler, P. 1973. Sport fish investigations of Alaska: Population studies of northern pike and whitefish in the Minto Flats complex with emphasis on the Chatanika River. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1972-1973, Project F-9-5, Vol. 14, G-II-J, Juneau (Pages 59-81).
- Kratt, L.F., and R.J.F. Smith. 1977. A post-hatching sub-gravel stage in the life history of the Arctic grayling. *Transactions of the American Fisheries Society* 106:241-243.
- Kratt, L.F., and R.J.F. Smith. 2006. An analysis of the spawning behavior of the Arctic grayling *Thymallus arcticus* with observations on mating success. *Journal of Fish Biology* 17:661-666.
- Krueger, C.C., R.L. Wilmot, and R.J. Everett. 1999. Stock origins of Dolly Varden collected from Beaufort Sea coastal sites of Arctic Alaska and Canada. *Transactions of the American Fisheries Society* 128:49-57.
- Lambert, Y., and J.J. Dodson. 1990. Freshwater migration as a determinant factor in the somatic cost of reproduction of two anadromous coregonines of James Bay. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 318-334.
- Lear, W.H. 1979. Distribution, size and sexual maturity of Arctic cod (*Boreogadus saida*) in the northwest Atlantic during 1959-1978 St. John's, Newfoundland. Canadian Atlantic Fisheries Science Advisory Commission. Research Document 79/58. 40 p.
- Lindsey, C.C. 1963. Sympatric occurrence of two species of humpback whitefish in Squanga Lake, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 20: 749-767.
- Lowry, L.F., and K. Frost. 1981. Distribution, growth and foods of Arctic cod (*Boreogadus saida*) in the Bering, Chukchi and Beaufort Seas. *Canadian Field Naturalist* 95:186-191.
- Lubinski, B.R., M.J. Millard, R. Schneidervin, and J.L. Melegari. 1999. A mark-recapture experiment to estimate abundance of lake trout in Lake Schrader, Arctic National Wildlife Refuge, Alaska, 1995. U.S. Fish and Wildlife Service. Unpublished Fisheries Technical Report. 14p.
- Mann, G.J. 1974. Life history types of the least cisco (*Coregonus sardinella*, Valenciennes), in the Yukon Territory, North Slope, and east Mackenzie River Delta drainages. In P.J. McCart [ed] Life histories of three species of freshwater fish in Beaufort Sea Drainages, Yukon Territory. Arctic Gas Biological Report Series 18(3): 160 pp.
- Mann, G.J., and P.J. McCart. 1981. Comparison of sympatric dwarf and normal populations of least cisco (*Coregonus sardinella*) inhabiting Trout Lake, Yukon Territory. *Canadian Journal of Fisheries and Aquatic Sciences* 38: 240-244.



- Martin, N.V. 1957. Reproduction of lake trout in Algonquin Part, Ontario. Transactions of the American Fisheries Society. 86:231-244.
- McCart, P. J. 1980. A Review of the systematic and ecology of Arctic char, *Salvelinus alpinus*, in the western Arctic. Canadian Technical Report of Fisheries and Aquatic Sciences. No. 935: 89 p.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. Journal of the Fisheries Research Board of Canada 30:1215-1220.
- McCart, P., P. Craig, and H. Bain. 1972. Report on fisheries investigations in the Sagavanirktok River and neighboring drainages. Alyeska Pipeline Service Company, 170 pp.
- McDermid, J.L., J.D. Reist, and R.A. Bodaly. 2007. Phylogeography and postglacial dispersal of whitefish (*Coregonus clupeaformis* complex) in northwestern North America. Archiv Für Hydrobiologie, Special Issues: Advances in Limnology 60: 91-109.
- McDonald, M.E., and A.E. Hershey. 2006. Shifts in abundance and growth of slimy sculpin in response to changes in the predator population in an Arctic Alaskan lake. Hydrobiologia. 240:219-233.
- McLeod, C.L., and J.P. O'Neil. 1983. Major range extension of anadromous salmonids and first record of Chinook salmon in the Mackenzie River drainage. Canadian Journal of Zoology 61: 2183-2184.
- McPhail, J.D., and C.C. Lindsey. 1970. Freshwater Fishes of Northern Canada and Alaska. Fisheries Research Board of Canada Bulletin 173: 381 pp.
- Morin, R., J.J. Dodson, and G. Power. 1982. Life history variations of anadromous cisco (*Coregonus artedii*), lake whitefish (*C. clupeaformis*), and round whitefish (*Prosopium cylindraceum*) populations of eastern James-Hudson Bay. Canadian Journal of Fisheries and Aquatic Sciences 39: 958-967.
- Morrow, J.E. 1980. The Freshwater Fishes of Alaska. Alaska Northwest Publishing Co., Anchorage, AK. 300 pp.
- Moskalenko, B.K. 1971. The whitefishes of Siberia. Pishchevaya Promyshlennost, Report SFWFR-TR-73-05, Moscow (translated from Russian in 1972 by R.M. Howland and G. Kavanagh, U.S. Department of the Interior, Division of Fishery Research, Washington D.C.).
- Moulton, L.L., W.A. Morris, C. George, J. Bacon, J.R. Rose, and M. Whitman. 2007. Surveys of fish habitats in the Teshekpuk Lake region, 2003-2005. Final Report to the North Slope Borough, Department of Wildlife Management, Barrow.
- Moulton, L.L., L.M. Philo, and J.C. George. 1997. Some reproductive characteristics of least ciscoes and humpback whitefish in Dease Inlet, Alaska. Page 119-126 in J. Reynolds, editor. Fish ecology in Arctic North America. American Fisheries Society 19, Bethesda, Maryland.
- Moulton, L.L., and B.T. Seavey. 2005. Harvest estimate and associated information for the 2004 Colville River fall fishery. A report prepared by MJM Research for ConocoPhillips Alaska, Inc., Anchorage.
- Mraz, D. 1964. Age and growth of the round whitefish in Lake Michigan. Transactions of the American Fisheries Society 93: 46-52.
- Normandeau, D.A. 1969. Life history and ecology of the round whitefish *Prosopium cylindraceum* (Pallas), of Newfound Lake, Bristol, New Hampshire. Transactions of the American Fisheries Society 98: 7-13.
- Page, L.M., H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, N. E. Mandrak, R.L. Mayden, and J.S. Nelson. 2013. Common and scientific names of fishes from the United States, Canada, and Mexico, seventh edition. American Fisheries Society Special Publication 34, Bethesda, Maryland.



- Palmer, S.R. 1962. Handbook of North American Birds Vol. 1. Yale University Press, New Haven Connecticut.
- Pedersen, S., and A. Linn, Jr. 2005. Kaktovik 2000-2001 Subsistence Fishery Harvest Assessment. Federal Subsistence Fishery Monitoring Program, Final Project Report No. FIS 01-101. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information, Services Division, Anchorage, Alaska.
- Percy, R. 1975. Fishes of the outer Mackenzie Delta. Canadian Department of the Environment. Beaufort Sea Project. Technical Report 8. 114p.
- Percy, R., W. Eddy, and D. Munro. 1974. Anadromous and freshwater fishes of the outer Mackenzie Delta. Fisheries and Marine Service, Environment Canada. Interim Report of Beaufort Sea Project Study B2. 51p.
- Plumb, M.P. 2006. Ecological factors influencing fish distribution in a large subarctic lake system. Master's Thesis, University of Alaska Fairbanks.
- Prasolov, P.P. 1989. On the biology of the broad whitefish, *Coregonus nasus*, from the lower Ob River basin. Journal of Ichthyology 29: 47-53.
- Rabus, B.T., and K.A. Echelmeyer. 1998. The mass balance of McCall Glacier, Brooks Range, Alaska, U.S.A.; its regional relevance and implications for climate change in the Arctic. Journal of Glaciology 44(147):333-351.
- Reist, J.D., and W.A. Bond. 1988. Life history characteristics of migratory coregonids of the lower Mackenzie River, Northwest Territories, Canada. Finnish Fisheries Research 9: 133-144.
- Reist, J.D., J.D. Johnson, and T.J. Carmichael. 1997. Variation and specific identity of char from Northwestern Arctic Canada and Alaska. American Fisheries Society Symposium. 19:250-261.
- Salo, O. 1991. Life history of chum salmon (*Oncorhynchus keta*). Pages 231-310 in C. Groot and L. Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia.
- Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.
- Seigle, J. 2003. Determination of marine migratory behavior and its relationship to selected physical traits for least cisco (*Coregonus sardinella*) of the Western Arctic Coastal Plain, Alaska. Master's thesis. Oregon State University, Corvallis, Oregon.
- Shestakov, A.V. 2001. Biology of the broad whitefish *Coregonus nasus* (Coregonidae) in the Anadyr basin. Journal of Ichthyology 4(9): 746-754.
- Smith, M.W., and R.S. Glesne. 1983. Aquatic studies on the North Slope of the Arctic National Wildlife Refuge, 1981 and 1982. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report Number 83-01, Fairbanks, Alaska.
- Stein, J.N., C.S. Jessop, T.R. Porter, and K.T.J. Chang-Kue. 1973. Fish resources of the Mackenzie River Valley. Fisheries Service, Department of the Environment, Winnipeg, Manitoba.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. Arctic 59:37-46.
- Stewart, D.B., T.J. Carmichael, C.D. Sawatzky, N.J. Mochnacz, and J.D. Reist. 2007. Fish life history and habitat use in the Northwest Territories: round whitefish (*Prosopium cylindraceum*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2795, Winnipeg.
- Swanson, H.K., K.A. Kidd, and J.D. Reist. 2010. Effects of Partially Anadromous Arctic Char (*Salvelinus alpinus*) Populations on Ecology of Coastal Arctic Lakes. Ecosystems. 13:261-274



- Tallman, R.F., M.V. Abrahams, and D. H. Chudobiak. 2002. Migration and life history alternatives in a high latitude species, the broad whitefish, *Coregonus nasus* Pallas. *Ecology of Freshwater Fish* 11: 101–111.
- Tallman, R.F., and M.K. Friesen. 2007. A review of population trends in length and age of lake whitefish (*Coregonus clupeaformis*) harvested from Great Slave Lake between 1972 and 1995. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2819, Winnipeg, MB.
- Trawicki, J.M., S.M. Lyons, and G.V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska.
- Underwood, T.J., J.A. Gordon, M.J. Millard, L.A. Thorpe, and B.M. Osborne. 1995. Characteristics of selected fish populations of Arctic Wildlife Refuge coastal waters, final report, 1988-1991. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 28.
- Underwood, T.J., M.J. Millard, and L.A. Thorpe. 1996. Relative abundance, length frequency, age, and maturity of Dolly Varden in near-shore waters of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 125:719-728.
- VanGerwen-Toyne, M., J. Walker-Larson, and R.F. Tallman. 2008. Monitoring spawning populations of migratory coregonids in the Peel River, NT: The Peel River study 1998-2002. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2851, Winnipeg, MB.
- Ward, P., and P. Craig. 1974. Catalogue of streams, lakes, and coastal areas in Alaska along routes of the proposed gas pipeline from Prudhoe Bay, Alaska to the Alaska/Canadian border. Biological Report Series, Volume 19. Canadian Arctic Gas Study Ltd/Alaska Arctic Gas Study Co., Calgary.
- Welch, H.E., R.E. Crawford, and H. Hop. 1993. Occurrence of arctic cod (*Boreogadus saida*) schools and their vulnerability to predation in the Canadian High Arctic. *Arctic* 46:331 – 339.
- West, R.L., and D.J. Fruge. 1989. A review of coastal plain fish surveys and the results of 1986 fish surveys of selected coastal lakes and streams, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 4. 22p.
- West, R.L., M.W. Smith, W.E. Barber, J.B. Reynolds, and H. Hop. 1992. Autumn migration and overwintering of Arctic grayling in coastal streams of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 121:709-715
- West, R.L., and D.W. Wiswar. 1985. Fisheries investigations on the Arctic National Wildlife Refuge, Alaska, 1984. Pages 729-777 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1984 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Westin, L. 1969. The mode of fertilization, parental behavior and time of egg development in fourhorn sculpin. Report from the Institute of Freshwater Research Drottningholm. 49:175–182.
- Westin, L. 1970. The food ecology and the annual food cycle in the Baltic population of four-horn sculpin *Myoxocephalus quadricornis* Pisces. Report from the Institute of Freshwater Research Drottningholm. 50:168-210.
- White, D.M., P. Prokein, M.K. Chambers, M.R. Lilly, and H. Toniolo. 2008. Use of synthetic aperture radar for selecting Alaskan lakes for winter water use. *Journal of the American Water Resources Association* 44:276–284.



- Wilson, W.J., E.H. Buck, G.F. Player, and L.D. Dreyer. 1977. Winter water availability and use conflicts as related to fish and wildlife in Arctic Alaska—a synthesis of information. FWS/OBS-77/06. U.S. Fish and Wildlife Service, Washington, DC.
- Wipfli, M.S. 2009. Food supplies of stream-dwelling salmonids. Pages 39-52 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Wiswar, D.W. 1986. Notes on the age, growth, distribution and summer feeding habits of Arctic flounder in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. U.S. Fish and Wildlife Service. Fairbanks Fishery Resources Progress Report Number FY86-3.
- Wiswar, D.W. 1991. Summer distribution of fishes in the Okpilak and Akutoktak rivers, Arctic National Wildlife Refuge, Alaska, 1989. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 11.
- Wiswar, D.W. 1992. Summer distribution of Arctic fishes in the Okpilak, Akutoktak, and Jago rivers, Arctic National Wildlife Refuge, Alaska, 1990. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 17.
- Wiswar, D.W. 1994. Summer distribution of Arctic fishes in the 1002 Area of the Arctic National Wildlife Refuge, Alaska, 1991 with emphasis on selected lakes, tundra streams, and the Sadlerochit River drainage. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 27.
- Wiswar, D.W., and R.L. West. 1987. Fisheries investigations in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. Pages 778-800 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Wiswar, D.W., R.L. West, and W.N. Winkleman. 1995. Fisheries Investigation in Oruktalik Lagoon, Arctic National Wildlife Refuge, Alaska, 1986. U. S. Fish and Wildlife Service, Fairbanks Fisheries Resource Office, Alaska Fisheries Technical Report No. 30. Fairbanks, AK.
- Wootton, R.J. 1984. A functional biology of sticklebacks. University of California Press. Berkeley, CA.
- Yoshihara, H.T. 1972. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1971-1972. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-4, Job G-III-A. 49 p.
- Yoshihara, H.T. 1973. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1972-1973. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-5, Job G-III-A. 86 p.
- Zimmerman, C.E., A.M. Ramey, S.M. Turner, F.J. Mueter, S.M. Murphy, J.L. Nielsen. 2013. Genetics, recruitment, and migration patterns of Arctic cisco (*Coregonus autumnalis*) in the Colville River, Alaska, and Mackenzie River, Canada. Polar Biology 36:1543–1555.
- Zyus'ko, A.Y., V.V. Rusanov, and Z.A. Chernyayev. 1993. Biological data on round whitefish, *Prosopium cylindraceum*, from the Chara River. Journal of Ichthyology 33(2): 37-48.



## Birds

### Waterfowl and Waterbirds

Fourteen waterfowl and eight waterbird species regularly occur in the Coastal Plain (Table 1). Waterfowl and waterbirds generally arrive in late May and June and initiate nests from late May through July (Johnson and Herter 1989; U.S. Fish and Wildlife Service, unpublished data). Waterfowl and waterbirds are an important subsistence resource for local rural residents (summarized in U.S. Fish and Wildlife Service 2015a).

Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution for the Coastal Plain unreliable. In 2015, a ground survey conducted across most Arctic Refuge barrier islands found over 800 Common Eider (*Somateria mollissima*) nests (U.S. Fish and Wildlife Service, unpublished data). During fall, Snow Geese occur in large numbers; at times more than 300,000 stage on the Refuge coastal plain prior to fall migration (Garner and Reynolds 1986; Kendall 2006). Post-breeding and molting waterbirds use Coastal Plain lagoons in the fall with over 28,000 Long-tailed Ducks (*Clangula hyemalis*) counted along the Refuge coast in some years (Lysne et al. 2004).

### Shorebirds

Seventeen shorebird species regularly occur on the Coastal Plain (Table 1). Of these, six are listed as high conservation concern by the U.S. Shorebird Conservation Plan Partnership (2016). Shorebirds arrive to the Coastal Plain in mid-May through June (R. Lancot, pers. comm.) with most initiating nests in June, though a small number begin laying eggs in late May and into early July (Saalfeld and Lancot 2015). Brown et al. (2007) conducted surveys of breeding shorebirds during June of 2002 and 2004 and encountered 14 shorebird species and estimated that 230,000 (95-percent CI: 104,000–363,000) shorebirds occupied the Coastal Plain during the breeding season. Species richness and density were typically highest in wetland and riparian habitats. Among wetland plots, densities were highest near the Canning River Delta on the western edge of the Coastal Plain. Shorebirds stage along Coastal Plain river deltas after breeding as they prepare for fall migration to wintering areas in the Americas and Asia (Brown et al. 2012; Churchwell et al. 2018; Taylor et al. 2010; Taylor et al. 2011).

### Raptors

Five raptor species regularly occur on the Coastal Plain (Table 1). Golden Eagles are protected under the Bald and Golden Eagle Protection Act. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995). Some Snowy Owls (*Bubo scandiacus*) winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (*Falco peregrinus*), Rough-legged Hawks (*Buteo lagopus*), and Short-eared Owls (*Asio flammeus*), arrive to the Arctic and initiate nesting in May and early June (summarized in Bechard and Swem 2002; Cade 1960; Pitelka et al. 1955).



## Landbirds

Ten landbird species regularly occur on the Coastal Plain (Table 1). Three are considered permanent residents: Willow Ptarmigan (*Lagopus lagopus*), Rock Ptarmigan (*L. muta*), and Common Raven (*Corvus corax*) (U.S. Fish and Wildlife Service 2015).

**3.2.4 Table 1.** List of 57 fairly common, common, and abundant breeding and nonbreeding bird species for the coast, inland, and barrier island and lagoon regions of the Coastal Plain of the Arctic National Wildlife Refuge, Alaska from Pearce et al. (2018). Source references used are: 1. Garner and Reynolds 1986; 2. Garner and Reynolds 1987; 3. Brown et al. 2007; 4. Dau and Bollinger 2009; 5. U.S. Fish and Wildlife Service 2015; 6. Kendall 2005; 7. U.S. Fish and Wildlife Service 2008; 8. IUCN 2017; 9. Warnock 2017; 10. U.S. Shorebird Conservation Plan Partnership 2016. Generalized categories of abundance were used by most references since few quantitative surveys have been conducted in the 1002 Area. For Dau and Bollinger (2009), we did not include species with less than or equal to 15 average sightings per year (see table 2). In cases where habitat area is given as “coastal plain” by a reference, both coast and inland areas are included. Abbreviations: B, breeding, NB, non-breeding, LC, least concern, MC, moderate concern, HC high concern.

Commented [CMA15]: No table 2

Species	Region of Coastal Plain			Reference	Birds of Conservation Concern (2008) <sup>7</sup>	IUCN Status (2017) <sup>8</sup>	Audubon Watchlist (2017) <sup>9</sup>	Shorebird Conservation Plan Status List (2017) <sup>10</sup>
	Coast	Inland	Barrier Islands and Lagoons					
Greater White-fronted Goose ( <i>Anser albifrons</i> )	NB	NB		1, 2, 5		LC		
Snow Goose ( <i>Anser caerulescens</i> )	NB	NB		1, 2, 5		LC		
Brant ( <i>Branta bernicla</i> )	B, NB		NB	1, 2, 4		LC	Yellow	
Cackling Goose ( <i>Branta hutchinsii</i> )	B, NB	B, NB		1, 2, 5		LC	Yellow	
Tundra Swan ( <i>Cygnus columbianus</i> )	B, NB	B, NB		1, 2, 5, 6		LC		
American Wigeon ( <i>Mareca americana</i> )	NB			1		LC		
Northern Pintail ( <i>Anas acuta</i> )	B, NB	B, NB	NB	1, 2, 4, 5		LC		
Greater Scaup ( <i>Aythya marila</i> )	NB		NB	1, 4		LC	Red	



King Eider ( <i>Somateria spectabilis</i> )	B, NB		NB	2, 4, 5		LC	Yellow	
Common Eider ( <i>Somateria mollissima</i> )	NB		B, NB	1, 2, 4, 5, 6		Near Threatened		
Surf Scoter ( <i>Melanitta perspicillata</i> )			NB	1, 4		LC	Declining	
White-winged Scoter ( <i>Melanitta fusca</i> )	NB		NB	4, 5, 6		LC		
Long-tailed Duck ( <i>Clangula hyemalis</i> )	B, NB	B	NB	1, 2, 4, 5, 6		Vulnerable	Declining	
Red-breasted Merganser ( <i>Mergus serrator</i> )	NB	B	NB	1, 2, 4, 5, 6		LC		
Willow Ptarmigan ( <i>Lagopus lagopus</i> )	B, NB	B, NB		1, 2, 5		LC		
Rock Ptarmigan ( <i>Lagopus muta</i> )	B, NB	B, NB		1, 2, 5		LC		
Sandhill Crane ( <i>Antigone canadensis</i> )	NB			2		LC		
Black-bellied Plover ( <i>Pluvialis squatarola</i> )	NB			1, 2, 5		LC		MC
American Golden-plover ( <i>Pluvialis dominica</i> )	B, NB	B, NB		1, 2, 3, 5		LC	Red	HC
Semipalmated Plover ( <i>Charadrius semipalmatus</i> )		B, NB		2, 5		LC		LC
Upland Sandpiper ( <i>Bartramia longicauda</i> )		B		5	X	LC		LC
Whimbrel ( <i>Numenius phaeopus</i> )		NB		2	X	LC	Yellow	HC
Ruddy Turnstone ( <i>Arenaria interpres</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Stilt Sandpiper ( <i>Calidris himantopus</i> )	B, NB	B		1, 2		LC	Declining	LC



Sanderling ( <i>Calidris alba</i> )	NB			2		LC	Declining	MC
Dunlin ( <i>Calidris alpina</i> )	B, NB	B		1, 2, 3	X	LC	Red	HC
Baird's Sandpiper ( <i>Calidris bairdii</i> )	B	NB		1, 2		LC		LC
Buff-breasted Sandpiper ( <i>Calidris subruficollis</i> )	B	B		1, 2	X	Near Threatened	Red	HC
Pectoral Sandpiper ( <i>Calidris melanotos</i> )	B, NB	B, NB		1, 2, 3, 5, 6		LC	Red	HC
Semipalmated Sandpiper ( <i>Calidris pusilla</i> )	B, NB	B, NB		1, 2, 3, 5		Near Threatened		HC
Western Sandpiper ( <i>Calidris mauri</i> )	NB			1, 2		LC	Yellow	MC
Long-billed Dowitcher ( <i>Limnodromus scolopaceus</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Red-necked Phalarope ( <i>Phalaropus lobatus</i> )	B, NB	B		1, 2, 3, 5		LC	Declining	MC
Red Phalarope ( <i>Phalaropus fulicarius</i> )	B, NB	B, NB		1, 2, 3, 5		LC		MC
Pomarine Jaeger ( <i>Stercorarius pomarinus</i> )	B, NB	B, NB		1, 2, 5		LC		
Parasitic Jaeger ( <i>Stercorarius parasiticus</i> )	NB	NB		1, 2, 5		LC		
Long-tailed Jaeger ( <i>Stercorarius longicaudus</i> )	B, NB	B, NB		1, 2, 5		LC		
Glaucous Gull ( <i>Larus hyperboreus</i> )	B, NB	NB	B, NB	1, 2, 4, 5, 6		LC		
Arctic Tern ( <i>Sterna paradisaea</i> )	NB	NB	B	1, 2, 5, 6	X	LC	Declining	



Red-throated Loon ( <i>Gavia stellata</i> )	B, NB		NB	1, 2, 4, 5, 6	X	LC	Declining	
Pacific Loon ( <i>Gavia pacifica</i> )	B, NB	B, NB	NB	1, 2, 4, 5, 6		LC	Declining	
Yellow-billed Loon ( <i>Gavia adamsii</i> )	NB		NB	2	X	Near Threatened	Red	
Rough-legged Hawk ( <i>Buteo lagopus</i> )	NB	NB		2		LC		
Golden Eagle ( <i>Aquila chrysaetos</i> )	NB	NB		1, 2, 5		LC		
Snowy Owl ( <i>Bubo scandiacus</i> )	B, NB	B, NB		1, 2, 5		Vulnerable	Red	
Short-eared Owl ( <i>Asio flammeus</i> )	B	B		1, 2, 5	X	LC	Declining	
Peregrine Falcon ( <i>Falco peregrinus</i> )	NB			2	X	LC		
Common Raven ( <i>Corvus corax</i> )		NB		2		LC		
Eastern yellow Wagtail ( <i>Motacilla tschutschensis</i> )	B	B, NB		1, 2, 5		LC		
Common Redpoll ( <i>Acanthis flammea</i> )	B	B		1, 2, 5		LC		
Hoary Redpoll ( <i>Acanthis hornemanni</i> )	B	B		1, 2, 5				
Lapland Longspur ( <i>Calcarius lapponicus</i> )	B	B		1, 2, 5		LC	Declining	
Snow Bunting ( <i>Plectrophenax nivalis</i> )	B	B	B, NB	5, 6		LC	Declining	
American Tree Sparrow ( <i>Spizelloides arborea</i> )		B		1, 2, 5		NA	Declining	
Savannah Sparrow ( <i>Passerculus sandwichensis</i> )	B	B		1, 2, 5		LC	Declining	



White-crowned Sparrow ( <i>Zonotrichia leucophrys</i> )		B	1		LC	Declining	
--	--	---	---	--	----	-----------	--

## Bird References

- Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (*Buteo lagopus*). in A. F. Poole, and F. B. Gill, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Brown, S., J. Bart, R. B. Lanctot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the arctic national wildlife refuge. The Condor 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. Waterbirds 35:546-554.
- Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. University of California Publications in Zoology 63:151-290.
- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of beaufort sea deltas by hatch-year semipalmated sandpipers. Estuaries and Coasts 41:280-292.
- Dau, C. P., and K. S. Bollinger. 2009. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 1-5 July 2009.
- Garner, G. W., and P. E. Reynolds. 1987. 1985 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Garner, G. W., and P. F. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. Final report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*). in P. G. Rodewald, editor. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. in.
- Johnson, S., and D. Herter. 1989. The birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage, AK.
- Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, 2003-2004. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge.
- Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). in A. F. Poole, and F. B. Gil, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002-17. U.S. Geological Survey. Report 2331-1258.



- Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. *The Condor* 57:3-18.
- Saalfeld, S. T., and R. B. Lanctot. 2015. Conservative and opportunistic settlement strategies in Arctic-breeding shorebirds. *The Auk* 132:212-234.
- Stehn, R. A., W. W. Larned, and R. M. Platte. 2013. Analysis of aerial survey indices monitoring waterbird populations of the Arctic Coastal Plain, Alaska, 1986-2012. USFWS, Migratory Bird Management, Anchorage and Soldotna.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, F. Huettmann, D. A. Nigro, and S. J. Kendall. 2010. Distribution and community characteristics of staging shorebirds on the northern coast of Alaska. *Arctic* 63:451-467.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, S. J. Kendall, and D. A. Nigro. 2011. Residence time and movements of postbreeding shorebirds on the northern coast of Alaska. *The Condor* 113:779-794.
- U.S. Fish & Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. U.S. Fish and Wildlife Service.
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- U.S. Shorebird Conservation Plan Partnership. 2016. Shorebirds of Conservation Concern in the United States of America — 2016. Pages 12 in B. Andres, editor. U.S. Shorebirds of Conservation Concern — 2016. U.S. Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska.
- Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.



## Terrestrial Mammals

### Caribou

Caribou (*Rangifer tarandus*) are the most abundant large mammal in Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for brown bears and wolves. Caribou have been present in northeastern Alaska and the northern Yukon since the early Pleistocene. Human use of caribou in the region may date back thousands of years. Remnants of caribou fences and corral structures used by the Gwich'in people are found throughout the current southern range of the Porcupine caribou herd (Warbelow et al. 1975).

Large caribou herds tend to migrate over long distances using seasonally available forage resources that are often widely distributed. Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators. In the Arctic, caribou reproduction is highly synchronous and the majority of calving occurs in a two- to three-week period. Most adult females give birth to a single calf. Caribou calves are precocious, being able to stand and nurse within one hour after birth and follow their mothers within a few hours. The first 24 hours of life are critical, when a behavioral bond is formed between the calf and its mother. Disturbance of maternal groups on the calving grounds may interfere with bond formation and can increase calf mortality. After calving, small bands of cows with newborn calves gradually merge into larger groups and are joined by yearlings, barren females, and bulls arriving from wintering areas.

Summer weather conditions promote the emergence of mosquitoes, nose bots, warble flies, and other biting insects. Insect harassment drives caribou into densely packed groups. These post-calving aggregations often move toward the Arctic coast or to higher elevations in the mountains to find relief from insects. By August, large aggregations gradually disperse into widely interspersed smaller groups that move progressively toward winter ranges. Breeding takes place in late fall, and by mid-November, caribou arrive in areas where they will spend the winter.

Four caribou herds live in northern Alaska. Two of these, the Porcupine and Central Arctic herds, consistently use Arctic Refuge seasonally or throughout the year. In addition, some caribou from the Teshekpuk herd occasionally use the Arctic Refuge during winter. Caribou would be most susceptible to interaction and potential disturbance from winter exploration activities during their spring migration to calving grounds within the Arctic Refuge coastal plain and for those that overwinter in that area.

### Porcupine Caribou Herd

The Porcupine caribou herd ranges over 130,000 square mi (337,000 square km) of wild lands in northeastern Alaska and northwestern Canada (Lenart 2007). Porcupine caribou are an important resource used by residents of Arctic Village, Venetie, Stevens Village, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Many visitors come to Arctic Refuge during early summer with hopes of seeing large numbers of caribou.

During the 1960s and 1970s, the Porcupine caribou herd was thought to be relatively stable at about 100,000 animals. Herd numbers increased after 1978, peaked at 178,000 in 1989, and then declined to 123,000 caribou in 2001 (Lenart 2007). Between 2002 and 2009, no estimates of abundance were

**Commented [CMA16]:** This is one of the few places we talk about effects – is that appropriate here? Are we supposed to be addressing both affected environment and environmental consequences or is the consultant writing the environmental consequences section?



available. During this period, caribou left the coastal plain and northern foothills of Arctic Refuge earlier and did not form large post-calving aggregations, or weather conditions precluded flights to photograph groups. In 2010, 169,000 caribou were counted in a photo-census of the Porcupine caribou herd (Caikoski 2011). From 2013 to 2017 the population size was the largest observed for his herd since monitoring began in 1977, with an estimated population of 197,000 in 2013 and 218,000 in 2017 (Alaska Department of Fish and Game, 2017b).

The Porcupine herd migrates hundreds of miles from wintering grounds south of the Brooks Range to give birth on the coastal plain and northern foothills of Arctic Refuge and nearby Yukon Territory in Canada. The entire Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou (Griffith et al. 2002). Foothills and mountains of Arctic Refuge are also important summer, fall, and winter habitats, as well as spring and fall migration routes. As the summer progresses and willows (*Salix* sp.) emerge, caribou also use riparian habitats. The Porcupine caribou herd generally overwinters south of the Brooks Range in Arctic Refuge and in the Richardson and Ogilvie mountains of the Yukon Territory, Canada. Winter distribution varies by year but is primarily south of the Brooks Range (Caikoski 2011).

Spring migration to calving grounds begins in mid-April and continues through May. Pregnant caribou move northward from wintering areas toward calving grounds, where they give birth during the first week in June. Timing and routes of migration vary annually depending on where the caribou overwintered, snow conditions, and timing of the onset of spring weather. Caribou wintering in Alaska often follow a northeasterly route to the Arctic coast, crossing the southern flanks and valleys of the Brooks Range, eventually entering Canada near the Firth River and following it to the coast. Caribou wintering in Canada also converge in this region. In many years, migrating caribou then move westward along the coast to calving grounds within the Arctic Refuge, although some calving often occurs in the northern Yukon. Some caribou wintering in Alaska move in a more northerly direction, crossing the eastern Brooks Range and traveling more directly toward the Arctic coast.

Since intensive monitoring began in 1983, the Porcupine caribou herd has calved in a region extending from the northern foothills of the Brooks Range to the Arctic coast and from the Canning River in Arctic Refuge to the Babbage River in Canada, an area of nearly 8.9 million acres (Griffith et al. 2002). During the calving season in early June, Porcupine caribou selected areas of wet sedge, herbaceous tussock tundra and riparian vegetation types (Griffith et al. 2002). Emerging tussock cotton grass (*Eriophorum vaginatum*) flowers were an important source of high quality forage in areas used by calving caribou (Jorgenson et al. 2002). This plant species had greater biomass and forage quality in tussock tundra compared with other vegetation types. The distribution of tussock tundra and moist sedge-willow tundra was greater in calving areas in the Arctic Refuge coastal plain than in areas further south and east (Jorgenson et al. 2002).

### **Central Arctic Caribou Herd**

The annual range of the Central Arctic caribou herd overlaps that of the Porcupine caribou herd. Two main calving concentration areas have been identified for the Central Arctic caribou herd: a western area



between the Kuparuk and Colville rivers, and an eastern area between the Sagavanirktok and Canning rivers. The eastern area includes the Canning River delta region in northwest Arctic Refuge.

During most winters, scattered groups of animals range throughout the coastal plain west of the Katakaturuk River and adjacent uplands to the south. Between 2002 and 2009, the winter distribution of the Central Arctic caribou included areas both north and south of the Brooks Range in Arctic Refuge. In some years, this herd mixed with Porcupine caribou wintering in the same region. In 2010, almost all Central Arctic caribou wintered on the south side of the Brooks Range in Alaska, as did Porcupine caribou.

This herd was estimated at about 5,000 caribou in the mid-1970s when it was first identified as a distinct herd (Cameron and Whitten 1979). The herd grew to almost 13,000 by the early 1980s and over 25,000 by the late 1990s (Cameron et al. 2002). A photo-census in 2010 counted more than 70,000 caribou in the Central Arctic herd, but a late spring in 2013 resulted in high mortality and the population dropped to 50,000 animals (Alaska Department of Fish and Game 2017a). By 2016 the population estimate had decreased an additional 50 percent, to less than 23,000 caribou. The declines are attributed to high adult female mortality and loss of individuals to other herd units during mixing of the Central Arctic, Teshekpuk and Porcupine caribou herds.

#### **Mammal Species other than Caribou**

As established by ANILCA, one purpose of the Arctic Refuge is to “conserve fish and wildlife populations and habitats in their natural diversity.” Among the wildlife species specifically mentioned under this purpose are Dall’s sheep, muskoxen, moose, brown bear, wolf, wolverine, and caribou.

Dall’s sheep do not occur on the Coastal Plain, but are found in the Brooks Range Mountains to the south, where the species reaches its northernmost geographic extent. The eastern Sadlerochit Mountains, near the southern border of the Arctic Refuge coastal plain, contains habitat suitable for sheep, and the species has occasionally been seen there. Sheep are sensitive to disturbance from noise and aircraft traffic, particularly during the lambing season (mid to late May). Dall’s sheep populations throughout the Brooks Range peaked during the 1980s, declined steeply during the early 1990s (most likely due to adverse weather), increased slowly through approximately 2011, then declined again during 2012-2014 in association with a series of severe winters. Surveys during 2015-2017 suggested that lamb production and survival were relatively high, and the population may once again be increasing.

Populations of both muskoxen (*Ovibos moschatus*) and moose (*Alces alces*) have experienced marked changes over the last several decades. Muskoxen were reintroduced to the coastal plain in the Arctic Refuge in 1969 and 1970. The population subsequently grew through about 1985, then remained relatively stable for the next decade. Beginning in 1998, however, muskox numbers within the refuge dropped dramatically and have remained very low ever since. The overall muskox population in northeast Alaska and northwest Canada peaked in 1993, declined through 2006, and has remained relatively stable since then. Most of that decline was due to population losses from the Arctic Refuge. Today, most of the muskoxen in the area are either west or east of the Arctic Refuge (U.S. Fish and Wildlife Service 2015a). Female muskoxen do not typically breed until they are 4 or 5 years old, most



only breed every other year (or less frequently), and produce a single calf. Muskoxen subsist on generally low quality forage in winter, and to compensate, they conserve energy by reducing their winter activity. Calves are born between mid-April and mid-May, 4 to 6 weeks before snowmelt and the onset of growth of nutritious forage. As a result, late winter is a time of high vulnerability (U.S. Fish and Wildlife Service 2015a).

Moose distribution on the Coastal Plain is largely confined to patches of woody vegetation along streams during winter, but some of these moose spread out across the Coastal Plain during summer. Moose populations in northeast Alaska, including the Arctic Refuge, increased rapidly during the 1980s. This was followed by a decline of at least 50% from 1989 to 1994, leading to harvest closures. By the early 2000s, moose populations west of the refuge had started to increase, and by 2015 there was some indication that moose were beginning to increase within drainages along the northwestern part of the Refuge. However moose continue to occur at low density east of the Canning River on the coastal plain and in the northern foothills of the Refuge. Because of concerns about the small population size, harvest restrictions have been maintained (U.S. Fish and Wildlife Service 2015a).

Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Grizzly bear abundance on the coastal plain varies seasonally, with highest densities occurring during early summer, when caribou are present. Throughout the Arctic, grizzly bears have low rates of reproduction. They do not reproduce until they are approximately 9 years of age in the Arctic Refuge, average litter size is 2, bear cubs experience high first-year mortality, and the interval between successful litters is greater than 3 years. Bears emerge from their dens from late March through May. Females with cubs usually emerge later than adult males (U.S. Fish and Wildlife Service 2015a, 2015b). The den emergence period overlaps the late operation and entire demobilization phases of winter exploration activities. Human-bear conflicts would be possible at this time as recently-emerged and hungry bears are ranging widely in search of early spring food.

**Commented [CMA17]:** Another instance of talking about possible effects

Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Where both species occur, red foxes have been observed killing arctic foxes. Studies in Scandinavia suggest that red foxes may outcompete arctic foxes and may be the cause of declining arctic fox populations in some areas. The principal prey of both species during summer includes a variety of small mammals and ground nesting birds, but particularly brown and collared lemmings. Lemming populations in the Arctic cycle in abundance, with large peaks in abundance occurring approximately every 4 years, and arctic fox abundance generally cycles in response to changes in lemming abundance. There is evidence from Scandinavia and Utqiagvik, Alaska, that the magnitudes of these cycles have been reduced in recent years in association with a warming climate. Reduction or elimination of fox population cycles is predicted to have negative effects on alternate prey species, such as ground-nesting birds. In addition, provision of supplemental food, such as garbage, is likely to increase fox abundance near industrial infrastructure, and this may reduce survival of some ground nesting bird species. On the Alaskan North Slope, arctic foxes have a high incidence of rabies, but little is known about the relationship between disease and fox population dynamics or the potential for rabies to spread to other species.



Little is known about the abundance, distribution, and species composition of small mammal communities in northeastern Alaska. The limited small mammal surveys that have been carried out have identified at least one species, the holarctic least shrew, that until relatively recently was unknown in North America. Maintaining populations of rare, endemic species will require identifying their current distributions, habitat requirements, and sensitivity to disturbance. Of the more common species, arctic ground squirrels have a patchy distribution in the Arctic Refuge coastal plain because denning habitat is limited by a lack of well drained soils. In areas where ground squirrels occur, they are an important source of food for foxes, bears, wolves, wolverines and weasels. Microtine rodents, particularly brown lemmings, are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many species including bears, wolves, foxes, and wolverines in years when they are abundant. Extreme fluctuations in population abundance affect the abundance and distribution of lemming predators as well as predation on other species such as ground nesting birds.

### Terrestrial Mammal References

- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Caikoski, J.R. 2011. Units 25A, 25B, 25D and 26C caribou [Porcupine Herd]. Pp. 251-270 in P. Harper (ed.), Caribou management report of survey-inventory activities 1 July 2008-30 June 2010. Juneau, AK: Alaska Department of Fish and Game, Division of Wildlife Conservation.
- Cameron, R.D., and K.R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. *Journal of Wildlife Management* 43(3):626-33.
- Cameron, R.D., W.T. Smith, R.G. White and B. Griffith. 2002. The Central Arctic Caribou Herd. Pp. 38-45 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Jorgenson, J.C., M.S. Udevitz and N.A. Felix. 2002. Forage quantity and quality. Pages 6-50 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 in Harper, editor. Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact statement, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.

Warbelow, C., D. Roseneau, and P. Stern. 1975. The Kutchin caribou fences of northeastern Alaska and the Northern Yukon. In R.D. Jakimchuk, editor. Studies of large mammals along the proposed Mackenzie Valley Gas Pipeline Route from Alaska to British Columbia. Arctic Gas Biological Report Series. Volume 32. Renewable Resources Consulting Services, Canadian Arctic Gas Study, Limited, and Alaska Arctic Gas Company, Calgary, Alberta, Canada.

## Subsistence

Section 803 of ANILCA defines subsistence uses as: “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible by-products of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade” (16 U.S.C. § 3113).

Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes due to their close proximity within or adjacent to the Refuge boundaries (U.S. Fish and Wildlife Service 2015a, 2015b). Residents of Arctic Village, a Gwich’in community, and Kaktovik, an Inupiat community, use the Refuge most frequently. The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010).

Not only are subsistence opportunities critical to the cultural identities of these communities, the resources gained provide needed sustenance for residents. There are few year-round employment opportunities and food costs are high due to the cost of air transportation. Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl and fish return to the Refuge and coastal plain in abundance for another season.

Although both Arctic Village and Kaktovik rely heavily on the Refuge for subsistence resources, the resources used are significantly different. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska’s Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys come primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on this resource, the Gwich’in people consider the Porcupine caribou herd’s calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich’in Nation 1988).

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea. The Kaktovikmiut’s way of life continues to be heavily dependent on subsistence harvest of marine and



terrestrial animals and fish. Kaktovik bowhead whaling occurs only in the fall from late August to early October, when the whales migrate close to shore, because the spring migration passes too far offshore for hunts to occur. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35-68).

In addition to whales, Kaktovik residents also harvest a considerable number of Dall sheep and caribou, which contribute 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resource. Inland coastal areas are also accessed by walking, or to a limited extent by ATV use on private Kaktovik Inupiat Corporation lands.

**Demographic Characteristics** of the Communities near Arctic Refuge (derived from data in U.S. Fish and Wildlife Service. 2015a).

<b>Demographic Characteristic</b>	<b>Arctic Village</b>	<b>Chalkyitsik</b>	<b>Cold-foot</b>	<b>Fort Yukon</b>	<b>Kaktovik</b>	<b>Venetie</b>	<b>Wise-man</b>	<b>Prudhoe Bay</b>
Overall 2010 Census Population	152	69	10	583	239	166	14	2174
American Indian and Alaska Native	135	59	1	520	212	152	0	163
White	7	10	9	45	24	3	13	1804
Two or more races	10	0	0	10	3	10	1	41
Other races	0	0	0	8	0	1	0	166
Median age	29	27.5	43	33.7	30.5	30.5	28.5	50

**Commented [CMA18]:** Seems a little odd to present some of this data without talking about its relationship to subsistence – which is the subject of this section



Median household income	\$27,250 +/- \$9,667	\$38,750 +/- \$16,617	N/A	\$33,194 +/- \$7,432	\$58,125 +/- \$33,478	\$28,333 +/- \$21,379	N/A	94,906 +/- 11,207
<b>Employment in 2016</b>								
Employed (#)	87	48	11	266	125	103	5	1978
Employed in the Private Sector (#)	14	6	9	113	41	23	5	1978
Employed in local and/or state government (#)	73	42	2	153	84	80	0	0
Employed in all 4 Quarters (#)	31	27	9	138	93	40	0	1891

### Subsistence References

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaf.edu/pages/scientific.html>. Accessed July 27, 2012
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution). <http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



## Recreation

Management Guidance: Preserving unique recreational values currently found in the Coastal Plain is one of the original purposes of the Arctic National Wildlife Refuge, and an extensive body of sources provide the context for interpreting these recreational values (U.S. Fish and Wildlife Service 2015). This purpose encompasses a range of composite values allowing experiences unique on a national scale, including natural conditions (where plant and animal species and communities or biophysical processes had previously not been altered); and undeveloped setting characteristics (where immersion in an untrammeled landscape free from modern human manipulation remains). This, paired with the Refuge's extreme remoteness and wild character, provide a degree of physical and psychological separation from the reminders of modern civilization unsurpassed anywhere on American soil, and insure areas where enjoyment is earned through effort.

The Refuge's recreational management prioritizes maintaining opportunities to experience a sense of freedom, exploration, and discovery; and to encounter challenge, and experience true independence and self-reliance. According to the Arctic National Wildlife Refuge visitor study summary (Christensen 2009), the greatest positive influence on visits came from experiencing the components of "Wilderness" (92%), "A Sense of Vastness" (92%), "Remoteness and Isolation" (89%), "A Sense of Adventure" (84%), and "Natural Conditions" (84%). The Refuge purposes most frequently rated as "Very Important" were "Wildlife" (97%), "Wilderness" (96%), "A bequest to future generations" (89%), "Remoteness and isolation" (89%), and "A place where natural processes continue" (86%).

The Coastal Plain is located on lands within Alaska Department of Fish and Game (ADF&G) Game Management Unit (GMU) 26C. ADF&G regulates the hunting and fishing seasons, licenses, and bag limits. Nonresident brown bear and Dall sheep hunters must be accompanied in the field by a big game guide authorized to operate in the area. There are two registration brown bear hunting seasons in GMU 26C. Caribou hunting is open year round. Fishing season is open year-round, but limits have been set by species for lakes and flowing or salt waters.

Visitors from around the state, nation, and world recreate in the Coastal Plain, but so do subsistence users (Alaska Federation of Natives 2010), as well as do local residents that are not subsistence users as defined by Section 803 of ANILCA. While the latter groups are not considered visitors, they are mentioned in this section because they are also recreational users.

Activities: Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. More recently, shoulder season activities such as polar bear viewing, kite-skiing/boarding, and aurora viewing are also enjoyed. Occasionally, non-resident snow machine expeditions travel across the Coastal Plain, originating from the pack ice north of the Dalton Highway prohibition area, and anecdotal reports have been submitted of fat-tire biking expeditions.

The majority of visitors float rivers north from the Brooks Range Mountains or view polar bears from the Refuge's coastal lagoon waters immediately surrounding Kaktovik; while hiking/backpacking, and hunting/fishing comprise a smaller portion of the predominant visitor activities. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the



Marsh Fork-Canning, Main Stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen. The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. More than half of the commercially-supported visitation is guided (U.S. Fish and Wildlife Service 2011).

Detailed commercial use reporting, visitor registration/field contacts, and regular visitor use monitoring have not been conducted. Information about current characteristics of visitor use (amount, type, timing, and distribution of visitor activities and behaviors); and visitor experiences (perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area), are very limited. Generally, what is understood comes from the required reports of commercial motorboat and air operators (including hunt guides), and reports show commercially-supported visitor use has been low in numbers and dispersed geographically.

Access: Most visitors engaged in recreation away from Kaktovik within the Coastal Plain use small, fixed-wing aircraft for access. Motorized and non-motorized boats, as well as foot-based access methods are also commonly used. Recreational snowmachine use is occasional but increasing. Adequate snow cover to prevent resource damage is required for allowable snow machine access. Very occasionally, visitors experience helicopters, but helicopters are not used for recreational access. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated.

Visitor Use Numbers: Visitation to the Coastal Plain for traditional recreational activities has generally remained stable since the late 1980s, averaging around 1000 visitors annually (the calculated average of annual total known visitation between 2001 and 2009 was 1,126 people). Where locations are known, about 77% of overall commercially-supported visitation occurs north of the Brooks Range. The North Slope river drainages most commonly visited include the Kongakut River (21%), Canning River (Marsh Fork-Canning: just over 8%; Main Stem-Canning: over 4%), Hulahula River (just under 9%), and Jago River (5 %) (U.S. Fish and Service 2011).

While overall use for traditional activities has remained stable, the recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. In 2010, the Refuge formalized a commercial recreational guide polar bear viewing program on Refuge waters in response to interest from local business to offer these services (see submerged lands section for more information about Refuge jurisdiction over surface activities on coastal lagoons).

In addition to the stable estimate of visitor use numbers for traditional activities, it is now estimated that in 2015 and 2016, the polar bears around Kaktovik experienced approximately 2,500 views<sup>[7]</sup> by clients and guides taking part in commercially-operated water-based polar bear viewing (U.S. Fish and Wildlife Service 2017). These estimated views were made by an average of just over 42 viewers per day during an approximately 60-day viewing season in late August to early October (viewers includes clients and

Commented [CMA19]: Footnote a result of cut and paste?



guides). Visitor use from polar bear viewing tourism increased rapidly between 2011 and 2015, but may be reaching a stable level since 2015 because of the somewhat static availability of regularly-scheduled commercial flights, visitor housing and authorized boat guides. Still, the number of bear views per day has been increasing, indicating that operators are clustering their services around a core viewing season and taking an increasing number of trips each day. The increasing numbers of viewers (clients and guides) per day each season, with the average trip length remaining fairly constant, indicates the average number of hours spent daily on water by all guides combined has steadily increased. Since 2011, viewing has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017).

No visitor use numbers are known for the reported increases in numbers of spring caribou hunters, fat-tire bikers, snowmachiners, or aurora watchers.

Distribution: Multiple recreation areas/routes of known interest to visitors of the Coastal Plain include: caribou migration viewing June-July including the following unimproved landing areas: Jago Bitty, Lower Marsh Creek, Lower Canning River, Kataktuiruk River, and Aichilik River; abundant and diverse bird sighting areas in June-July include the Lower Canning and Kaktaktuiruk Rivers; routes from the Neruokpuk Lakes Complex through the Arctic Coastal Plain from March until September (includes spring ski touring); routes between the Sadlerochit Mountains and Brown Low Point along the Kataktuiruk River (includes backpacking and packrafting); kayaking coastal lagoons June-October between the Hulahula and Kongakut River deltas, providing paddling within the Refuge's Marine Protected Area and access to Kaktovik during open water; and expedition-length packrafting routes with resupplies at major river crossings June-September, including Upper Marsh Fork to Kaktovik, Arctic Village to Kaktovik, Neruokpuk Lakes Complex to Kaktovik, and Turner River to Kaktovik.

Trends: There has been a steady increase in the number of commercial permits issued for air taxi operators providing access (as well as commercial filming permits in the Coastal Plain) and demand for recreational use of areas such as the Refuge's pristine night sky environment are expected to continue to increase. A planning effort is underway to ensure that the Refuge provides quality polar bear viewing opportunities that minimize threats to public safety, minimize potential disturbance to polar bears, and minimize conflicts with local residents.

### **Recreation References**

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom.
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- U.S. Fish and Wildlife Service. 2011. Arctic National Wildlife Refuge public use summary. Arctic Refuge, Fairbanks, Alaska, USA.  
[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/pureportap2010.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/pureportap2010.pdf).  
 (accessed May 29, 2018).

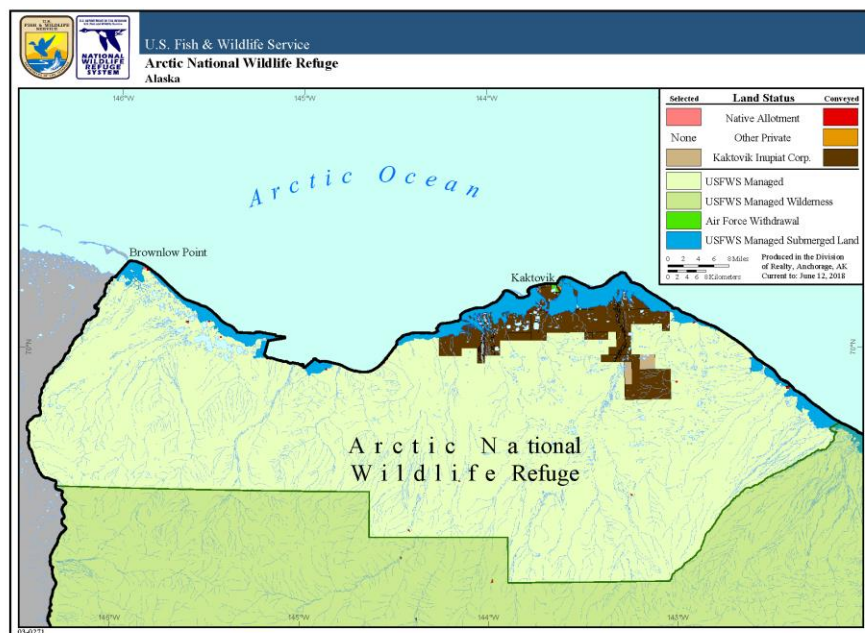


- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).

DRAFT



## Land Status Map





**To:** Wendy Loya[wendy\_loya@fws.gov]  
**Cc:** Mitch Ellis[mitch\_ellis@fws.gov]; Eric Taylor[eric\_taylor@fws.gov]; Sara Boario[sara\_boario@fws.gov]  
**From:** Colligan, Mary  
**Sent:** 2018-06-21T13:33:41-04:00  
**Importance:** Normal  
**Subject:** Re: Note to Reviewer: Coastal Plain Seismic EA Draft Affected Environment Chapter and Specialist Reports  
**Received:** 2018-06-21T13:33:53-04:00  
[DRAFT\\_Seismic\\_EA\\_Chapter\\_3\\_Existing\\_Condition\\_06182018\\_MAC\(1\).docx](#)

I have attached my comments and suggested edits. I don't know if others have already completed their reviews or if they want to add to this. I have the note to reviewer so can sign that and note I submitted comments electronically.

If others let me know where they are in their review I can move the note to reviewer accordingly.

Thanks

On Mon, Jun 18, 2018 at 4:10 PM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Hi Mary, Mitch, Eric and Sara,

Attached is a draft of the Coastal Plain Seismic EA Draft Affected Environment Chapter and Specialist Reports requested by BLM Arctic Field Office in anticipation of a seismic application from SAE.

It was agreed that this would go out for concurrent review to all ARDs in order to meet the rapid timeline. The desired date to BLM was set as 6/22 so that BLM Arctic Field office staff can use it as a basis to start identifying issue and environmental consequences. However, FWS has not been notified by BLM that a complete application for a seismic permit has been submitted, so deadline is primarily based off "intent to keep things moving." I will check in on Thursday afternoon to get your feedback on timeline.

I will send the original note to reviewers down to Anchorage with Mary this week.

Thank you,

Wendy

Dr. Wendy M. Loya,



Arctic Program Coordinator

Office of Science Applications, US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

Mary Colligan

Assistant Regional Director

Fisheries and Ecological Services

U.S. Fish and Wildlife Service, Alaska Region

1011 E. Tudor Road, MS-361

Anchorage, AK 99503

907-786-3505

cell: 907-223-5945



## DRAFT Arctic Refuge Coastal Plain Seismic EA

Chapter 3 Affected Environment

Prepared by the US Fish and Wildlife Service

### Oil and Gas Resources

USGS Open File Report 2009-1112 (Attanasi and Freeman 2009) provided an update of the economics of undiscovered oil and gas resources in the North Slope of Alaska, including the Arctic Refuge coastal plain. The study estimated there was a 95% probability the Arctic Refuge coastal plain contained at least 5.92 billion barrels of technically recoverable oil, and a 5% probability the technically recoverable volume of oil could be 15.16 billion barrels. The mean estimate of technically recoverable oil for the Arctic Refuge coastal plain was 10.35 billion barrels. Of this, 80 to 90 percent was estimated to be economically recoverable at \$42/barrel. The threshold price to initiate exploration was estimated to be from \$20 to \$21 per barrel. The current price of West Coast crude is around \$75/barrel. The current price of West Texas Intermediate crude is around \$65/barrel. The U.S. Energy Information Agency forecasts the price of crude oil to steadily rise to over \$85 per barrel over the next 10 years (U.S. Energy Information Agency, 2018).

Deleted:

The USGS study projected that oil deposits are expected to occur in 10 areas (rather than a single large accumulation), which would require dispersed drilling sites to develop all the recoverable oil resources. Most of the oil deposits (over 80%) are thought to lie in the western Arctic Refuge coastal plain (eg. in the area known as the “undeformed area” west of the Marsh Creek anticline).

The USGS report did not include estimates related to the production of natural gas from the Arctic Refuge coastal plain.

### Air Quality

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, air quality monitoring occurs in the active oil fields of Pt. Thomson, Badami, Endicott and Prudhoe Bay. Data available from these sites confirm that pollutant concentrations in the study area are in compliance with the respective National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS) according to the Pt. Thomson EIS (U.S. Department of Defense 2012). With prevailing winds from the northeast, it is likely that air quality on the Arctic Refuge Coastal Plain would generally experience less impacts from existing industrial emissions from development to the west, except during instances when winds come from the west.

Commented [CMA1]: Do you think Greg would want this reordered consistent with how he wanted our scoping comments? Or does it need to be aligned with the outline BLM presented during the call yesterday?

Commented [CMA2]: How is this consistent with the first sentence saying there is no data?

### Climate

The climate of the Arctic Refuge coastal plain is characterized by short and cool summers, and long, cold winters. The growing season lasts from June to August, although extending earlier and later over time. Subfreezing temperatures and snow may occur at any time during the year. The coastline and barrier islands experience more frequent cloudiness and fog with higher winds. Clear skies are more common,



winds are variable, and summers are warmer and less cloudy with increasing distance from the coast. At Barter Island, temperatures average 40 °F in July (warmest month) and -20 °F in February (coldest month) (Table 4–2). Temperatures to the south on the coastal plain and in the northern foothills of the Brooks Range are more similar to those measured at weather stations at Kuparuk and Toolik Lake, ranging from means of 47 to 53 °F in July and -18 to -6 °F in February.

Snowfall measurements date back to 1949 on Barter Island, but the monitoring site was taken out of service in 1989, resulting in a discontinuous record of snow climatology. In 2000, three meteorological stations were established (Urban and Clow 2017) as part of the Global Terrestrial Network for Permafrost (DOI/GTN-P) in remote parts of the Arctic National Wildlife Refuge coastal plain. The limited data available from these stations are the only modern continuous record of snow accumulation in this region of Alaska. The average annual water equivalent of all precipitation is less than 10 inches, most of which falls as summer rainfall, but includes 32 to 46 inches of snowfall. Evaporation rates are low due to low temperatures and a short growing season. The length of the snow season impacts the timing of winter exploration activities as well as the breeding phenology of flora and fauna. In addition, the snowpack in the Brooks Range, and glacier mass, affect water availability in rivers and lakes for fish and wildlife habitat, as does the presence of frozen masses of emergent groundwater known as *aufeis*.

Surface winds along the Arctic coast average 9 to 15 miles per hour (mph), with occasional intense storms generating winds exceeding 70 mph. Winds are predominantly from the northeast, although the strongest winds come from the west. September and October are the windiest months on the coast, probably due to maximum amounts of open water (Wendler et al. 2010). During winter, winds are a major force affecting the distribution and amount of snow cover on the coastal plain. Higher, rolling terrain is often blown clear, or nearly so, while dense snow drifts accumulate in sheltered areas along stream banks.

## Water Resources

Ninety-nine percent of the Arctic Refuge coastal plain is considered wetlands; however, lakes are scarce and account for less than two percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre, and ninety percent are less than 12 acres. During winter, most waterbodies on the Arctic Refuge coastal plain freeze solid as they are typically not as deep as the depth of freeze (approximately 7 ft; Trawicki et al. 1991; Lyons and Trawicki 1994). Small pockets of unfrozen water occur in lakes with depths that exceed ice growth. By the end of the winter season, the volume of liquid water in these lakes has been estimated to be reduced by ninety-eight percent (Craig 1989b). Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. Up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer (Bowling et al. 2003), with the remainder coming from direct precipitation.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed



reaches. During spring, snowmelt begins in the foothills and proceeds to the coastal plain providing as much as 50% of the annual flow to rivers (Clough et al. 1987, Sloan 1987).

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a). Spring systems on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakturak springs.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands.

## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented and all are characterized by a cold temperature regime: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristsels, Typic Haplogelepts, and Typic Histoturbels (Soil Survey Staff 2014, 2016). Soil texture varies across topographic features. Uplands slope gently northward and are generally composed of silt, rocky silt and peat with some glaciated uplands containing a broader range of particle sizes. Lowlands such as the plains and floodplains have coarser textured soils composed of sand, gravel and peat. The majority of uplands are located in the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, uplands are primarily located along the southern boundary and extend approximately one-third of the way to the coast.

Permafrost is any soil that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces in the region and as much as 88% of the planning area is underlain by ice rich permafrost (>50% water). Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Permafrost on the coastal plain is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

Commented [CMA3]: Arctic Refuge coastal plain?



The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). Nearly all the biological activity in soils of the far north takes place within this zone and it is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018).

## Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west. The varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

The three major ecoregions in the Arctic Refuge coastal plain are the coast, coastal plain, and foothills. The coast has bays and inlets, lagoons with barrier islands, exposed peat bluffs, drained breached lake basins, and deltas. The Beaufort Coastal Plain ecoregion is a smooth treeless plain rising gradually from the Arctic Ocean to the foothills of the Brooks Range. This ecoregion is mainly undulating coastal plains and vast floodplains, with a small proportion of thaw lake plains. The dominant vegetation along the coast and within the coastal plain is mainly Moist sedge-willow or Moist sedge-Dryas tundra; however, salt marshes are found in coastal depressions along the coast while wet graminoid occupy basins on the coastal plain. Permafrost-related features include extensive networks of ice-wedge polygons, beaded streams, oriented lakes, peat ridges, and frost boils. On the southern end of the Arctic Refuge coastal plain, the Brooks Range Foothills ecoregion has rolling hills and plateaus, with better defined drainages and fewer lakes than in the Coastal Plain. The foothills reach north all the way to the coast along 10 miles of the coast in the western half of the Arctic Refuge coastal plain. Permafrost features are common. Vegetation in the foothills is mainly Moist tussock tundra. There are few if any known non-native or invasive species within the coastal plain.

## Fisheries

The Arctic Refuge coastal plain hosts few species of fish due to limited availability of freshwater habitats. Common species present in freshwater lakes and rivers within the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius*. Round whitefish and burbot are present in the Canning River, but nowhere else in the Arctic Refuge coastal plain (Frugé and Palmer 1994).



Dolly Varden occur as two forms: anadromous populations that rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; and dwarf populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs (Craig and McCart 1974; Fruge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

The lagoons are very productive environments for marine and anadromous species during summer. Lagoons become hypersaline and very cold environments under ice. As winter approaches and the lagoons begin freezing, anadromous fishes return to freshwater and marine fishes retreat to offshore environments. Common anadromous species that occur in the nearshore marine environments adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, and rainbow smelt *Osmerus mordax*. (Craig 1984; Fruge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Arctic cisco, broad whitefish, humpback whitefish, least cisco, and rainbow smelt feed along the coast but have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species are thought to be strays from southern Chukchi or northern Bering Sea populations (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009).

While there are numerous marine species in the Beaufort Sea, only four are abundant in the nearshore marine environments adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species migrate along shore in the southern Beaufort Sea, marine species migrate towards shore during summer and away from shore during winter (Craig 1984).

## Birds

The Arctic Refuge Coastal Plain and adjacent marine waters are recognized as Important Bird Areas by the American Bird Conservancy, Audubon, and Birdlife International. In the Arctic Refuge's northern foothills, coastal plain, and adjacent marine waters, at least 158 species of migratory birds have been recorded, (U.S. Fish and Wildlife Service 2015a). At least 57 species regularly occur as breeding, non-breeding, or both in the Coastal Plain (summarized in Pearce et al. 2018).

Although some Arctic Refuge Coastal Plain bird species have been fairly well studied [e.g., Golden Eagles (*Aquila chrysaetos*) and Snow Geese (*Chen caerulescens*), Douglas et al. 2002], distribution and abundance data are incomplete for many and contemporary information is lacking for most. Of the 57 species known to regularly occur in the Coastal Plain, nine are U.S. Fish and Wildlife Birds of Conservation Concern and nine are listed as Near Threatened by the International Union for Conservation of Nature or are on the Audubon Alaska Red List (Table 1, IUCN 2017; U.S. Fish and Wildlife Service 2008; Warnock 2017). The only bird species known to occur in the Coastal Plain listed under the Endangered Species Act (ESA) are the threatened Alaska-breeding population of the Steller's eider



(*Polysticta stelleri*) and threatened spectacled eider (*Somateria fischeri*). Both species primarily occur west of Arctic Refuge with Steller's eider listed as a "rare visitor" and spectacled eider as a "rare breeder" in the Coastal Plain (U.S. Fish and Wildlife Service 2015a) and will be addressed under section 7 consultation pursuant to the ESA.

## Terrestrial Mammals

The Arctic Refuge coastal plain provides habitat for many species of terrestrial mammals, including caribou, muskoxen, moose, grizzly bears, wolves, foxes, wolverines, and a variety of rodents and other small mammals. Muskoxen were reintroduced to the region in 1969 and 1970. The population increased and spread across the coastal plain through about 1998, then declined steeply through 2006. Currently, few muskoxen reside within the Refuge year-round (U.S. Fish and Wildlife Service 2015a) but populations are stable or increasing in nearby areas to the east and west. Moose on the coastal plain are largely restricted to patches of woody vegetation along streams during winter, but moose spread out across the area during summer. Moose populations in the Arctic Refuge increased rapidly during the 1980s, then declined during the 1990s. More recently, moose abundance has increased along the northwestern part of the Refuge, but not along most of the coastal plain east of the Canning River (U.S. Fish and Wildlife Service 2015a). Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Some grizzly bears den on the coastal plain during winter, but bear abundance in the area is highest in early summer during caribou calving. Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Arctic fox abundance cycles in response to changes in lemming abundance, which has pronounced effects on alternate prey species, such as ground-nesting birds. Little is known about the abundance, distribution, and species composition of small mammal communities in northeastern Alaska. Of the more common species, arctic ground squirrels have a patchy distribution on the coastal plain because denning habitat is limited. Microtine rodents, particularly brown lemmings, are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many predators in years when they are abundant.

## Caribou

Caribou are the most abundant large mammal in the Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters in Arctic Village, Venetie, Stevens Village, Beaver, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for grizzly bears and wolves. The two caribou herds most commonly occurring in the Arctic Refuge are the Porcupine and Central Arctic herds. The Porcupine herd is one of the 2 largest herds in North America. In 2017 this herd was estimated to comprise 219,000 caribou (Alaska Department of Fish and Game 2017b). The Porcupine herd ranges over 130,000 square mi (337,000 square km) in northeastern Alaska and northwestern Canada (Lenart 2007). The Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou in many years (Griffith et al. 2002), and some caribou are found there during winter. The Central Arctic herd currently numbers about 23,000 caribou (2016 estimate; Alaska Department of Fish and Game 2017a). The annual range of this herd overlaps that of the Porcupine caribou herd in the western part of the Refuge. Most calving by Central Arctic caribou occurs on State lands west of the Refuge, but the western coastal plain of the Refuge is often used by the



Central Arctic herd during post calving, summer, and fall. Some caribou from this herd and the neighboring Teshekpuk herd occasionally use the Refuge coastal plain during winter.

## Threatened and Endangered Species

Alaska-breeding Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), and polar bear (*Ursus maritimus*) are listed as threatened pursuant to the ESA of 1973, as amended. All three of these species may occur in the Arctic Refuge coastal plain, although listed eiders are not present during the winter months and the Arctic Refuge is at the eastern edge of their current range.

The proposed action is within the range of the Southern Beaufort Sea (SBS) subpopulation of polar bear, a species [globally](#) listed as threatened under the [federal](#) ESA in addition to being protected under the Marine Mammal Management Protection Act (MMPA). The SBS subpopulation had an estimated population size of approximately 900 bears in 2010. This estimate represents a significant reduction from previous estimates of approximately 1,800 in 1986, and 1,526 in 2006. Although there was some evidence in the 2010 estimate that the population might be beginning to increase, analyses of over 20 years of data on the size and body condition of bears in this subpopulation demonstrated declines for most sex and age classes.

Declining sea ice conditions in the Beaufort Sea have led to an increase in the proportion of the subpopulation coming onshore in summer and autumn (from 5.8% during 1986-1999 to 20% during 2000-2014) and a 30 day increase in time spent on land. Bears in the SBS subpopulation are drawn to bowhead whale remains from subsistence harvest, particularly adjacent to the community of Kaktovik, Alaska, where ~60% of bears coming onshore will reside in late summer/fall.

The Arctic Refuge coastal plain has also been documented to be an important area for denning by polar bears and will likely increase in importance as the percent of bears denning on land increases with sea ice loss. Designated [critical denning habitat](#) overlaps with 77% of the 1002 area of the Arctic National Wildlife Refuge. [The Arctic Refuge coastal plain contains 38% more denning habitat than the region immediately west of the refuge. Polar bears have been shown to den in the Arctic Refuge coastal plain area with greater frequency than expected based on available habitat, with 22% of identified dens for bears from 2000-2010 in the SBS subpopulation occurring within the area.](#)

## Prehistoric and Historic Cultural Resource Sites

Knowledge of prehistoric and historic cultural resource sites in the study area is mostly derived from investigations conducted in the latter half of the 20<sup>th</sup> Century. From the most relevant studies (Solecki et al. 1973, Hall 1982, Jacobson and Wentworth 1982, Wilson 1991, and Grover and Laughlin 2012), it is understood that human use of the area north of the Brooks Range has been occurring for more than 10,000 years. An examination of the Alaska Heritage Resource Survey database (Office of History and Archaeology 2018), indicates there are 70 recorded sites located on lands managed by the U.S. Fish and Wildlife Service within the Arctic Refuge coastal plain (Table 1).



Cultural Period	Location:			Total
	Coastal	Inland adjacent to rivers and creeks	Inland on elevated dry ground	
Prehistoric	1	23	3	27
Historic	28	14		42
Multi-Component		1		1
Total	29	38	3	70

Table 1. Cultural Resource Sites within the Arctic Refuge coastal plain.

As indicated above, these sites are predominantly located along river corridors and the coast of the Beaufort Sea. All of the recorded sites are exposed and most, especially those along the coast, are subject to active erosion caused by sea storms.

Prehistoric sites generally consist of stone tent rings and lithic scatters (or artifacts) embedded and partially exposed in the tundra. Tent ring sites, with or without surface-distributed artifacts, are generally located on well drained, stable river banks or occasionally on higher bluffs near water courses. Sites characterized solely by the presence of artifacts generally consist of small amounts of lithic debris from stone tool manufacture and utilization. The known artifact sites occur in two major settings: the tops of rises (such as ridges and knolls) which give a good view of the surrounding terrain; and in blowouts in stabilized sand dunes near river mouths.

Historic sites consist of standing structures or above-ground tangible evidence of such structures. These sites include log cabins, sod houses, graves, ice cellars, drying racks, and remnant features associated with Cold War Era Distant Early Warning line sites. The majority of the historic sites are located immediately adjacent to the Beaufort Sea coast, although a few have been found on river courses several miles inland.

## Subsistence



One of the purposes of the Arctic Refuge is to provide the opportunity for continued subsistence uses by local residents in a manner consistent with the purposes of conserving fish and wildlife populations and habitats and fulfilling international treaty obligations with respect to fish and wildlife. Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes (U.S. Fish and Wildlife Service 2015a, 2015b). The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010). Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl and fish return to the Refuge and coastal plain in abundance for another season.

The communities of Arctic Village and Kaktovik rely heavily on the Arctic Refuge, including the nearshore marine environment, for subsistence resources due to their close proximity within or adjacent to the Refuge boundaries. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys came primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on Porcupine caribou, the Gwich'in people consider the herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988). Other important species include whitefish, pike, lake trout, Dall Sheep and ducks.

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea which is heavily dependent on subsistence harvest of marine and terrestrial animals and fish. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35–68). Dall sheep and caribou are harvested which contributes 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs mostly in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resource. Kaktovik residents harvest Arctic cisco, Dolly Varden, sculpin, Arctic cod, arctic flounder, grayling, and chum salmon, which accounted for 11 percent of the estimated total edible pounds in 1994–1995 (Brower et al. 2000:37).

## Recreation

Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the Marsh Fork-Canning, main stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen.



The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were recommended to Congress for inclusion in the Wild and Scenic River System in 2015 because of their recreation and cultural values.

Visitor use monitoring has not been conducted, although calculated averages of known visitation based on commercial operator reports between 2001 and 2009 was determined to be 1,126 people annually. These reports showed that 77% of commercially-supported visitor use occurs north of the Brooks Range. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary.

The recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. Since 2011, polar bear viewing in the lagoons surrounding Kaktovik has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017). No visitor use numbers for other emerging uses on the Coastal Plain such as spring caribou hunting, fat tire biking and aurora-watching are known.

## Acoustic Environment

Little data on the acoustic qualities of the Arctic Refuge coastal plain are available, with the exception of short-term data collected in the extreme northwest corner in support of the Point Thomson EIS (U.S. Army Corps of Engineers 2012). Natural sound levels were found to be low, and they dominated the sound environment in both winter and summer. These sounds include atmospheric/meteorological phenomena, water features, insects, birds, and other animals. Natural sound levels were greater in summer due to the influence of water features such as the Canning River. Natural sound levels were found to be "lower than typical residential noise environments and comparable to an unoccupied building." Sections of the Arctic Refuge coastal plain that are away from the windy coastline and running water would be expected to be even quieter, with the predominance of natural sounds coming from wildlife and insects.

Both natural quiet and natural sound are intrinsic elements of the wilderness characteristics of the area and of the adjacent designated Wilderness. As such, their perpetuation is important for meeting the Refuge's purposes, goals, objectives, and special values. Noise from human activities in the Arctic Refuge coastal plain is essentially absent, with the exception of high altitude jet aircraft and occasional single and twin engine aircraft overflights.

Resources within the Arctic Refuge coastal plain that may be particularly sensitive to noise include polar bears, especially during denning, caribou, especially during calving and post-calving activities, and migratory birds, especially during breeding and brood-rearing activities. People who may be adversely affected by noise in the area include residents of Kaktovik, especially those engaged in subsistence



activities on the coastal plain beyond the village itself, and recreational visitors, most of whom seek a wilderness experience free of noise.

## Wilderness Characteristics and Values

The Arctic Refuge, including the coastal plain, was initially proposed by the National Park Service as “The Last Great Wilderness” (Kaye 2006), and Public Land Order 2214 (1960) which established the original Arctic Range and identified three purposes of preservation of wilderness values, wildlife and recreational values and is still applicable to Refuge management. ANILCA section 101(b) outlines the intent “to preserve in their natural state extensive unaltered arctic tundra...ecosystems; and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on free flowing rivers....” Further, ANILCA 304(g)(2)(B) requires the Secretary of the Interior to identify and describe “the special values of the refuge, as well as...wilderness value of the refuge” when developing plans. Consistent with the purpose and ANILCA, the Refuge’s 2015 Comprehensive Conservation Plan recommend the Arctic Refuge coastal plain for Wilderness designation because it exemplifies wilderness qualities.

Studies of Refuge visitors (Christensen and Christensen 2009) and the broader national public’s values and interests related to the Refuge (Bengston et al. 2010) show that these wilderness qualities are highly prominent in the public’s perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge’s Special Values (U.S. Fish and Wildlife Service 2015a) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain’s wilderness purpose and its function within the larger Refuge. Wilderness associated values include ecological, scientific, wildlife, aesthetic, recreational, and symbolic values.

Landres et al. (2015) defined the four primary qualities of Wilderness described in the Wilderness Act as: (1) undeveloped - free from roads, structures, and other evidence of modern human occupation or improvements, where the land essentially retains its original character and ecological function; (2) untrammeled - essentially unrestricted and free from modern human control or manipulation; (3) natural - when ecological systems are substantially free from the effects of modern civilization; and (4) primitive or unconfined recreation in wilderness settings - characterized by freedom from management restrictions on visitor behavior. Refuge management in the coastal plain has been consistent with these qualities. There are no roads, structures or improvements on Refuge lands within the coastal plain, natural processes are allowed to play out unfettered by management actions, and opportunities for solitude, primitive and unconfined recreation exist across the entire area.

## Wild and Scenic Rivers

The Wild and Scenic Rivers Act mandates protections for rivers that are designated rivers of the National Wild and Scenic River System (NWSRS), and [for those that are recommended for inclusion in the NWSRS](#). A river’s preliminary Classification (either Wild, Scenic, or Recreational; based on level of infrastructure) and Wild and Scenic Values (free flowing condition; water quality at time the river was



found Eligible; and Outstandingly Remarkable Values (ORV) for each river segment) must be maintained. Numerous rivers bisecting the Coastal Plain were found to be Eligible during the Wild and Scenic River Review completed as part of the 2015 Revised Refuge CCP (See CCP Table 3-1. Eligible Rivers). Protections are required once a river or river segment is found eligible, but once an eligible river is found non-suitable, there is no legal mandate to protect the values that made the river Eligible. The Atigun, Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be suitable.

**Commented [CMA4]:** Is "eligible" supposed to be capitalized or only when used like "Eligible River"?

**Deleted:** All of the Eligible rivers studied for inclusion were found non-suitable except t

The recommendation for inclusion of these four rivers in the NWSRS was carried forward to Congress in 2015. Recommended rivers potentially affected by the proposed action include the Hulahula River (Recreational and Cultural ORVs); and may include the Marsh Fork-Canning if its Recreational ORV is affected by downstream exploration activities on the Canning River; and possibly the Kongakut, since its Recreational, Scenic, and Geologic ORVs may be tied to the coastal lagoons currently mapped within the exploration area. All of the Recommended rivers were given a preliminary classification of "Wild", meaning their condition at the time of Eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted.

Permanent structures generally are not allowed, with the exception of historic and cultural resources and, in certain limited circumstances, subsistence or administrative cabins and associated structures. Cabins, temporary structures, and hardened sites should not be visible from the river; where this is impractical, facilities and structures are to be rustic or unobtrusive in appearance. Public use facilities would provide opportunities for low-impact, backcountry recreation experiences.

**Commented [CMA5]:** Is there a distance prohibition here?

## Other Special Land Designations

### Marine Protected Areas

**Policy Framework:** Executive Order 13158 on Marine Protected Areas 13158 (2000) is intended to strengthen and expand the nation's system of MPAs. MPAs are defined as "...any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The Arctic National Wildlife Refuge meets the US criteria for a "marine protected area" or MPA.

**National System of MPAs:** In 2005, the Refuge was nominated by DOI and subsequently accepted for inclusion in the national system of MPAs: a voluntary association of federal, state, territorial and tribal MPAs coordinated by NOAA and DOI as part of their partnership under EO13158. Membership status in the national system does not currently convey any additional protections or restrictions beyond the Refuge's current management authorities. Some parts of the Refuge fall within designated wilderness, while others are outside of the wilderness boundary. The current management approach ensures the integrity of this area.

**Commented [CMA6]:** These seems out of place in the MPA discussion?

**Spatial Extent:** All marine waters located within Refuge boundaries, approximately 100,000 acres of marine waters and lagoons located off the northern coast of the Refuge, are listed as part of the National MPA System (see MPA Inventory page of NOAA's National Marine Protected Areas Center website). Shifting shorelines and marine-freshwater boundaries at river mouths create some variability in the



acreage estimate for the Refuge's contribution to the national system of MPAs, on the order of plus or minus several hundred acres.

## Land Status

The Alaska Native Claims Settlement Act of 1971 (ANCSA) and ANILCA determined the current land ownership patterns in and surrounding Arctic Refuge. ANCSA authorized the formation of Alaska Native village and regional corporations, enabling northeast Alaska's Native Iñupiat and Athabascan peoples to select and gain title to Federal lands that were originally part of their ancestral homelands. Map XX shows, by general ownership, the approximate area of non-Refuge lands within the coastal plain.

## Submerged Lands

In 1997 the Supreme Court ruled that submerged lands (including tidally influenced lands) within the Arctic Range boundary did not transfer to the State of Alaska at statehood (*United States v. Alaska*, No. 84 Original). The Court's decision recognized that the application to create the Arctic Range (which predated statehood) clearly intended these submerged lands, including rivers, lakes, and lagoons, to be included as part of the Range. Arctic Refuge, therefore, contains navigable and non-navigable waters. Submerged lands within the boundaries of the original Arctic Range, including river beds, were retained in Federal ownership on the date Alaska was granted statehood.

## Chapter 3 Affected Environment References

- Attanasi, E.D., and Freeman, P.A., 2009, Economics of undiscovered oil and gas in the North Slope of Alaska: economic update and synthesis: U.S. Geological Survey Open-File Report 2009-1112, 59 p. available only online.
- Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellanum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.  
<http://www.nativefederation.org/frames/subsistence.html>.
- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaf.edu/pages/scientific.html>. Accessed July 27, 2012
- Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. *International Journal of Wilderness*. 16: 13-20.



- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brower, H.K., T.P. Olemaun, and T.R. Hepa. 2000:37. North Slope Borough subsistence harvest documentation project: data for Kaktovik. Department of Wildlife, North Slope Borough, Barrow, Alaska.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416. doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Craig, P.C. 1977. Arctic char in the Sadlerochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), *Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char*, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 35:48-52.
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. *Transactions of the American Fisheries Society* 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. *Biological papers of the University of Alaska* 24:131-152.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. *Arctic*. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 In P.C. Craig (ed.), *Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories*. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Douglas, D., P. Reynolds, and E. Rhode. 2002. Arctic refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.
- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362-378.
- Fruge, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994-1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.



- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature*: 1973.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), *Arctic Refuge coastal plain terrestrial wildlife research summaries*. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Grover, Margan Allyn and Erin Laughlin. 2012. *Archaeological Survey of the Mid-Beaufort Sea Coast: An Examination of the Impacts of Coastal Changes on Cultural Resources*. Prepared for the Kaktovik Tribal Partnership Program. U.S. Army Corps of Engineers, Alaska District.
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution).  
<http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Hall, Edwin S., Jr. 1982. *Preliminary Archaeological and Historic Resource Reconnaissance of the Coastal Plain Area of the Arctic National Wildlife Refuge, Alaska*. Technical Memorandum # 1, Edwin S. Hall and Associates, Brockport, N.Y.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. (1991). Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110.  
doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009. Salmon in the Arctic and how they avoid lethal low temperatures. *North Pacific Anadromous Fish Commission Bulletin*. 5:39-50.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. In Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kane, D.L., Slaughter, C.W. 1973. Seasonal regime and hydrological significance of stream icings in central Alaska. *The Role of Snow and Ice in Hydrology: proceedings of the Banff Symposia*, Volume 1:528-540.
- Kaye, R. 2006. *Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge*. University of Alaska Press, Fairbanks, Alaska.
- Landres, Peter; Barns, Chris; Boutcher, Steve; Devine, Tim; Dratch, Peter; Lindholm, Adrienne; Merigliano, Linda; Roeper, Nancy; Simpson, Emily. 2015. Keeping it wild 2: an updated interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 114 p.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 in Harper, editor. *Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006*. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.



- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 30:1215–1220.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- Office of History and Archaeology. 2018. Alaska Heritage Resource Survey database, State of Alaska, Department of Natural Resources.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleux and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Soil Survey Staff. (2014). *Keys to soil taxonomy* (12th ed.). Washington DC: USDA-Natural Resources Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*. Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Solecki, Ralph S., Bert Salwen, and Jerome Jacobson. 1973. *Archaeological Reconnaissances: North of the Brooks Range in Northeastern Alaska*. Department of Archaeology, University of Calgary, Occasional Papers No. 1.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. *Arctic* 59:37–46.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- Urban, F.E., and Clow, G.D., 2017, DOI/GTN-P Climate and active-layer data acquired in the National Petroleum Reserve–Alaska and the Arctic National Wildlife Refuge, 1998–2015: U.S. Geological Survey Data Series 1021, 546 p., <https://doi.org/10.3133/ds1021>.
- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.



- U.S. Energy Information Agency. 2018. Annual Energy Outlook 2018: Table 12: Petroleum and Other Liquids Prices, Reference case. Retrieved from [https://www.eia.gov/outlooks/aeo/tables\\_ref.php](https://www.eia.gov/outlooks/aeo/tables_ref.php)
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska
- Wendler, G., M. Shulski, and B. Moore. 2010. Changes in the climate of the Alaskan North Slope and the ice concentration of the adjacent Beaufort Sea. *Theoretical and Applied Climatology* 99(1-2):67-74.
- Wilson, Curtis James. 1991. *An indigenous Nineteenth-Century Settlement/Subsistence System in the Area of Demarcation Bay, Alaska*. Ph.D. dissertation, Department of Anthropology, State University of New York at Binghamton.



DRAFT

Specialist Reports/Appendices

**Commented [CMA7]:** In many cases, there is complete duplication in the specialist report with text in the summary section – I have highlighted where I see duplication



## Air Quality

Air quality includes air pollutant concentrations and air quality-related values, such as atmospheric deposition and visibility. Air pollutant concentration usually refers to the mass of pollutant present in a volume of air. EPA has set National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants, and are described in the NPRA IAP/FEIS (DOI 2012).

**Commented [CMA8]:** Not sure what this adds

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, Air Quality occurs at Pt. Thomson, Badami, Endicott and Prudhoe Bay where oil and gas infrastructure operates in active developments. The available data confirm that pollutant concentrations in the study area are in compliance with the respective NAAQS and AAAQS according to the Pt. Thomson EIS (USDOD 2012). With prevailing winds from the north east in the Arctic Refuge Coastal Plain, it is likely that air quality would generally experience less impacts from existing industrial emissions from north slope development to the west except during instances when winds come in from the west.

**Commented [CMA9]:** Air Quality occurs?

**Formatted:** Highlight

**Formatted:** Highlight

**Commented [CMA10]:** How is this consistent with the first sentence saying there is no data?

**Formatted:** Highlight

**Formatted:** Highlight

The North Slope is subject to a condition known as "arctic haze." Arctic haze is a condition of reduced visibility in arctic regions. Arctic haze peaks in the spring and is most severe when stable, high-pressure systems produce clear, calm weather (NSIDC 2011). Sources of pollutants creating haze have been attributed to industrial pollutants (sulfur compounds and black carbon particles-the products of iron, nickel and copper smelters and inefficient coal-burning plants) from Eurasia, soot from forest fires and burning of farm fields in Eurasia, and submicron organic particles sampled have shown characteristics of emissions from northern Asia, Siberia, and, to a lesser extent, interior regions of Alaska and Canada (U.S. Department of Defense 2012). The haze is worse in spring due to stagnant air and the lack of precipitation. Conditions improve in the summer as the atmosphere mixes more and precipitation washes the pollutants from the air.

**Commented [CMA11]:** Not sure this edit is correct, but the sentence reads a little weird

## Air Quality References

- US Department of the Interior (DOI), Bureau of Land Management. 2012. National Petroleum Reserve-Alaska Final Integrated Activity Plan/ Environmental Impact Statement. Anchorage, AK.
- NSIDC (National Snow and Ice Data Center). 2011. Arctic Climatology and Meteorology Website. University of Colorado Boulder. [http://nsidc.org/arcticmet/quickfacts/arctic\\_haze.html](http://nsidc.org/arcticmet/quickfacts/arctic_haze.html). (Accessed June 15, 2018)
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.

## Water Resources

Aquatic habitats on the Arctic Refuge coastal plain are underlain by permanently frozen ground and fed by precipitation, snowmelt, groundwater springs, and meltwater from overflow ice and glaciers (Lyons and Trawicki 1994, Childers et al. 1997). These habitats include lagoons and bays; mountain, tundra, and spring-fed streams and rivers; riparian corridors; lakes; wet meadow zones; and other wetlands.



Ninety-nine percent of the Arctic Refuge coastal plain is considered wetland; however, lakes are very scarce (less than two percent of the land surface area) compared to the eastern NPR-A where lakes cover approximately twenty percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre and ninety percent are less than 12 acres. Most lakes are surrounded by extensive wet meadow zones that are important to several species of water birds (Bayha 1996). A study of 115 of the largest lakes indicated most lakes are shallow and freeze to the bottom during winter (Trawicki et al. 1991). The estimated volume of liquid water in these lakes is 1.1 billion gallons by the end of the winter season. Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. The recharge capacity of many lakes is generally limited to snowmelt and direct precipitation in the vicinity of the lake.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed reaches.

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a), an important subsistence fish. Springs on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the coastal plain of the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakturuk springs.

Tall willow shrublands grow along the riparian corridors of rivers, streams, and spring-fed reaches. Vegetation along riparian corridors provides stream bank stability, delivers organic matter to aquatic habitats, provides cover and nesting habitat to numerous bird species, and supports exceptionally high species diversity in a relatively species-poor arctic environment. During winter, riparian vegetation provides denning habitat for polar bears and grizzly bears, and forage and cover for caribou, moose and muskox.

Sixteen lagoons and bays line the coast and support numerous invertebrate species (Dunton et al. 2012), nineteen marine fish species, and twelve anadromous species. During winter, liquid water below ice in lagoons tends to be hyper saline unless fed by groundwater.



With the exception of spring-fed systems, the hydrology of the Arctic Refuge's aquatic habitats is strongly influenced by the climate, which is characterized by extremely low winter temperatures; short, cool summers; and exceptionally low year-round precipitation (averaging 6.3 inches per year). Fish and wildlife use of aquatic habitats on the Arctic Refuge coastal plain is tightly intertwined with the harsh constraints and abundant benefits imposed by seasonal hydrology.

Winter is the harshest and most critical time for species relying on aquatic habitats, but unique features of these habitats allow for sustenance of life. Shortened daylight hours and extreme cold temperatures cause most waterbodies on the Arctic Refuge coastal plain to freeze solid (Lyons and Trawicki 1994), reducing the volume of liquid water by ninety-eight percent (Craig 1989a). As ice growth continues throughout the winter, dissolved oxygen concentrations decrease while ion concentrations increase. Small pockets of unfrozen water only occur in lakes that are more than seven-feet deep, small isolated pools beneath riverine ice hummocks, spring-fed river reaches (Lyons and Trawicki 1994), and below ice covering coastal lagoons and bays. Fish and other aquatic organisms are constrained to these isolated pockets of liquid water for the next several months until temperatures warm and ice breakup occurs in late May and June (Craig 1989a).

The spring season brings about major shifts in hydrology that recharge aquatic habitats and enhance fish migration. Snowmelt starts earliest in the foothills and then proceeds to the coastal plain. During this time, sheets of snowmelt water flow over frozen ground, as much as 50% of the annual flow of rivers takes place (Clough et al. 1987, Sloan 1987), extensive fields of aufeis play an important role directing river flow paths over land and into new channels, and snowmelt and flood waters create ephemeral connections between aquatic habitats and recharge floodplain lakes and wet meadow zones. On the North Slope, up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer and immediately following snowmelt, surface waters are at their maximum extent (Bowling et al. 2003). Meanwhile, fish take advantage of the elevated water levels to begin migrating to summer feeding habitats and migratory water birds arrive to take advantage of the abundant food sources and nesting habitats in the wet meadow zones surrounding lakes and shallow ponds. Within two weeks of snowmelt, overland flow ceases and many hydrologic systems become disconnected (Bowling et al. 2003).

During the short Arctic summer, aquatic habitats are teeming with life and provide habitat for millions of water birds, twelve species of marine fish, eighteen species of anadromous and freshwater fish (U.S. Fish and Wildlife Service 2015), and numerous invertebrate species that are important to upper trophic levels. A lack of precipitation and relatively high evapotranspiration causes flow to cease in some streams and rivers (Lyons and Trawicki 1994), thaw of frozen soils and evapotranspiration leads to significant drawdown of lakes and wetlands (Bowling et al. 2003), water birds and fish begin migrating to critical overwintering habitats, and aquatic invertebrates move to deeper water or burrow down into sediments to avoid freezing.

**Commented [CMA12]:** Different numbers than on the bottom of the previous page

### Water Resources References

Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellatum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.



- Bayha, Keith D. 1996. Criteria for instream water rights for selected 1002 area lakes, Arctic National Wildlife Refuge. Water Resources Branch, U.S. Fish and Wildlife Service. Anchorage, Alaska. WRB 96-05.
- Bowling, L.C., D.L. Kane, R.E. Gieck, L.D. Hinzman, D.P. Lettenmaier. 2003. The role of surface water storage in a low-gradient Arctic watershed. *Water Resources Res.* 39(4).
- Childers, J.M., C. E. Sloan, J.P. Meckel, and J.W. Nauman. 1977. Hydrologic reconnaissance of the eastern north slope, Alaska, 1975. U.S. Geological Survey Open-File Report 77-492 U.S. Geological Survey, Anchorage, Alaska, USA.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.
- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleux and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.



## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Carter et al. 1986; Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristsels, Typic Haplogelepts, Typic Histoturbels (Soil Survey Staff 2016). Climate is the dominant soil-forming factor in coastal plain soils. The cold climate inhibits certain soil-forming processes such as weathering by removal of calcium components and movement of clay downward through the soil (Tedrow 1977), while organic matter accumulation is heightened due to the reducing conditions caused by saturation, slowed decomposition in the cold, wet conditions, and churning of the surface organic materials to the lowest parts of the active layer and upper permafrost (Ovenden 1990; Ping et al 2004; Ping et al 2008).

Soil texture varies by physiographic feature across three ecoregions, Brooks foothills, Beaufort coastal plain, and the Beaufort Sea coast (Carter et al. 1986; Jorgenson et al. 2015). The Brooks foothills dominate the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, the foothills are primarily located along the southern boundary and extend approximately one-third of the way to the coast. Physiographic features include uplands, glaciated uplands, floodplains, and lowlands. Uplands generally contain fine grain soils composed of silt or peat and rocky silt. Glaciated uplands contain a broader range of particles sizes with peat, silt, and diamicton. Lowland and floodplain soils in the foothills are coarser textured and composed of peat, sand and gravel or silt, sand, and gravel respectively.

The Beaufort coastal plain is the dominant ecoregion in the east and the major physiographic features are coastal plain and floodplain. Soils here are coarser and similar to the NPR-A. Coastal plain features are generally composed of peat and pebbly silty sand or peat sand and gravel. Floodplains are similar to the foothills and are composed of silt, sand, and gravel.

The Beaufort Sea coast lies across the northern margin of the coastal plain and includes the barrier islands. A wide range of soil textures can be encountered here and range from mud to sand and gravel. River deltas along the coast are classified as floodplains and have finer grain soils than the inland floodplains. Soils of coastal floodplains are composed of peat, silt, and sand

Permafrost is any ground (soil, rock or sediment) that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces in the region and is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). Increases in permafrost thickness and extent are driven by climatic cooling, maturation of vegetation, increased albedo (reflectance), and decreased snow cover. Climatic warming, removal or compaction of vegetation, and mass wasting will decrease the thickness or extent of the permafrost (U.S. Army Corps of Engineers 2012). As much as 88% of the planning area is underlain by ice rich permafrost (>50% water) which occurs as pore, segregated, and massive ice. Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Ice wedges are the most common type of massive ice and polygonal ground is the common surface feature across the coastal plain (Clough et al. 1987; Kanevskiy et al. 2013). In areas of silty soils, volumetric ice content can be as high as 89% with 50% as ice wedges and no surface formation of polygonal ground (Kanevskiy et al. 2013).



The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). The cold climate results in a lack of weathering and infiltration of organic acids that results in reduced the nutrient availability (Everett 1979; Everett and Brown 1982); however, nearly all the biological activity in soils of the far north takes place within this zone. The active layer is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018). Additionally, some studies have shown that nonacidic soils tend to have a deeper active layer than acidic soils (Nelson et al. 1998; Walker et al. 2003) and that there is a strong soil pH-vegetation relationship (Walker et al. 2003).

### Soils and Permafrost References

- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416.  
doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Carter, L. D., Ferrians Jr, O. J., & Galloway, J. P. 1986. *Engineering-geologic maps of northern Alaska coastal plain and foothills of the Arctic National Wildlife Refuge* (86-334). Retrieved from <http://pubs.er.usgs.gov/publication/ofr86334>
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Everett, K.R. 1979. Evolution of the Soil Landscape in the Sand Region of the Arctic Coastal Plain as Exemplified at Atkasook, Alaska. *Arctic* 32(3):207-223.
- Everett, K.R., and J. Brown. 1982 Some Recent Trends in the Physical and Chemical Characterization and Mapping of Tundra Soils, Arctic Slope of Alaska. *Soil Science Society Journal* 133(5):264-280.
- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature*: 1973.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. 1991. Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110. doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*.



- U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kanevskiy, M., Shur, Y., Jorgenson, M. T., Ping, C. L., Michaelson, G. J., Fortier, D., Stephani, E., Dillion, M., and Tumskey, V. 2013. Ground ice in the upper permafrost of the Beaufort Sea coast of Alaska. *Cold Regions Science and Technology*, 85, 56-70.  
doi:<https://doi.org/10.1016/j.coldregions.2012.08.002>
- Nelson, F.E., K.M. Hinkel, N.I. Shiklomanov, G.R. Mueller, L.L. Miller, and D.A. Walker. 1998. Active-layer Thickness in North-Central Alaska: Systematic Sampling, Scale, and Special Autocorrelation. *Journal of Geophysical Research-Atmospheres* 103:28,963-28,973.
- Ovenden, L. 1990. "Peat Accumulation in Northern Wetlands." *Quaternary Research* 13:377-386
- Ping, C.L., H.M. Clark, and D.K. Swanson. 2004. "Cryosols in Alaska." In *Cryosols: Permafrost-Affected Soil*, ed. J.M. Kimble. Berlin: Springer-Verlag
- Ping, C.L., G.J. Michaelson, J.M. Kimble, V.E. Romanovsky, Y.L. Shur, D.K. Swanson, and D.A. Walker. 2008. "Cryogenesis and Soil Formation along a Biogradient in Arctic North America." *Journal of Geophysical Research* 113:G03S12.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*. Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Tedrow, J.C.F. 1977. *Soils of the Polar Landscapes*. New Brunswick, NJ: Rutgers University Press.
- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- Walker, D.A., G.J. Jia, H.E. Epstein, M.K. Reynolds, F.S. Chapin III, C. Copass, L.D. Hinzman, J.A. Knudson, H.A. Maier, G.J. Michaelson, F. Nelson, C.L. Ping, V.E. Romanovsky, and N. Shiklomanov. 2003. "Vegetation-Soil-Thaw-Depth Relationships along a Low-Arctic Bioclimate Gradient, Alaska: Synthesis of Information from the ATLAS Studies." *Permafrost and Periglacial Processes* 14:103-123.



# Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west (Figure 1). The more varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types more sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

Foothills of the Brooks Range cover 45% of the area (Walker et al. 1982). Broad uplands are dissected by north-flowing rivers. Hilly coastal plains cover 22% of the area and have gently undulating tundra with small thaw lakes. Flat thaw lake plains with large lakes cover 3% of the area. River floodplains cover 25% of the area. Vegetation is a nearly continuous, highly interspersed mosaic of plants less than 0.5 m tall, mainly sedges, low shrubs, and mosses. Shrubs are taller along drainages. Soil texture and moisture are important determinants of the different tundra vegetation types (Table 1), which were based on Walker et al. (1982).

Table 1. Vegetation types of the coastal plain of the Arctic NWR, Alaska, USA, based on Walker et al. (1982). From Jorgenson et al. 2010.

Type	Description
Wet sedge tundra (13% of area)	Low-lying flats and drainages with the sedges <i>Carex aquatilis</i> and <i>Eriophorum angustifolium</i> and little moss or shrub cover. The poorly drained soils are saturated throughout the summer and have a thick, fibrous organic horizon.
Sedge–willow tundra (30%)	Low-lying flats and gentle slopes with the sedges <i>Eriophorum angustifolium</i> and <i>Carex aquatilis</i> and the willows <i>Salix pulchra</i> and <i>S. reticulata</i> . Mosses include <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Aulacomnium</i> spp., <i>Sphagnum</i> spp., and <i>Campylium stellatum</i> . On fine-grained retransported, laciofluvial, and abandoned floodplain deposits. Soils have moderately thick organic layer and are saturated at intermediate depths but generally free of surface water.



Sedge–Dryas tundra (13%)	Moderately well-drained sites dominated by the dwarf shrub <i>Dryas integrifolia</i> and the sedge <i>Carex bigelowii</i> , with the willows <i>Salix richardsonii</i> , <i>S. phlebophylla</i> , and <i>S. reticulata</i> and mosses such as <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Distichium capillaceum</i> , and <i>Ditrichum flexicaule</i> . Forbs (e.g., <i>Lupinus arcticus</i> ), lichens (e.g., <i>Cetraria</i> spp.), and horsetails (e.g., <i>Equisetum variegatum</i> ) are common. Found on moist calcareous slopes and pebbly glacial and marine sediments. Notable for a hummocky surface topography, patches of exposed mineral soil, and extremely variable organic horizons resulting from active and stabilized frost boils.
Tussock tundra (28%)	Moderately well-drained slopes dominated by the tussock-forming sedge <i>Eriophorum vaginatum</i> , with shrubs <i>Salix pulchra</i> , <i>Betula nana</i> , <i>Ledum palustre</i> ssp. <i>decumbens</i> , and <i>Vaccinium vitis-idaea</i> . Bryophytes include <i>Hylocomium splendens</i> , <i>Sphagnum</i> spp., <i>Aulacomnium turgidum</i> , <i>Ptilidium ciliare</i> , and <i>Tomenthypnum nitens</i> . Occurs on deposits of loess or colluvial material on top of coarser, residual materials or glacial drift.
Shrub tundra (5%)	Dominated by low and dwarf shrubs, with <i>Betula nana</i> or <i>Salix pulchra</i> and understory species similar to tussock tundra. In the study area, occurs only on raised areas with high-centered polygon surface morphology.
Riparian shrubland (2%)	Willow shrublands on river floodplains and stream banks, dominated by <i>Salix alaxensis</i> , <i>S. glauca</i> , and <i>S. richardsonii</i> , commonly with a forb understory. Willows have an average height of 0.5 m and maximum of about 1.5 m. Occurs on both young floodplain deposits with mixed gravel and fine-grained material, and older terraces with a thin, fine-grained alluvium layer over gravel.
Dryas terrace (3%)	Infrequently flooded river terraces with <i>Dryas integrifolia</i> and other dwarf shrubs, forbs, horsetails, mosses, and lichens similar to sedge–Dryas tundra. Well-drained soils with a very thin organic mat over river deposits.



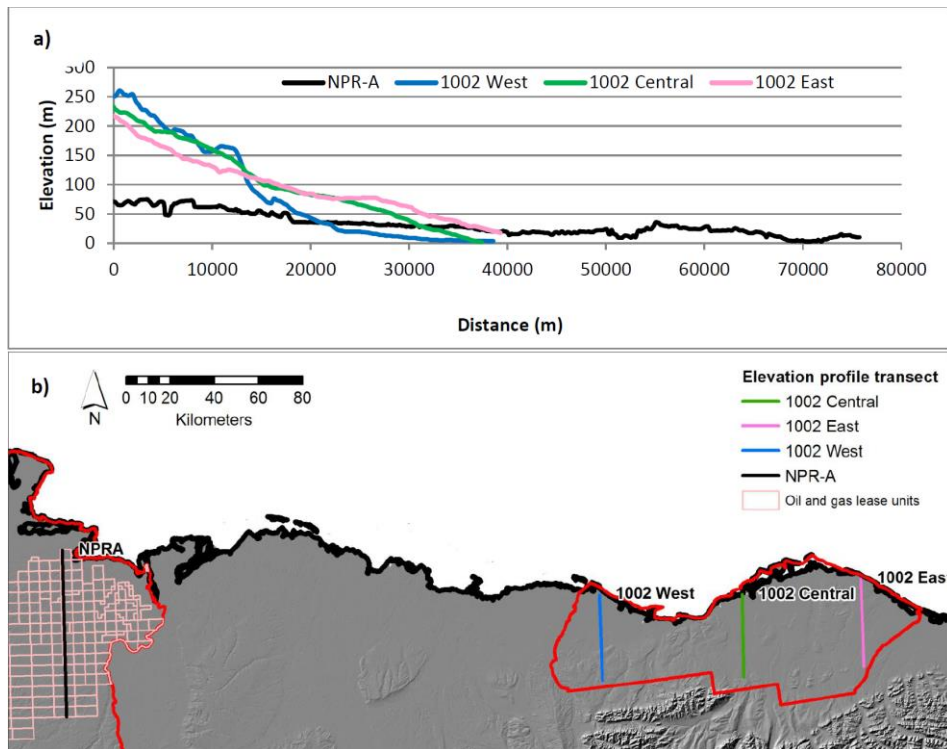


Figure 1: a) Hillslope profiles and b) transect locations within the coastal plain and NPR-A. Hillslope profiles derived from 30m digital elevation model.

### Vegetation References

- Jorgenson, J.C., J.M. Ver Hoef, and M.T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications* 20(2): 205-221.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Walker, D. A., K. R. Everett, W. Acevedo, L. Gaydos, J. Brown, and P. J. Webber. 1982. Landsat-assisted environmental mapping in the Arctic National Wildlife Refuge, Alaska. CRREL Report 82-27. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, USA.



## Fisheries

### Overview

The eastern North Slope in Alaska is endowed with limited freshwater options for fish. As a result, there are only a few species that occupy the freshwater habitats that are available. Lake density is very low in the Arctic Refuge coastal plain, east of the Canning River drainage, but increases progressively to the west (White et al. 2008; Arp and Jones 2009). Several mountain streams cross the Arctic Refuge coastal plain between the Canning and Aichilik rivers (Craig and McCart 1975). These streams flow during summer with snowmelt, rainfall, perennial springs, and for some streams, melting glaciers (Craig and McCart 1975; Rabus and Echelmeyer 1998; Kane et al. 2013), however, only the perennial springs provide flow during winter (Craig and McCart 1975). Craig (1989a) estimated that winter habitat in the area was only about 5% of what was available for fishes during summer.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons are very productive environments for marine and anadromous species during summer. In winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, some lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.

Freshwater species present in the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius* (Fruge and Palmer 1994). Round whitefish and burbot are present in the Canning River but nowhere else in the Arctic Refuge coastal plain (Craig 1977c; Fruge and Palmer 1994). Dolly Varden are present in three life history forms: anadromous populations in which most members rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; residual dwarf males of the anadromous populations that choose to stay in freshwater rivers rather than migrate to sea; and dwarf resident populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977c; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs that are used for overwintering habitat (Craig and McCart 1974; Fruge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

Anadromous species known to occur in or adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, and rainbow smelt *Osmerus mordax* (Craig 1984; Fruge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Dolly Varden are known to migrate long distances along the coast during their summer feeding forays, east to the Mackenzie River and west to the Colville River or beyond (Kruger et al. 1999), and some individuals

Commented [CMA13]: Summary talks about 2 life forms



migrate into offshore waters as well (Courtney et al. 2018). Arctic cisco have natal origins in the Mackenzie River but disperse as juveniles to coastal habitats including the Colville River delta, where many overwinter in brackish environments (Galloway et al. 1983; Fechtelmann et al. 2007). Rearing Arctic cisco make annual feeding migrations along shore during summer and eventually return to the Mackenzie River to spawn. Broad whitefish, humpback whitefish, and least cisco that are encountered in nearshore environments adjacent to the Arctic Refuge coastal plain have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species that occur in nearshore waters adjacent to the Arctic Refuge coastal plain or in rivers within the Arctic Refuge coastal plain are thought to be strays from southern Chukchi or northern Bering Sea populations, although some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage (Stephenson 2006; Irvine et al. 2009). Rainbow smelt are known to spawn in the Mackenzie and Colville rivers as well as in the Kuk River drainage farther west (Craig 1984). Dolly Varden and Arctic cisco are the primary food fishes for people in north east Alaska (Craig 1989b; Pederson and Linn 2005).

There are about 12 species of marine fishes that are commonly encountered in nearshore brackish environments adjacent to the Arctic Refuge coastal plain, only four of which are relatively abundant during the summer season (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species tend to migrate along shore in the southern Beaufort Sea, marine species are thought to follow a very different migratory pattern; moving towards shore and into shallow water during summer and away from shore and into deeper water during winter (Craig 1984). It is not uncommon to find these four common marine species in brackish environments during summer, or even in the very lower reaches of the rivers in the area.

### Species accounts

Some of the fish species of ecological and/or subsistence value in or adjacent to the Arctic Refuge coastal plain are discussed below. Information about distribution, life history characteristics, and subsistence use is presented when available.

**Broad whitefish** *Coregonus nasus* are large, primarily benthic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They are present but uncommon in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Broad whitefish populations may exhibit either anadromous or freshwater resident life histories (Reist and Bond 1988; Chudobiak 1995; Brown et al. 2007). Because rivers flowing through the Arctic Refuge coastal plain do not support spawning or overwintering habitats for broad whitefish, they spawn and overwinter in aquatic habitats in the lower Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, all broad whitefish encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the Beaufort Sea and occasionally in the lower reaches of the larger rivers (Ward and Craig 1974; Craig 1984; Brown 2008).

Age at maturity for broad whitefish ranges from about five years old for the earliest maturing populations, such as those in the Peel (VanGerwen-Toyne et al. 2008) and Yukon (Carter 2010) rivers, to about eight years old for the latest maturing populations, such as those in the Selawik River in western Alaska (Brown 2004) and in the Teshekpuk Lake region in northern Alaska (Moulton et al. 2007). Broad whitefish spawn in flowing water over gravel in late October and November (Chang-Kue and Jessop



1997; Shestakov 2001; Carter 2010), which is three to four weeks later than other whitefish species. They survive spawning and may spawn multiple times during their lives. Once mature, spawning may be annual (Tallman et al. 2002) or less frequently (Prasolov 1989; Brown 2004). Broad whitefish are capable of living for 20 years or more (Brown 2004; VanGerwen-Toyne et al. 2008), and the oldest individuals in a population may exceed 30 years (Bond and Erickson 1985; Reist and Bond 1988). Broad whitefish are a very good food fish (McPhail and Lindsey 1970; Morrow 1980) and are harvested at times in nearshore waters adjacent to the Arctic Refuge coastal plain (Pedersen and Linn 2005).

**Humpback whitefish** *Coregonus clupeaformis* are medium size, primarily benthic-feeding whitefish that are widely distributed in rivers, lakes, and estuaries of northern North America (McPhail and Lindsey 1970). Many similar forms have been described across North American and Asia and substantial taxonomic debate continues regarding appropriate species designations (Lindsey 1963; Alt 1979; Bodaly et al. 1988; Bernatchez and Dodson 1994). McPhail and Lindsey (1970) considered humpback whitefish to be part of a complex of three species that included *C. clupeaformis*, *C. pidschian*, and *C. nelsoni*, distinguished based on slight differences of modal gill raker counts on the first gill arch. A recent meristic, morphometric, and genetics analysis of the three humpback whitefish forms across North America concluded that the complex should be considered a single species, *C. clupeaformis*, differentiated at the subspecies level (McDermid et al. 2007). Humpback whitefish encountered in Alaska have traditionally been classified as *C. pidschian* in interior (Alt 1979) and Arctic habitats (Craig 1984), while in Canada they have been classified as *C. clupeaformis* (Bryan 1973; Craig 1984; Reist and Bond 1988). All humpback whitefish forms are referred to here as *C. clupeaformis*, per McDermid et al. (2007).

Humpback whitefish are rare in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Similar to the situation with broad whitefish, spawning and overwintering habitats of humpback whitefish are in the lower Sagavanirktok River and farther west and in the Mackenzie River and farther east, so humpback whitefish encountered in or near the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea.

Age at maturity for humpback whitefish range from about age 5 for the earliest maturing populations, such as those in southern Hudson Bay in eastern Canada (Morin et al. 1982) and in the Kuskokwim River (Harper et al. 2007), to age 11 for a much later maturing population in Dease Inlet in western Arctic Alaska (Moulton et al. 1997). River spawning humpback whitefish spawn in flowing water over gravel in late September and early October (Stein et al. 1973; Alt 1979; Brown 2006; Harper et al. 2009). Lake resident populations spawn over rock, gravel, and sand substrates between mid-October and late December, much later than river spawning populations (Bidgood 1974; Bryan and Kato 1975; Anras et al. 1999). Humpback whitefish in some populations may spawn two or more years in a row (Brown 2006, 2009), while in other populations alternate year spawning may be more common (Lambert and Dodson 1990; Moulton et al. 1997). Humpback whitefish are capable of living for 20 years or more (Moulton et al. 2007; Harper et al. 2007; VanGerwen-Toyne et al. 2008) and the oldest individuals within a population often exceed 30 years (Barnes and Power 1984; Howland et al. 2001; Brown and Fleener 2001). Humpback whitefish are considered to be a good food fish. They have been exploited in commercial food fisheries in North America more than any other whitefish species (Bodaly 1986; Ebener 1997; Tallman and Friesen 2007) and are routinely harvested in subsistence fisheries in Alaska and northwestern Canada (Corkum and McCart 1981; Georgette and Shiedt 2005).



**Least cisco** *Coregonus sardinella* are relatively small, pelagic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They have been documented in estuaries, rivers, and lakes from various locations in Alaska and northwest Canada (Alt 1980; Mann and McCart 1981; Reist and Bond 1988; Moulton et al. 1997; Seigle 2003). Because rivers within the Arctic Refuge coastal plain do not support spawning or overwintering habitats for least cisco, they spawn and overwinter in aquatic habitats in the Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, least cisco encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea (Craig 1984; Brown 2008).

Age at maturity for least cisco varies throughout Alaska, with interior and Kuskokwim River fish maturing as early as age 3 (Brown and Fleener 2001; Harper et al. 2007; Brown 2009), age 5 in the Selawik region (Brown 2004), and age 7 in Arctic Alaska (Moulton et al. 1997). Least cisco as old as 25 years or more have been reported (Mann 1974; Moulton et al. 1997). Least cisco are known to undertake extensive spawning migrations from lower drainage or estuarine rearing habitats to spawning habitats that may be several hundred kilometers upstream (Reist and Bond 1988; Brown et al. 2007). Spawning is thought to be either annual (Brown 2004) or less frequent (Mann 1974; Moulton et al. 1997), taking place from late September to early October (Kepler 1973; Mann 1974; Alt 1980). Eggs are broadcast in flowing water over gravel for riverine populations (Alt 1980, 1983; Brown 2009). Isolated populations in lakes are evidently capable of spawning in the absence of flowing water (Doxey 1991), however, actual spawning habitats within lakes have not been identified. Least cisco are harvested in subsistence fisheries as human or dog food, but they are generally captured incidentally to other larger whitefish species (Georgette and Shiedt 2005; Moulton and Seavey 2005).

**Arctic cisco** *Coregonus autumnalis* are relatively small, pelagic-feeding whitefish, with a near circumpolar distribution in Arctic waters (McPhail and Lindsey 1970; Moskalenko 1971). Populations have been documented in several large rivers in northern Europe and Asia, and in the Mackenzie River in northwestern Canada. All evidence indicates that Arctic cisco observed in Alaskan waters originate in the Mackenzie River drainage in Canada (Galloway et al. 1983; Fechhelm et al. 2007; Zimmerman et al. 2013), where several spawning populations have been identified (McLeod and O'Neil 1983; Dillinger et al. 1992). Juveniles disperse throughout the Beaufort Sea coastal waters of northwest Canada and Alaska for rearing and feeding (Fechhelm and Fissil 1988; Fechhelm and Griffiths 1990; Fechhelm et al. 2007). Overwintering habitats include brackish environments in the Sagavanirktok and Colville River deltas in the west and the Mackenzie and Anderson River deltas in the east (Craig 1984; 1989a; Fechhelm et al. 2007). Arctic cisco encountered in nearshore habitats adjacent to the Arctic Refuge coastal plain are either foraging or if mature, are migrating from overwintering habitats in the Colville River delta back to the Mackenzie River to spawn (Craig 1989a; Fechhelm et al. 2007; Brown 2008).

Arctic cisco are fully anadromous and are not known to exist as freshwater residents (Reist and Bond 1988). Age at maturity, based on minimum ages of Arctic cisco sampled from spawning migrations in the Mackenzie River drainage, has been estimated at seven to eight years (Stein et al. 1973; Van Gerwen-Toyne et al. 2008). Arctic cisco are capable of spawning more than once and some may live for as long as 20 years or so (Reist and Bond 1988; Van Gerwen-Toyne et al. 2008). The spawning migration into the Liard River, in the upper Mackenzie River drainage, entails an upstream migration of over 2,000 km (McLeod and O'Neil 1983). During summer, Arctic cisco are one of the most abundant species in nearshore waters of the Beaufort Sea, including areas adjacent to the Arctic Refuge coastal plain (Craig



1984; Brown 2008), and one of the primary species taken in the Kaktovik subsistence fishery (Griffiths et al. 1977; Pedersen and Linn 2005).

**Round whitefish** *Prosopium cylindraceum* are a relatively small, primarily benthic-feeding whitefish common in northern North America and northeastern Asia (McPhail and Lindsey 1970). While anadromous populations of round whitefish exist in certain coastal drainages (Morin et al. 1982), most round whitefish populations are freshwater resident forms, occupying freshwater rivers and lakes (Morrow 1980; Stewart et al. 2007). Round whitefish are present in several drainages and lakes on the North Slope of Alaska (McCart et al. 1972; Alt 1976), but within the Arctic Refuge coastal plain they occur only in the Canning River and not farther east (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983).

Age at maturity for round whitefish ranges from as young as age 3 for early maturing populations, such as those in southeast Canada (Morin et al. 1982), to age 8 or older for later maturing populations such as those in the northeast Asia (Gudkov 1999) and in the upper Chandalar River drainage (Craig and Wells 1975). Spawning for riverine round whitefish takes place in flowing water over gravel in late September and October (Craig and Wells 1975; Zyus'ko et al. 1993). Lake resident populations spawn over a mixed substrate composed of rocks, gravel, and mud in November or December (Normandeau 1969; Bryan and Kato 1975, Haymes and Kolenosky 1984). Round whitefish may spawn every year following maturity, as suggested by Craig and Wells (1975), but most reports suggest that spawning takes place less frequently (Jessop and Power 1973; Zyus'ko et al. 1993; Gudkov 1999). Round whitefish are capable of living for 20 years or more (Craig and Wells 1975; Plumb 2006) and the oldest individuals within a population may exceed 30 years (Gudkov 1999). Round whitefish have been exploited as a food fish for many years in the Laurentian Great Lakes (Mraz 1964; Fleischer 1992). They are occasionally harvested in subsistence fisheries in Alaska, but are usually a minor component of the catch (Pedersen and Linn 2005).

**Dolly Varden** (*Salvelinus malma*) is a coldwater species distributed on the Arctic coast of North America from the Mackenzie River west and south through Alaska to British Columbia and on the western side of the Pacific from the Chukotsk Peninsula of Russia south to Japan and Korea (Scott and Crossman 1973; Reist et al. 1997; DeCicco 1997). Previous to 1997, Dolly Varden in northern Alaska were often referred to as Arctic char (*Salvelinus alpinus*), although for many decades there has been an understanding that there were morphological differences between char to the east of the Mackenzie River and those to the west (McCart 1980). Reist et al. (1997) conducted detailed morphology and genetics analyses and formally established anadromous char in northern Alaska and northwest Canada as Dolly Varden.

Dolly Varden are widely distributed within the northern part of the Arctic NWR and several rivers flowing through the Arctic Refuge coastal plain support spawning populations including the Canning (Craig 1977c), Hulahula (Daum et al. 1984; Brown et al. 2014), and Aichilik (Craig and McCart 1974; West and Wiswar 1985) rivers. In addition, several isolated resident populations have been documented in springs and lakes in the Canning (McCart and Craig 1973; Craig 1977c), Sadlerochit (Craig 1977b; Wiswar 1994), and Jago (Daum et al. 1984) River drainages. It should be noted that it isn't clear at this point whether the lake resident char in the Jago River valley (Daum et al. 1984) are Dolly Varden or Arctic char.

Resident and anadromous forms of Dolly Varden exhibit a number of distinct life history characteristics (Craig and McCart 1974; McCart 1980). Resident fish rarely achieve seven years of age and typically do

Commented [CMA14]: Different from Chukotka peninsula?



not exceed 250 mm in length (Craig 1977b; Craig 1978; Armstrong and Morrow 1980). Resident fish primarily feed on dipteran larvae and other macroinvertebrates, achieve sexual maturity between the ages of two and four, and with few exceptions, utilize spring habitat exclusively for all life history stages (Craig 1977b; McCart 1980). Alternatively, anadromous fish may live to 10 years of age or more and grow to over 800 mm in length (Armstrong and Morrow 1980; Craig and Haldorson 1981; Underwood et al. 1996). Sexual maturity may be attained as early as 4 years for certain precocious individuals, although the majority of anadromous fish don't mature until 6 or 8 years at lengths of 400 mm or greater (McCart 1980; Underwood et al. 1996). First migration to sea occurs between the ages of 2 and 5 years, with the majority of individuals migrating at 3 to 4 years (Yoshihara 1973; McCart 1980; Underwood et al. 1996). In late spring or early summer, Dolly Varden migrate to brackish, nearshore coastal areas of the Beaufort Sea from overwintering habitats in deep pools and spring-fed areas in coastal rivers (Craig 1989a; Fechhelm et al. 1997; Jarvela and Thorsteinson 1997). While at sea, individuals move extensively along the Arctic coast within mixed-stock aggregates feeding heavily upon mysid shrimp and amphipods with some incidence of piscivory (Craig 1984, 1989a; Krueger et al. 1999). Additionally, recent satellite telemetry data indicate that at least some Dolly Varden migrate as much as 60 km or more offshore, a migratory phenomenon that was previously unknown (Courtney et al. 2018). Anadromous Dolly Varden return to freshwater in late summer or early fall to spawn and overwinter (Craig 1984; Craig 1989a). Catch data indicate that the majority of returning spawners are female, suggesting different rates of mortality among the sexes. However, because virtually all individuals of the anadromous populations that remain resident are male (Furniss 1975; Craig 1978; McCart 1980), and those residual males can be very numerous on spawning grounds, it is thought that they account for the proportional differences between males and females observed returning from the sea. Spawning is thought to occur most often in non-consecutive years with mature females building redds within spring-fed areas of tributary streams and rivers where males compete for access (Furniss 1975; McCart 1980). Genetic structure within drainage systems indicates that spawning fish display a high level of fidelity to natal drainages (Everett et al. 1997; Krueger et al. 1999; Crane et al. 2005). Some individuals are known to overwinter in non-natal drainages during nonspawning years (McCart 1980; Brown et al. 2014). Fry emerge from nests under ice cover in May and June and are believed to remain in close proximity to spawning beds throughout the first year of life (McCart 1980).

Anadromous Dolly Varden are the primary species caught in subsistence fisheries by residents of Kaktovik, in a winter fishery at Fish Hole 2 on the Hulahula River and in coastal areas during the summer (Craig 1989b; Pederson and Linn 2005). There is also evidence of recreational use and harvest on some of the more popular rivers that flow through the Arctic Refuge coastal plain (Arvey 1991; Jennings et al. 2010).

**Arctic char** (*Salvelinus alpinus*) inhabit freshwater and marine habitats and exhibit a circumpolar distribution within the Holarctic (Johnson 1980; Reist et al. 1997). While both anadromous and freshwater-resident forms are present within Alaska, only lake-resident populations exist within the Arctic NWR (Reist et al. 1997). Within North Slope drainages, populations have been documented in a few lakes within the upper Canning and Sagavanirktok River drainages (McCart et al. 1972; Craig 1977c) and in Peters and Schrader lakes in the upper Sadlerochit River drainage (Ward and Craig 1974; Craig 1977c). It is also possible that isolated lake-resident char in the Jago River drainage are Arctic char, but meristic data necessary to make that determination is not available (Daum et al. 1984). At this time, Arctic char have not been documented in waterbodies within the Arctic Refuge coastal plain.



Arctic char body size and growth varies dramatically among areas, but in general, lake-resident Arctic char are smaller and grow at slower rates relative to anadromous forms (Craig 1977c). For example, lake-resident Arctic char in Big Lake, located in the headwaters of the Canning River, were found not to exceed 190 mm in length, while populations in adjacent lakes reached sizes upwards of 400 mm (Craig 1977c). Sexual maturity is attained between the ages of 3 and 8 with maximum ages greater than 10 years (Craig 1977c). Spawning is thought to occur during fall in deeper portions of lacustrine habitats to avoid ice scouring (Armstrong and Morrow 1980). Individuals feed non-selectively on insect larvae, amphipods, planktons, and fish where available (Craig 1977c; Armstrong and Morrow 1980). No data regarding abundance or harvest are currently available.

**Lake trout** (*Salvelinus namaycush*) inhabit deep, coldwater lakes and are widely distributed throughout northern North America from the Alaskan peninsula east across Canada to Nova Scotia and south to northern New York (Scott and Crossman 1973). Within the Refuge, lake trout are present in some coastal and headwater lakes where suitable overwintering habitat exists (Scott and Crossman 1973). On the North Slope, lake trout have been documented in Elusive Lake in the Sagavanirktok River drainage, two unnamed coastal lakes in the Canning River drainage, and Okpilak, Wahoo, Peters, and Schrader lakes (Ward and Craig 1974; Daum et al. 1984; Bendock and Burr 1985; West and Fruge 1989). At this time, Lake trout have not been documented in waterbodies within the Arctic Refuge coastal plain.

Lake trout are long-lived (40+ years) and can reach sizes upwards of 1,000 mm fork length (Furniss 1974; Craig and Wells 1975; Morrow 1980). Individuals feed on invertebrates early in life, eventually shifting to a piscivorous diet as gape expands with increasing body size. Forage likely consists of any co-occurring fish species, with documented consumption of Arctic char, ninespine stickleback, slimy sculpin, Arctic grayling, and whitefish (*Coregonus* spp.) in Alaska (Burr 1990; McDonald and Hershey 2006; Swanson et al. 2010). Lake trout become sexually mature between the ages of 5 and 13 with the majority of individuals maturing at 7 or 8 years (Craig and Wells 1975; Morrow 1980). In general, lake trout spawn in the fall over large boulder or rubble substrate at depths less than 13 m (Scott and Crossman 1973). Time of and length at emergence varies depending on habitat conditions with eggs typically requiring a 4 to 5 month incubation period (Martin 1957).

The Schrader Lake population of lake trout was estimated to contain roughly 7,000 individuals in 1995, with the majority of fish ranging between 390 and 500 mm in length (Lubinski et al. 1999). Lake trout from Peter and Schrader lakes are harvested in subsistence fisheries by residents of Kaktovik (Craig 1989b; Pederson and Linn 2005). Elusive Lake, located in the Ribdon River drainage supports a small lake trout sport fishery, however no specific sport harvest data could be found for Refuge waters (Bendock and Burr 1985; Jennings et al. 2010).

**Chum salmon** (*Oncorhynchus keta*) are distributed on the western coast of North America from southern California to the Arctic and in Asia from Siberia south to Japan (Scott and Crossman 1973). Chum salmon are semelparous and anadromous, with adults typically ranging between 550 and 650 mm in length (Horne-Brine et al. 2009). Fry emerge from gravel nests in early spring and shortly thereafter begin to disperse to the marine environment. At sea, juveniles prey upon various copepods and amphipods until growth permits the consumption of fish (Salo 1991). Individuals return to freshwater to spawn in natal tributaries beginning in summer and fall between the ages of two and six, with the majority of fish returning as four and five year olds (Gilk et al. 2009; Horne-Brine 2009). On the spawning grounds, females construct gravel nests where eggs are deposited and subsequently covered with gravel (Morrow 1980).



Within North Slope waters of the Arctic NWR, chum salmon have been captured in low numbers in the Sadlerochit, Sagavanirktok, and Canning rivers as well as nearshore coastal areas (Smith and Glesne 1983; Craig and Haldorson 1986; Brown 2008). Some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage while others consider all encountered in the Beaufort Sea to be strays originating from more southerly drainages (Craig and Haldorson 1986; Irvine et al. 2009b). Residents of Kaktovik infrequently harvest chum salmon in subsistence fisheries in nearshore areas surrounding Barter Island in the southern Beaufort Sea (Pedersen and Linn 2005).

**Chinook salmon** (*Oncorhynchus tshawytscha*) are distributed along the west coast of North America from southern California to Point Hope, Alaska and in Asia from Siberia south to Japan (Scott and Crossman 1973). Within the northern part of the Arctic NWR, Chinook salmon are rarely encountered in nearshore environments and have not been captured in any of the rivers, despite occasional catches in the Colville River to the west and Mackenzie River to the east (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009a). Chinook salmon are anadromous, semelparous, and the largest of the Pacific salmon species. Adults commonly reach lengths of 430 to 860 mm, but may grow to upwards of 1000 mm on occasion (Horne-Brine et al. 2009). Fry emerge in spring and usually spend the first year of life in freshwater habitats feeding on aquatic and terrestrial invertebrates (Wipfli 2009). Smolts migrate to sea in spring where growth rates subsequently increase as individuals shift to a primarily piscivorous diet (Bradford et al. 2009). In the ocean, the majority of Chinook salmon occupy habitats in the southern Bering Sea where they spend between one and five years before returning to natal freshwater streams to spawn in mid-July to late August (Healey 1991). On the spawning grounds, females construct gravel nests in flowing water where eggs are deposited and covered with substrate.

**Arctic grayling** (*Thymallus arcticus*) reside in lakes and rivers of northern North America from Hudson Bay to the western shores of Alaska and in Asia from Siberia to North Korea (Scott and Crossman 1973). In Beaufort Sea drainages of the Arctic NWR, including those flowing across the Arctic Refuge coastal plain, Arctic grayling are widespread and abundant (Garner and Reynolds 1986; Craig and Wells 1975). Sexual maturity is attained between the ages of four and eight with individuals typically reaching 300 to 350 mm in length and between 450 and 750 grams in weight (McCart et al. 1972; Craig and Poulin 1975; Morrow 1980). Spawning occurs annually shortly after break up in early spring in small river and lake tributaries over areas of sandy gravel (Bishop 1971). When stream habitat is not available, spawning may also occur in larger substrates in rivers and lakes (Scott and Crossman 1973). Males are territorial on the spawning grounds, however no nest is constructed (Kratt and Smith 2006). The incubation period is relatively short and juvenile fish emerge from the substrate roughly 9 to 21 days following spawning, depending on water temperature (Morrow 1980; Kratt and Smith 1977). Adults feed on aquatic and terrestrial invertebrates and may undertake extensive inter- and intra-drainage movements between overwintering sites (deep pools, lakes, spring-fed areas) and summer feeding habitats following reproduction (Craig and Poulin 1975; West et al. 1992). Arctic grayling are, at least for short periods, tolerant of saline conditions, as individuals are sometimes captured in estuarine waters during inter-drainage movements in coastal systems (West et al. 1992). Additional biological information regarding Arctic grayling inhabiting North Slope rivers and lakes within the Arctic NWR are present in a number of publications (Furniss 1975; Garner and Reynolds 1986; Deschermeier et al. 1986; Wiswar 1991, 1992, 1994; West et al. 1992). Recreational harvest is likely to occur throughout the Refuge, although, no specific data are available (Jennings et al. 2010).



**Burbot** (*Lota lota*) inhabit deep areas of rivers and lakes of the circumpolar north extending south into some temperate areas of Europe, Asia, and North America (Morrow 1980). Within North Slope waters of the Arctic NWR, burbot have been documented in lakes and main-stem areas of the Canning River, including the segment along the western boundary of the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983) and in the Sagavanirktok River but not in any other rivers or lakes within the Arctic Refuge coastal plain (Bendock 1980; Bendock and Burr 1985). Burbot are rarely observed in nearshore environments (Craig 1984).

Burbot typically reach lengths of 400 to 550 mm and weigh between 0.5 and 1 kg, however, individuals greater than 1,500 mm and weighting over 30 kg have been reported (Chen 1969; Evenson 1990). Most individuals are sexually mature by the age of seven (earlier in southern latitudes) and spawn under the cover of ice between the months of November and February (Chen 1969). Spawning may not be an annual event and generally takes place over gravel and sand substrate in relatively shallow areas of rivers and lakes (Chen 1969; Breaser et al. 1988). Eggs and sperm are released simultaneously by a mating pair with fertilized eggs settling into spaces in the substrate and developing over the next one to two months without parental care. Juvenile burbot feed on insect larvae and other invertebrates until roughly the third or fourth year after which they feed primarily on fish (Chen 1969). Seasonal movements ranging from a few kilometers to over 250 kilometers have been reported within riverine populations most likely associated with the connection of spawning and foraging habitats (Percy 1975; Breaser et al. 1988; Evenson 1990).

**Ninespine stickleback** (*Pungitius pungitius*) are distributed in North America from Cook Inlet, Alaska, north to the Arctic Ocean and southeast through Canada terminating on the Atlantic Coast of New England (Scott and Crossman 1973; Morrow 1980). Within North Slope waters of the Arctic NWR, ninespine stickleback are present in the lower reaches of most of the major drainages including those that flow through the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977a; Wilson et al. 1977; Bendock and Burr 1985). Furthermore, ninespine stickleback are commonly found in coastal brackish lagoons (Griffiths et al. 1977; West and Wiswar 1985; Wiswar et al. 1995; Brown 2008) and coastal lakes where they are often the only species present (West and Fruge 1989; Trawicki et al. 1991; Wiswar 1994).

Ninespine stickleback are tolerant of salinities < 20 ppt and may move between fresh and saltwater throughout the year as access and conditions permit (Wootton 1984). Individuals attain sexual maturity by the age of two, seldom live beyond the age of five, and typically reach 65 mm in length with some as large as 90 mm (Scott and Crossman 1973; Heins et al. 2003). Spawning occurs in freshwater between the months of May and July in shallow areas containing aquatic vegetation (Wootton 1984). Males construct nests from algae and small debris where females deposit eggs. After fertilization, males protect nesting areas from predators and fan oxygenated water over the clutch of eggs. Young emerge roughly a week to a month later at which time males continue to provide care by preventing them from straying from nursery areas. Little is known regarding seasonal movements, however, spawning individuals likely move from shallow (littoral, tributary, or slough habitat) to deep (river deltas, coastal areas, lake bottoms) areas in fall (Wootton 1984). Ninespine stickleback prey on aquatic insects and small crustaceans and are an important prey item of predatory fish and birds (Palmer 1962; Morrow 1980). Additional biological data on ninespine stickleback are available in numerous publications (Yoshihara 1972; Ward and Craig 1974; Craig 1977a; Griffiths et al. 1977; Wilson et al. 1977; Bendock and Burr 1985; West and Wiswar 1985; West and Fruge 1989; Trawicki et al. 1991; Wiswar et al. 1995; Jarvela and Thorsteinson 1999;



Brown 2008). While they are commonly found in most North Slope coastal habitats of the Refuge, catch rates vary dramatically among areas and years.

**Arctic cod** (*Boreogadus saida*) is a marine species distributed throughout the entire northern polar basin, around Greenland and Iceland, into Hudson Bay, and in the North Bering Sea (Cohen et al. 1990). Arctic cod are commonly encountered and sometimes abundant in nearshore coastal areas adjacent to the Arctic NWR in the southern Beaufort Sea (Craig et al. 1982; Brown 2008).

Arctic cod prefer cold (0-6°C), saline (20-30 ppt) habitats, but are at least temporarily tolerant of fluctuating temperatures, salinities, and turbidities as they are found in both in- and off-shore marine areas, estuaries, and occasionally in the lower reaches of coastal rivers (Lowry and Frost 1981; Craig et al. 1982; Cohen et al. 1990). Adults typically range between 60 and 170 mm in length with some individuals reaching 250 mm (Craig et al. 1982). Sexual maturity is attained between the ages of two and three with maximum ages of six to seven years (Lear 1979; Craig et al. 1982). During late summer and fall, Arctic cod may aggregate into large schools and move into nearshore coastal areas that are transitioning from estuarine to marine conditions (Craig et al. 1982; Hop et al. 1997). Seasonal movements and schooling behavior may be associated with spawning, foraging, predator avoidance, or habitat availability as Arctic cod are often found associated with the edges of pack ice (Welch et al. 1993; Hop et al. 1997). Spawning occurs under ice between the months of November and March, presumably close to shore (Lowry and Frost 1981; Craig et al. 1982). Arctic cod prey on amphipods, copepods, and mysid shrimp and are an important prey item for many species of marine mammals, birds, and fish (Palmer 1962; Craig et al. 1982; Craig et al. 1984; Frost and Lowry 1984).

Arctic cod may be the most abundant and widely distributed fish species in the Beaufort Sea (Lowry and Frost 1981; Craig et al. 1982; Craig 1984). Catch data suggest Arctic cod are more abundant in coastal areas west of the Arctic NWR with one estimate, during the summer of 1978 in Simpson lagoon, numbering in the millions (Craig et al. 1982; Jarvela and Thorsteinson 1999). Within waters adjacent to the Arctic NWR, catch rates of Arctic cod are variable within and among years and areas, but tend to increase during late summer and fall (Griffiths et al. 1977; Fruge et al. 1989; West and Fruge 1989; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). There is some evidence that Arctic cod are harvested in subsistence fisheries in Kaktovik and Jago lagoons by residents of Kaktovik (Griffiths et al. 1977).

**Saffron cod** (*Eleginus gracilis*) is a marine species distributed throughout the North Pacific from the Yellow Sea in Asia to Southeast Alaska and north in the Arctic Ocean from eastern Siberia to northwestern Canada (Morrow 1980; Cohen et al. 1990). Saffron cod are widely distributed in the Beaufort Sea including coastal areas adjacent to the Arctic NWR (Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008).

Saffron cod inhabit both in- and off-shore marine and estuarine areas and are occasionally found in the lower reaches of coastal rivers (Morrow 1980). Average adult lengths range between 250 and 350 mm, with some individuals reaching up to 500 mm (Craig and Haldorson 1981). Sexual maturity is attained between the ages of two and three, with maximum ages reported between 10 and 12 years old (Cohen et al. 1990). Fish tend to move inshore in fall and winter to spawn, then move offshore in spring and summer to feed in deeper habitats (Morrow 1980). Forage consists of mysid shrimp, amphipods, and decapods, with larger individuals ingesting fish (Ellis 1962; Craig and Haldorson 1981).



Biological data pertaining to saffron cod are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths 1984, Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008) and in other locations (Bendock 1977; Craig et al. 1985; Griffiths et al. 1998; Fechelm et al. 2006). Catch rates vary substantially among years and areas.

**Fourhorn sculpin** (*Myoxocephalus quadricornis*) is a marine species distributed throughout the circumpolar north from the Baltic Sea, east across northern Siberia to the Arctic coast of Canada and south to Norton Sound, Alaska (Andriyashev 1954; Morrow 1980). Fourhorn sculpin are often abundant in nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008).

Fourhorn sculpin rarely descend below 15-20 meters in depth and inhabit cold nearshore marine and estuarine coastal areas year-round, occasionally moving into the lower reaches of coastal streams and rivers (Griffiths et al. 1977; Morrow 1980). Adults typically reach 280 mm in length but may grow to 365 mm and live to 14 years of age (Andriyashev 1954; Percy et al. 1974; Griffiths et al. 1975). Sexual maturity is attained between the ages of three and nine with the majority of fish mature by the age of six (Griffiths et al. 1975; Griffiths et al. 1977). Spawning is thought to occur in winter, although evidence of summer spawning also exists (Goldberg et al. 1987), with males excavating shallow depressions in soft substrate where females deposit eggs (Westin 1969). After fertilization, males remain in close proximity to the nest site, cleaning and fanning oxygenated water over the eggs. Young emerge two to three months later, depending on water temperature, and move into shallow waters close to shore (Westin 1970). Seasonal on- and off-shore movements by adults may be common with individuals feeding on invertebrates such as mysids, amphipod, isopods, and occasionally small fish (Griffiths et al. 1975; Griffiths et al. 1977).

Biological data pertaining to fourhorn sculpin are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008) and in other locations (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999). While catches vary among years and areas, fourhorn sculpin are typically one of the most abundant marine species in nearshore areas of the Arctic NWR.

**Arctic flounder** (*Pleuronectes glacialis*) is a marine species distributed from Queen Maude Gulf in Arctic Canada west along the coast of North America to Siberia and south to Bristol Bay, Alaska (Andriyashev 1954; Morrow 1980). Fishbase (Froese and Pauly 2017), a world-wide, web-based, fish taxonomy guide, classifies Arctic flounder as *Liopsetta glacialis* while the American Fisheries Society classifies the species as *Pleuronectes glacialis* (Page et al. 2013). We use the American Fisheries Society classification here. Arctic flounder are found throughout nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Jarvela and Thorsteinson 1999; Brown 2008).

Arctic flounder typically remain close to shore, inhabiting shallow brackish water habitats and river deltas, occasionally entering rivers and delta lakes (Craig 1977c; Wilson et al. 1977). Adults range between 150 and 250 mm in length, attain sexual maturity between the fourth and fifth years, and generally live to between 9 and 12 years of age, however, specimens as old as 19 have been reported (Andriyashev 1954; Griffiths et al. 1975; Griffiths et al. 1977; Bendock 1979; Morrow 1980). Spawning



is thought to occur in coastal areas between January and March but possibly as late as May in some areas (Andriyashev 1954; Morrow 1980). Young emerge roughly 40 days after fertilization depending on water temperature (Aronovich et al. 2003). Seasonal on- and off-shore movements are thought to occur with forage consisting mainly of amphipods, mollusks, crustaceans, and small fish (Griffiths et al. 1975; Morrow 1980; Wiswar 1986).

Relative to Arctic cod and fourhorn sculpin, Arctic flounder are less frequently captured, but still common in nearshore areas of the Beaufort Sea coast (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999; Fechem et al. 2006), including areas adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Underwood et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). In addition, Arctic flounder are infrequently captured in subsistence fisheries by the residents of Kaktovik in waters surrounding Barter Island (Pedersen and Linn 2005).

## Fisheries References

- Alt, K.T. 1976. Sport Fish Investigations of Alaska: Inventory and cataloging of North Slope waters. Alaska Fish and Game, Division of Sport Fish, Annual Performance Report. Project F-9-8, Vol. 17, G-I, Juneau (pages 129-150).
- Alt, K.T. 1979. Contributions to the life history of the humpback whitefish in Alaska. Transactions of the American Fisheries Society 108: 156-160.
- Alt, K.T. 1980. A life history study of sheefish and whitefish in Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1980-1981, Project F-9-12, Vol. 21, R-II, Juneau (pages 1-31).
- Alt, K.T. 1983. Inventory and cataloging of sport fish and sport fish waters of western Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1982-1983, Project F-9-15, Vol. 24, G-I-P-B, Juneau (pages 34-78).
- Andriyashev, A.P. 1954. Fishes of the northern seas of the U.S.S.R. keys to the fauna of the U.S.S.R. No. 53, 617p. Israel Program for Scientific Translations.
- Anras, M.L.B., P.M. Cooley, R.A. Bodaly, L. Anras, R.J.P. Fudge. 1999. Movement and habitat use by lake whitefish in a boreal lake: Integrating acoustic telemetry and geographic information systems. Transactions of the American Fisheries Society 128: 939-952.
- Armstrong, R.H., and J.E. Morrow. 1980. The Dolly Varden char, *Salvelinus malma*. Pages 99-140 in U.K. Balon (ed.) Charrs: Salmonid Fishes of the Genus *Salvelinus*. Dr. W. Junk bv Publishers.
- Aronovich, T.M., S.I. Doroshev, L.V. Spectorova, and V.M. Makhotin. 2003. Egg incubation and larval rearing of navaga (*Eleginus navaga* Pall.), polar cod (*Boreogadus saida* lepechin) and arctic flounder (*Liopsetta glacialis* Pall.) in the laboratory. Aquaculture, 6:233-242.
- Arp, C.D., and B.M. Jones. 2009. Geography of Alaska lake districts: identification, description, and analysis of lake-rich regions of a diverse and dynamic state. U.S. Geological Survey, Scientific Investigations Report 2008-5215.
- Arvey, W.D. 1991. Stock status of anadromous Dolly Varden in waters of Alaska's North Slope. Alaska Department of Fish and Game. Fishery Manuscript Number 91-3.
- Barnes, M.A., and G. Power. 1984. A comparison of otolith and scale ages for western Labrador lake whitefish, *Coregonus clupeaformis*. Environmental Biology of Fishes 10: 297-299.



- Bendock, T. 1977. Beaufort Sea estuarine fishery study. Final Report of the Principal Investigators, Outer Continental Shelf Environmental Assessment Program, Volume 4. National Oceanic and Atmospheric Administration, Anchorage.
- Bendock, T. 1979. Beaufort Sea estuarine fishery study. Final report. Pages 670-729 in Environmental assessment of the Alaskan continental shelf. BLM/NOAA, OCSEAP. No. 4. 804 p.
- Bendock, T. 1980. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1979-1980, Project F-9-12, Vol. 21, G-I-I, Juneau.
- Bendock, T. N., and J. M. Burr. 1985. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1984-1985, Project F-9-17, Vol. 26, G-I-I, Juneau.
- Bernatchez, L., and J.J. Dodson. 1994. Phylogeographic relationships among Palearctic and Nearctic whitefish (*Coregonus* sp.) populations as revealed by mitochondrial DNA variation. Canadian Journal of Fisheries and Aquatic Sciences 51 (Supplement 1): 240-251.
- Bidgood, B.F. 1974. Reproductive potential of two lake whitefish (*Coregonus clupeaformis*) populations. Journal of the Fisheries Research Board of Canada 31: 1631-1639.
- Bishop, F.G. 1971. Observations on spawning habits and fecundity of the Arctic grayling. The Progressive Fish Culturist. 33:12-19.
- Bodaly, R.A. 1986. Biology, exploitation and culture of coregonid fishes in Canada. Advances in Limnology 22: 1-30.
- Bodaly, R.A., J.W. Clayton, and C.C. Lindsey. 1988. Status of the Squanga whitefish, *Coregonus* sp., in the Yukon Territory, Canada. Canadian Field-Naturalist 102(1): 114-125.
- Bond, W.A., and R.N. Erickson. 1985. Life history studies of anadromous Coregonid fishes in two freshwater lake systems on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences Number 1336. 71p.
- Bradford, M.J., A.V. Vinster, and P.A. Milligan. 2009. Freshwater life history, habitat, and the production of Chinook salmon from the upper Yukon Basin. Pages 19-38 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Breaser, S.W., D.F. Stearns, M.W. Smith, R.L. West, and J.B. Reynolds. 1988. Observations of movements and habitat preferences of burbot in an Alaskan glacial river system. Transactions of the American Fisheries Society. 117:506-509.
- Brown, R.J. 2004. A biological assessment of whitefish species harvested during the spring and fall in the Selawik River Delta Selawik National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 77, Fairbanks, Alaska.
- Brown, R.J. 2006. Humpback whitefish *Coregonus pidschian* of the upper Tanana River drainage. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 90, Fairbanks, Alaska.
- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brown, R.J. 2009. Distributions and demographics of whitefish species in the upper Koyukuk river drainage, Alaska, with emphasis on seasonal migrations and important habitats of broad whitefish and humpback whitefish. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 104, Fairbanks, Alaska.



- Brown, R.J., N. Bickford, and K. Severin. 2007. Otolith trace element chemistry as an indicator of anadromy in Yukon River drainage Coregonine fishes. *Transactions of the American Fisheries Society* 136: 678-690.
- Brown, R.J., and C. Fleener. 2001. Beaver dam influence on fish in lentic and lotic habitats in the Black River drainage, Alaska. U.S. Fish and Wildlife Service, Study No. FIS-00-004.
- Brown, R.J., M.B. Loewen, and T.L. Tanner. 2014. Overwintering locations, migrations, and fidelity of radio-tagged Dolly Varden in the Hulahula River, Arctic National Wildlife Refuge, 2007–09. *Arctic* 67:149–158.
- Bryan, J.E. 1973. The influence of pipeline development on freshwater fishery resources of northern Yukon Territory, aspects of research conducted in 1971 and 1972. Pacific Region Department of the Environment, Northern Operations Branch Fisheries Service, Task Force on Northern Oil Development Report No. 73-6 (Information Canada Catalog No. R72-9773).
- Bryan, J.E., and D.A. Kato. 1975. Spawning of lake whitefish, *Coregonus chupeaformis*, and round whitefish, *Prosopium cylindraceum*, in Aishihik Lake and East Aishihik River, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 32: 283-288.
- Burr, J.M. 1990. Stock assessment and biological characteristics of lake trout populations in interior Alaska, 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-33. 59p.
- Carter, W.K. 2010. Life history and spawning movements of broad whitefish in the middle Yukon River. Master's Thesis, University of Alaska Fairbanks, Fairbanks, AK.
- Chang-Kue, K.J.T., and E.F. Jessop. 1997. Broad whitefish radiotagging studies in the lower Mackenzie River and adjacent coastal region, 1982-1993. Pages 117-146 in R.F. Tallman, and J.D. Reist, editors. The proceedings of the broad whitefish workshop: the biology, traditional knowledge and scientific management of broad whitefish (*Coregonus nasus* (Pallas)) in the lower Mackenzie River. Canadian Technical Report of Fisheries and Aquatic Sciences 2193, Winnipeg.
- Chen, L. 1969. The biology and taxonomy of the burbot *Lota lota*, in interior Alaska. Biological Papers of the University of Alaska. No. 11.
- Chudobiak, D. H. 1995. An examination of lacustrine and estuarine populations of Mackenzie broad whitefish (*Coregonus nasus* Pallas): the role of migration and commercial exploitation on life history variation. M. Sc. Thesis, Univ. Manitoba, Winnipeg. 135 pp.
- Cohen, D.M., T. Inada, T. Iwamoto, and N. Scialabba. 1990. FAO species catalogue. Vol. 10. Gadiform fishes of the world. An annotated and illustrated catalogue of cods, hakes, grenadiers, and other gadiform fishes known to data. FAO Fisheries Symposium Number 125, Vol. 10. 442 pp.
- Corkum, L.D., and P.J. McCart. 1981. A review of the fisheries of the Mackenzie delta and nearshore Beaufort Sea. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1613, Winnipeg.
- Courtney, M.B., B. Scanlon, R.J. Brown, A.H. Rikardsen, C.P. Gallagher, and A.C. Seitz. 2018. Offshore ocean dispersal of adult Dolly Varden *Salvelinus malma* in the Beaufort Sea. *Polar Biology* (<https://doi.org/10.1007/s00300-017-2246-5>).
- Craig, P.C. 1977a. Fisheries investigations in the Shaviovik River drainage, Alaska, with emphasis on Arctic char in the Kavik River (Chapter 3). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1977b. Arctic char in the Sadlerochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska



with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.

- Craig, P.C. 1977c. Ecological studies of anadromous and resident populations of Arctic char in the Canning river drainage and adjacent coastal waters of the Beaufort Sea, Alaska. Pages 1-116 (Chapter 1) In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. Journal of the Fisheries Research Board of Canada 35:48:52
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. Transactions of the American Fisheries Society 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. Biological Papers of the University of Alaska 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. Biological papers of the University of Alaska 24:131-152.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1982. Ecological studies of Arctic cod (*Boreogadus saida*) in Beaufort Sea coastal waters, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 39:395-406.
- Craig, P.C., W.B. Griffiths, S.R. Johnson, and D.M. Schell. 1984. Trophic dynamics in an Arctic lagoon. Pages 347-380 in The Alaskan Beaufort Sea: ecosystems and environments. P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1985. Distributional patterns of fishes in an Alaskan Arctic lagoon. Polar Biology 4:9-18.
- Craig, P.C., and L. Haldorson. 1981. Fish. In Beaufort Sea Barrier Island-Lagoon Ecological Process Studies: Final Report, Simpson Lagoon, Part 4. Environmental Assessment of the Alaskan Continental Shelf, Final Report of Principal Investigators Vol. 8: Biological Studies. Boulder, Colorado: National Oceanic and Atmospheric Administration, Outer Continental Shelf Environment Assessment Program, and Bureau of Land Management. 384-678.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. Arctic. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 In P.C. Craig (ed.), Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Craig, P. C., and P. J. McCart. 1975. Classification of stream types in Beaufort Sea drainages between Prudhoe Bay, Alaska, and the Mackenzie Delta, N.W.T., Canada. Arctic and Alpine Research 7:183-198.
- Craig, P.C., and V.A. Poulin. 1975. Movements and growth of Arctic grayling (*Thymallus arcticus*) and juvenile Arctic char (*Salvelinus alpinus*) in a small arctic stream, Alaska. Journal of the Fisheries Research Board of Canada. 32: 689-697.
- Craig, P.C., and J. Wells. 1975. Fisheries investigations in the Chandalar River region, northeast Alaska. Pages 1-114 (Chapter 1) In P.C. Craig (ed.), Fisheries Investigations in a Coastal Region of the Beaufort Sea, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 34.



- Craig, P.C., and J. Wells. 1976. Life history notes for a population of Slimy Sculpin (*Cottus cognatus*) in an Alaskan Arctic stream. *Journal of the Fisheries Research Board of Canada* 33:1639–1642.
- Crane, P., T. Viavant, and J. Wenburg. 2005. Overwintering patterns of Dolly Varden *Salvelinus malma* in the Sagavanirktok River in the Alaskan North Slope inferred using mixed-stock analysis. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report Number 84.
- Daum, D., P. Rost, and M.W. Smith. 1984. Fisheries studies on the North Slope of the Arctic National Wildlife Refuge, 1983. In G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1983 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage. 66p.
- DeCicco, A.L. 1997. Movements of postsmolt anadromous Dolly Varden in Northwest Alaska. *American Fisheries Society Symposium*. 19:175-183.
- Deschermeier, S.J., T.M. Stevens, D.W. Wiswar, and R.L. West. 1986. Fisheries investigations in the Kongakut River, Arctic National Wildlife Refuge, Alaska, 1985. In G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Dillinger, R.E., T.P. Birt, and J.M. Green. 1992. Arctic cisco, *Coregonus autumnalis*, distribution, migration and spawning in the Mackenzie River. *The Canadian Field-Naturalist* 106(2): 175-180.
- Doxey, M. 1991. A history of fisheries assessments and stocking programs in Harding Lake, Alaska, 1939-1989. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Manuscript Number 91-2, Anchorage.
- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362–378.
- Ebener, M.P. 1997. Recovery of lake whitefish populations in the Great Lakes. *Fisheries* 22(7): 18-20.
- Ellis, D.V. 1962. Observations on the distribution and ecology of some Arctic fish. *Arctic*, 15:179–189.
- Evenson, M.J. 1990. Movement, abundance, and length composition of burbot in rivers of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-3. 33p.
- Everett, R.J., R.L. Wilmont, and C.C. Krueger. 1997. Population genetic structure of Dolly Varden from Beaufort Sea drainages of Northern Alaska and Canada. *American Fisheries Society Symposium*. 19:240-249.
- Fechhelm, R.G., J.D. Bryan, W.B. Griffiths, and L.R. Martin. 1997. Summer growth patterns of northern Dolly Varden (*Salvelinus malma*) smolts from the Prudhoe Bay region of Alaska. *Canadian Journal of Fisheries and Aquatic Sciences*. 54:1103-1110.
- Fechhelm, R.G., G.B. Buck, and M.R. Link. 2006. Year 24 of the long-term monitoring of nearshore Beaufort Sea fishes in the Prudhoe Bay region, 2006. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska. 82 p.
- Fechhelm, R.G., and D.B. Fissel. 1988. Wind-aided recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into Alaskan waters. *Canadian Journal of Fisheries and Aquatic Sciences*. 45:906-910.
- Fechhelm, R.G., and W.B. Griffiths. 1990. Effect of wind on the recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into the central Alaskan Beaufort Sea. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 2164-2171.



- Fechhelm, R.G., B. Streever, and B.J. Gallaway. 2007. The arctic cisco (*Coregonus autumnalis*) subsistence and commercial fisheries, Colville River Alaska: a conceptual model. *Arctic* 60(4): 421-429.
- Froese, R. and D. Pauly. Editors. 2017. FishBase. World Wide Web electronic publication. [www.fishbase.org](http://www.fishbase.org), version (10/2017).
- Fleischer, G.W. 1992. Status of coregonine fishes in the Laurentian Great Lakes. *Polish Archives of Hydrobiology* 39: 247-259.
- Frost, K.J., and L.F. Lowry. 1984. Trophic relationships of vertebrate consumers in the Alaskan Beaufort Sea. Pages 381–401 in P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Fruge, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994–1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.
- Fruge, D.J., D.W. Wiswar, L.J. Dugan, and D.E. Palmer. 1989. Fish population characteristics of Arctic National Wildlife Refuge coastal waters, summer 1988. Progress Report. U.S. Fish and Wildlife Service, Fairbanks.
- Furniss, R.A. 1974. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-6. 45p.
- Furniss, R.A. 1975. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-7. 45p.
- Galloway, B.J., W.B. Griffiths, P.C. Craig, W.J. Gazey, and J.W. Helmericks. 1983. An assessment of the Colville River delta stocks of Arctic cisco – migrants from Canada? *Biological Papers of the University of Alaska* 21: 4-23.
- Garner, G.W., and P.E. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. final report; baseline study of the fish, wildlife, and habitats. U.S. Fish and Wildlife Service, Anchorage.
- Georgette, S., and A. Shiedt. 2005. Whitefish: traditional ecological knowledge and subsistence fishing in the Kotzebue Sound region, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper Number 290, Juneau.
- Gilk, S.E., D.B. Molyneaux, T. Hamazaki, J.A. Pawluk, and W.D. Templin. 2009. Biological and genetic characteristics of fall and summer chum salmon in the Kuskokwim River, Alaska. Pages 161-179 in C.C. Krueger and C.E. Zimmerman, editors. *Pacific salmon: ecology and management of western Alaska's populations*. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Goldberg, S.R., W.T. Yasutake, and R. West. 1987. Summer spawning in the fourhorn sculpin, *Myoxocephalus quadricornis*, from Alaska. *Canadian Field-Naturalist* 101:457
- Griffiths, W.B. 1984. Fish. Chapter three in J.C. Truett editor. Environmental characterization and biological use of lagoons in the eastern Beaufort Sea. Outer Continental Shelf Environmental Assessment Program Final reports of Principal Investigators Vol. 24. U.S. Department of Commerce, Anchorage Alaska.
- Griffiths, W.B., P.C. Craig, G. Walder, and G. Mann. 1975. Fisheries investigations in a coastal region of the Beaufort Sea (Nunavut Lagoon, Yukon Territory). In P.C. Craig, editor. Fisheries investigations in a coastal region of the Beaufort Sea. Biological Report Series, Volume 34. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W.B., J.K. DenBeste, and P.C. Craig. 1977. Fisheries investigations in a coastal region of the Beaufort Sea (Kaktovik Lagoon, Alaska). In P. McCart, editor. Fisheries investigations along



- the North Slope from Prudhoe Bay, Alaska to the Mackenzie Delta, N.W.T. Biological Report Series, Volume 40. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W. B., R.G. Fechhelm, B.J. Gallaway, L.R. Martin, and W.J. Wilson. 1998. Abundance of selected fish species in relation to temperature and salinity patterns in the Sagavanirktok delta, Alaska, following construction of the Endicott Causeway. *Arctic* 51:94–104.
- Gudkov, P.K. 1999. Relict population of round whitefish *Prosopium cylindraceum* from the eastern Chukotski Peninsula. *Journal of Ichthyology* 39(4): 294–300.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Harper, K.C., F. Harris, R.J. Brown, T. Wyatt, and D. Cannon. 2007. Stock Assessment of Broad Whitefish, Humpback Whitefish and Least Cisco in Whitefish Lake, Yukon Delta National Wildlife Refuge, Alaska, 2001–2003. U. S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 88. Kenai, AK.
- Harper, K.C., F. Harris, S.J. Miller, and D. Orabutt. 2009. Migration timing and seasonal distribution of broad whitefish, humpback whitefish, and least cisco from Whitefish Lake and the Kuskokwim River, Alaska, 2004 and 2005. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 105. Kenai, AK.
- Haymes, G.T., and Kolenosky, D.P. 1984. Distribution and characteristics of spawning round whitefish in Lake Ontario, 1976–1981. Ontario Fisheries Technical Report 14: ii + 9 pp.
- Healey, M.C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 311–3394 in C. Groot and L. Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia.
- Heins, D.C., J.M. Johnson, and J.A. Baker. 2003. Reproductive ecology of the ninespine stickleback from south-central Alaska. *Journal of Fish Biology* 63:1131–1143.
- Hop, H., H.E. Welch, and R.E. Crawford. 1997. Population structure and feeding ecology of Arctic cod schools in the Canadian high Arctic. American Fisheries Society Symposium 19:68–80.
- Horne-Brine, M.M., J. Bales, and L. DuBois. 2009. Salmon age and sex composition and mean lengths for the Yukon River Area, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 09-26, Anchorage.
- Howland, K.L., M.A. Treble, and R.F. Tallman. 2001. A biological analysis and population assessment of northern pike, inconnu and lake whitefish from the Mackenzie River delta exploratory fishery, 1989–1993. Canadian Technical Report of Fisheries and Aquatic Sciences 2330.
- Irvine, J.R., E. Linn, K. Gillespie, C. McLeod, and J.D. Reist. 2009a. Pacific salmon in Canada's Arctic draining rivers, with emphasis on those in British Columbia and the Yukon. Pacific Fisheries Resource Conservation Council. Vancouver, B.C.
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009b. Salmon in the Arctic and how they avoid lethal low temperatures. North Pacific Anadromous Fish Commission Bulletin. 5:39–50.
- Jarvela, L.E., and L.K. Thorsteinson. 1997. Movements and temperature occupancy of sonically tracked Dolly Varden and Arctic ciscoes in Camden Bay, Alaska. American Fisheries Society Symposium. 19:165–174.



- Jarvela, L.E., and L.K. Thorsteinson. 1999. The epipelagic fish community of Beaufort Sea coastal waters, Alaska. *Arctic*. 52:80-94.
- Jennings, G.B., K. Sundet, and A.E. Bingham. 2010. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2008. Alaska Department of Fish and Game, Fishery Data Series No. 10-22, Anchorage.
- Jessop, B.M., and G. Power. 1973. Age, growth, and maturity of round whitefish (*Prosopium cylindraceum*) from the Leaf River, Ungava, Quebec. *Journal of the Fisheries Research Board of Canada* 30: 299-304.
- Johnson, L. 1980. The Arctic charr, *Salvelinus alpinus*. Pp. 19-98 in E.K. Balon, ed. Charrs: salmonid fishes of the genus *Salvelinus*. Dr. W. Junk. The Hague.
- Kane, D.L., K. Yoshikawa, and J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrogeology Journal* 21:41–52.
- Kepler, P. 1973. Sport fish investigations of Alaska: Population studies of northern pike and whitefish in the Minto Flats complex with emphasis on the Chatanika River. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1972-1973, Project F-9-5, Vol. 14, G-II-J, Juneau (Pages 59-81).
- Kratt, L.F., and R.J.F. Smith. 1977. A post-hatching sub-gravel stage in the life history of the Arctic grayling. *Transactions of the American Fisheries Society* 106:241-243
- Kratt, L.F., and R.J.F. Smith. 2006. An analysis of the spawning behavior of the Arctic grayling *Thymallus arcticus* with observations on mating success. *Journal of Fish Biology* 17:661-666.
- Krueger, C.C., R.L. Wilmot, and R.J. Everett. 1999. Stock origins of Dolly Varden collected from Beaufort Sea coastal sites of Arctic Alaska and Canada. *Transactions of the American Fisheries Society* 128:49-57.
- Lambert, Y., and J.J. Dodson. 1990. Freshwater migration as a determinant factor in the somatic cost of reproduction of two anadromous coregonines of James Bay. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 318-334.
- Lear, W.H. 1979. Distribution, size and sexual maturity of Arctic cod (*Boreogadus saida*) in the northwest Atlantic during 1959-1978 St. John's, Newfoundland. Canadian Atlantic Fisheries Science Advisory Commission. Research Document 79/58. 40 p.
- Lindsey, C.C. 1963. Sympatric occurrence of two species of humpback whitefish in Squanga Lake, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 20: 749-767.
- Lowry, L.F., and K. Frost. 1981. Distribution, growth and foods of Arctic cod (*Boreogadus saida*) in the Bering, Chukchi and Beaufort Seas. *Canadian Field Naturalist* 95:186-191.
- Lubinski, B.R., M.J. Millard, R. Schneidervin, and J.L. Melegari. 1999. A mark-recapture experiment to estimate abundance of lake trout in Lake Schrader, Arctic National Wildlife Refuge, Alaska, 1995. U.S. Fish and Wildlife Service. Unpublished Fisheries Technical Report. 14p.
- Mann, G.J. 1974. Life history types of the least cisco (*Coregonus sardinella*, Valenciennes), in the Yukon Territory, North Slope, and east Mackenzie River Delta drainages. In P.J. McCart [ed] Life histories of three species of freshwater fish in Beaufort Sea Drainages, Yukon Territory. Arctic Gas Biological Report Series 18(3): 160 pp.
- Mann, G.J., and P.J. McCart. 1981. Comparison of sympatric dwarf and normal populations of least cisco (*Coregonus sardinella*) inhabiting Trout Lake, Yukon Territory. *Canadian Journal of Fisheries and Aquatic Sciences* 38: 240-244.



- Martin, N.V. 1957. Reproduction of lake trout in Algonquin Part, Ontario. Transactions of the American Fisheries Society. 86:231-244.
- McCart, P. J. 1980. A Review of the systematic and ecology of Arctic char, *Salvelinus alpinus*, in the western Arctic. Canadian Technical Report of Fisheries and Aquatic Sciences. No. 935: 89 p.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. Journal of the Fisheries Research Board of Canada 30:1215-1220.
- McCart, P., P. Craig, and H. Bain. 1972. Report on fisheries investigations in the Sagavanirktok River and neighboring drainages. Alyeska Pipeline Service Company, 170 pp.
- McDermid, J.L., J.D. Reist, and R.A. Bodaly. 2007. Phylogeography and postglacial dispersal of whitefish (*Coregonus clupeaformis* complex) in northwestern North America. Archiv Für Hydrobiologie, Special Issues: Advances in Limnology 60: 91-109.
- McDonald, M.E., and A.E. Hershey. 2006. Shifts in abundance and growth of slimy sculpin in response to changes in the predator population in an Arctic Alaskan lake. Hydrobiologia. 240:219-233.
- McLeod, C.L., and J.P. O'Neil. 1983. Major range extension of anadromous salmonids and first record of Chinook salmon in the Mackenzie River drainage. Canadian Journal of Zoology 61: 2183-2184.
- McPhail, J.D., and C.C. Lindsey. 1970. Freshwater Fishes of Northern Canada and Alaska. Fisheries Research Board of Canada Bulletin 173: 381 pp.
- Morin, R., J.J. Dodson, and G. Power. 1982. Life history variations of anadromous cisco (*Coregonus artedii*), lake whitefish (*C. clupeaformis*), and round whitefish (*Prosopium cylindraceum*) populations of eastern James-Hudson Bay. Canadian Journal of Fisheries and Aquatic Sciences 39: 958-967.
- Morrow, J.E. 1980. The Freshwater Fishes of Alaska. Alaska Northwest Publishing Co., Anchorage, AK. 300 pp.
- Moskalenko, B.K. 1971. The whitefishes of Siberia. Pishchevaya Promyshlennost, Report SFWFR-TR-73-05, Moscow (translated from Russian in 1972 by R.M. Howland and G. Kavanagh, U.S. Department of the Interior, Division of Fishery Research, Washington D.C.).
- Moulton, L.L., W.A. Morris, C. George, J. Bacon, J.R. Rose, and M. Whitman. 2007. Surveys of fish habitats in the Teshekpuk Lake region, 2003-2005. Final Report to the North Slope Borough, Department of Wildlife Management, Barrow.
- Moulton, L.L., L.M. Philo, and J.C. George. 1997. Some reproductive characteristics of least ciscoes and humpback whitefish in Dease Inlet, Alaska. Page 119-126 in J. Reynolds, editor. Fish ecology in Arctic North America. American Fisheries Society 19, Bethesda, Maryland.
- Moulton, L.L., and B.T. Seavey. 2005. Harvest estimate and associated information for the 2004 Colville River fall fishery. A report prepared by MJM Research for ConocoPhillips Alaska, Inc., Anchorage.
- Mraz, D. 1964. Age and growth of the round whitefish in Lake Michigan. Transactions of the American Fisheries Society 93: 46-52.
- Normandeau, D.A. 1969. Life history and ecology of the round whitefish *Prosopium cylindraceum* (Pallas), of Newfound Lake, Bristol, New Hampshire. Transactions of the American Fisheries Society 98: 7-13.
- Page, L.M., H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, N. E. Mandrak, R.L. Mayden, and J.S. Nelson. 2013. Common and scientific names of fishes from the United States, Canada, and Mexico, seventh edition. American Fisheries Society Special Publication 34, Bethesda, Maryland.



- Palmer, S.R. 1962. Handbook of North American Birds Vol. 1. Yale University Press, New Haven Connecticut.
- Pedersen, S., and A. Linn, Jr. 2005. Kaktovik 2000-2001 Subsistence Fishery Harvest Assessment. Federal Subsistence Fishery Monitoring Program, Final Project Report No. FIS 01-101. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information, Services Division, Anchorage, Alaska.
- Percy, R. 1975. Fishes of the outer Mackenzie Delta. Canadian Department of the Environment. Beaufort Sea Project. Technical Report 8. 114p.
- Percy, R., W. Eddy, and D. Munro. 1974. Anadromous and freshwater fishes of the outer Mackenzie Delta. Fisheries and Marine Service, Environment Canada. Interim Report of Beaufort Sea Project Study B2. 51p.
- Plumb, M.P. 2006. Ecological factors influencing fish distribution in a large subarctic lake system. Master's Thesis, University of Alaska Fairbanks.
- Prasolov, P.P. 1989. On the biology of the broad whitefish, *Coregonus nasus*, from the lower Ob River basin. Journal of Ichthyology 29: 47-53.
- Rabus, B.T., and K.A. Echelmeyer. 1998. The mass balance of McCall Glacier, Brooks Range, Alaska, U.S.A.; its regional relevance and implications for climate change in the Arctic. Journal of Glaciology 44(147):333-351.
- Reist, J.D., and W.A. Bond. 1988. Life history characteristics of migratory coregonids of the lower Mackenzie River, Northwest Territories, Canada. Finnish Fisheries Research 9: 133-144.
- Reist, J.D., J.D. Johnson, and T.J. Carmichael. 1997. Variation and specific identity of char from Northwestern Arctic Canada and Alaska. American Fisheries Society Symposium. 19:250-261.
- Salo, O. 1991. Life history of chum salmon (*Oncorhynchus keta*). Pages 231-310 in C. Groot and L. Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia.
- Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.
- Seigle, J. 2003. Determination of marine migratory behavior and its relationship to selected physical traits for least cisco (*Coregonus sardinella*) of the Western Arctic Coastal Plain, Alaska. Master's thesis. Oregon State University, Corvallis, Oregon.
- Shestakov, A.V. 2001. Biology of the broad whitefish *Coregonus nasus* (Coregonidae) in the Anadyr basin. Journal of Ichthyology 4(9): 746-754.
- Smith, M.W., and R.S. Glesne. 1983. Aquatic studies on the North Slope of the Arctic National Wildlife Refuge, 1981 and 1982. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report Number 83-01, Fairbanks, Alaska.
- Stein, J.N., C.S. Jessop, T.R. Porter, and K.T.J. Chang-Kue. 1973. Fish resources of the Mackenzie River Valley. Fisheries Service, Department of the Environment, Winnipeg, Manitoba.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. Arctic 59:37-46.
- Stewart, D.B., T.J. Carmichael, C.D. Sawatzky, N.J. Mochnacz, and J.D. Reist. 2007. Fish life history and habitat use in the Northwest Territories: round whitefish (*Prosopium cylindraceum*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2795, Winnipeg.
- Swanson, H.K., K.A. Kidd, and J.D. Reist. 2010. Effects of Partially Anadromous Arctic Char (*Salvelinus alpinus*) Populations on Ecology of Coastal Arctic Lakes. Ecosystems. 13:261-274



- Tallman, R.F., M.V. Abrahams, and D. H. Chudobiak. 2002. Migration and life history alternatives in a high latitude species, the broad whitefish, *Coregonus nasus* Pallas. *Ecology of Freshwater Fish* 11: 101–111.
- Tallman, R.F., and M.K. Friesen. 2007. A review of population trends in length and age of lake whitefish (*Coregonus clupeaformis*) harvested from Great Slave Lake between 1972 and 1995. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2819, Winnipeg, MB.
- Trawicki, J.M., S.M. Lyons, and G.V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska.
- Underwood, T.J., J.A. Gordon, M.J. Millard, L.A. Thorpe, and B.M. Osborne. 1995. Characteristics of selected fish populations of Arctic Wildlife Refuge coastal waters, final report, 1988-1991. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 28.
- Underwood, T.J., M.J. Millard, and L.A. Thorpe. 1996. Relative abundance, length frequency, age, and maturity of Dolly Varden in near-shore waters of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 125:719-728.
- VanGerwen-Toyne, M., J. Walker-Larson, and R.F. Tallman. 2008. Monitoring spawning populations of migratory coregonids in the Peel River, NT: The Peel River study 1998-2002. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2851, Winnipeg, MB.
- Ward, P., and P. Craig. 1974. Catalogue of streams, lakes, and coastal areas in Alaska along routes of the proposed gas pipeline from Prudhoe Bay, Alaska to the Alaska/Canadian border. Biological Report Series, Volume 19. Canadian Arctic Gas Study Ltd/Alaska Arctic Gas Study Co., Calgary.
- Welch, H.E., R.E. Crawford, and H. Hop. 1993. Occurrence of arctic cod (*Boreogadus saida*) schools and their vulnerability to predation in the Canadian High Arctic. *Arctic* 46:331 – 339.
- West, R.L., and D.J. Fruge. 1989. A review of coastal plain fish surveys and the results of 1986 fish surveys of selected coastal lakes and streams, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report Number 4. 22p.
- West, R.L., M.W. Smith, W.E. Barber, J.B. Reynolds, and H. Hop. 1992. Autumn migration and overwintering of Arctic grayling in coastal streams of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 121:709-715
- West, R.L., and D.W. Wiswar. 1985. Fisheries investigations on the Arctic National Wildlife Refuge, Alaska, 1984. Pages 729-777 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1984 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Westin, L. 1969. The mode of fertilization, parental behavior and time of egg development in fourhorn sculpin. Report from the Institute of Freshwater Research Drottningholm. 49:175–182.
- Westin, L. 1970. The food ecology and the annual food cycle in the Baltic population of four-horn sculpin *Myoxocephalus quadricornis* Pisces. Report from the Institute of Freshwater Research Drottningholm. 50:168-210.
- White, D.M., P. Prokein, M.K. Chambers, M.R. Lilly, and H. Toniolo. 2008. Use of synthetic aperture radar for selecting Alaskan lakes for winter water use. *Journal of the American Water Resources Association* 44:276–284.



- Wilson, W.J., E.H. Buck, G.F. Player, and L.D. Dreyer. 1977. Winter water availability and use conflicts as related to fish and wildlife in Arctic Alaska—a synthesis of information. FWS/OBS-77/06. U.S. Fish and Wildlife Service, Washington, DC.
- Wipfli, M.S. 2009. Food supplies of stream-dwelling salmonids. Pages 39-52 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Wiswar, D.W. 1986. Notes on the age, growth, distribution and summer feeding habits of Arctic flounder in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. U.S. Fish and Wildlife Service. Fairbanks Fishery Resources Progress Report Number FY86-3.
- Wiswar, D.W. 1991. Summer distribution of fishes in the Okpilak and Akutoktak rivers, Arctic National Wildlife Refuge, Alaska, 1989. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 11.
- Wiswar, D.W. 1992. Summer distribution of Arctic fishes in the Okpilak, Akutoktak, and Jago rivers, Arctic National Wildlife Refuge, Alaska, 1990. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 17.
- Wiswar, D.W. 1994. Summer distribution of Arctic fishes in the 1002 Area of the Arctic National Wildlife Refuge, Alaska, 1991 with emphasis on selected lakes, tundra streams, and the Sadlerochit River drainage. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 27.
- Wiswar, D.W., and R.L. West. 1987. Fisheries investigations in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. Pages 778-800 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Wiswar, D.W., R.L. West, and W.N. Winkleman. 1995. Fisheries Investigation in Oruktalik Lagoon, Arctic National Wildlife Refuge, Alaska, 1986. U. S. Fish and Wildlife Service, Fairbanks Fisheries Resource Office, Alaska Fisheries Technical Report No. 30. Fairbanks, AK.
- Wootton, R.J. 1984. A functional biology of sticklebacks. University of California Press. Berkley, CA.
- Yoshihara, H.T. 1972. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1971-1972. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-4, Job G-III-A. 49 p.
- Yoshihara, H.T. 1973. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1972-1973. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-5, Job G-III-A. 86 p.
- Zimmerman, C.E., A.M. Ramey, S.M. Turner, F.J. Mueter, S.M. Murphy, J.L. Nielsen. 2013. Genetics, recruitment, and migration patterns of Arctic cisco (*Coregonus autumnalis*) in the Colville River, Alaska, and Mackenzie River, Canada. Polar Biology 36:1543–1555.
- Zyus'ko, A.Y., V.V. Rusanov, and Z.A. Chernyayev. 1993. Biological data on round whitefish, *Prosopium cylindraceum*, from the Chara River. Journal of Ichthyology 33(2): 37-48.



## Birds

### Waterfowl and Waterbirds

Fourteen waterfowl and eight waterbird species regularly occur in the Coastal Plain (Table 1). Waterfowl and waterbirds generally arrive in late May and June and initiate nests from late May through July (Johnson and Herter 1989; U.S. Fish and Wildlife Service, unpublished data). Waterfowl and waterbirds are an important subsistence resource for local rural residents (summarized in U.S. Fish and Wildlife Service 2015a).

Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution for the Coastal Plain unreliable. In 2015, a ground survey conducted across most Arctic Refuge barrier islands found over 800 Common Eider (*Somateria mollissima*) nests (U.S. Fish and Wildlife Service, unpublished data). During fall, Snow Geese occur in large numbers; at times more than 300,000 stage on the Refuge coastal plain prior to fall migration (Garner and Reynolds 1986; Kendall 2006). Post-breeding and molting waterbirds use Coastal Plain lagoons in the fall with over 28,000 Long-tailed Ducks (*Clangula hyemalis*) counted along the Refuge coast in some years (Lysne et al. 2004).

### Shorebirds

Seventeen shorebird species regularly occur on the Coastal Plain (Table 1). Of these, six are listed as high conservation concern by the U.S. Shorebird Conservation Plan Partnership (2016). Shorebirds arrive to the Coastal Plain in mid-May through June (R. Lancot, pers. comm.) with most initiating nests in June, though a small number begin laying eggs in late May and into early July (Saalfeld and Lancot 2015). Brown et al. (2007) conducted surveys of breeding shorebirds during June of 2002 and 2004 and encountered 14 shorebird species and estimated that 230,000 (95-percent CI: 104,000–363,000) shorebirds occupied the Coastal Plain during the breeding season. Species richness and density were typically highest in wetland and riparian habitats. Among wetland plots, densities were highest near the Canning River Delta on the western edge of the Coastal Plain. Shorebirds stage along Coastal Plain river deltas after breeding as they prepare for fall migration to wintering areas in the Americas and Asia (Brown et al. 2012; Churchwell et al. 2018; Taylor et al. 2010; Taylor et al. 2011).

### Raptors

Five raptor species regularly occur on the Coastal Plain (Table 1). Golden Eagles are protected under the Bald and Golden Eagle Protection Act. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995). Some Snowy Owls (*Bubo scandiacus*) winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (*Falco peregrinus*), Rough-legged Hawks (*Buteo lagopus*), and Short-eared Owls (*Asio flammeus*), arrive to the Arctic and initiate nesting in May and early June (summarized in Bechard and Swem 2002; Cade 1960; Pitelka et al. 1955).



## Landbirds

Ten landbird species regularly occur on the Coastal Plain (Table 1). Three are considered permanent residents: Willow Ptarmigan (*Lagopus lagopus*), Rock Ptarmigan (*L. muta*), and Common Raven (*Corvus corax*) (U.S. Fish and Wildlife Service 2015).

**3.2.4 Table 1.** List of 57 fairly common, common, and abundant breeding and nonbreeding bird species for the coast, inland, and barrier island and lagoon regions of the Coastal Plain of the Arctic National Wildlife Refuge, Alaska from Pearce et al. (2018). Source references used are: 1. Garner and Reynolds 1986; 2. Garner and Reynolds 1987; 3. Brown et al. 2007; 4. Dau and Bollinger 2009; 5. U.S. Fish and Wildlife Service 2015; 6. Kendall 2005; 7. U.S. Fish and Wildlife Service 2008; 8. IUCN 2017; 9. Warnock 2017; 10. U.S. Shorebird Conservation Plan Partnership 2016. Generalized categories of abundance were used by most references since few quantitative surveys have been conducted in the 1002 Area. For Dau and Bollinger (2009), we did not include species with less than or equal to 15 average sightings per year (see table 2). In cases where habitat area is given as “coastal plain” by a reference, both coast and inland areas are included. Abbreviations: B, breeding, NB, non-breeding, LC, least concern, MC, moderate concern, HC high concern.

Commented [CMA15]: No table 2

Species	Region of Coastal Plain			Reference	Birds of Conservation Concern (2008) <sup>7</sup>	IUCN Status (2017) <sup>8</sup>	Audubon Watchlist (2017) <sup>9</sup>	Shorebird Conservation Plan Status List (2017) <sup>10</sup>
	Coast	Inland	Barrier Islands and Lagoons					
Greater White-fronted Goose ( <i>Anser albifrons</i> )	NB	NB		1, 2, 5		LC		
Snow Goose ( <i>Anser caerulescens</i> )	NB	NB		1, 2, 5		LC		
Brant ( <i>Branta bernicla</i> )	B, NB		NB	1, 2, 4		LC	Yellow	
Cackling Goose ( <i>Branta hutchinsii</i> )	B, NB	B, NB		1, 2, 5		LC	Yellow	
Tundra Swan ( <i>Cygnus columbianus</i> )	B, NB	B, NB		1, 2, 5, 6		LC		
American Wigeon ( <i>Mareca americana</i> )	NB			1		LC		
Northern Pintail ( <i>Anas acuta</i> )	B, NB	B, NB	NB	1, 2, 4, 5		LC		
Greater Scaup ( <i>Aythya marila</i> )	NB		NB	1, 4		LC	Red	



King Eider ( <i>Somateria spectabilis</i> )	B, NB		NB	2, 4, 5		LC	Yellow	
Common Eider ( <i>Somateria mollissima</i> )	NB		B, NB	1, 2, 4, 5, 6		Near Threatened		
Surf Scoter ( <i>Melanitta perspicillata</i> )			NB	1, 4		LC	Declining	
White-winged Scoter ( <i>Melanitta fusca</i> )	NB		NB	4, 5, 6		LC		
Long-tailed Duck ( <i>Clangula hyemalis</i> )	B, NB	B	NB	1, 2, 4, 5, 6		Vulnerable	Declining	
Red-breasted Merganser ( <i>Mergus serrator</i> )	NB	B	NB	1, 2, 4, 5, 6		LC		
Willow Ptarmigan ( <i>Lagopus lagopus</i> )	B, NB	B, NB		1, 2, 5		LC		
Rock Ptarmigan ( <i>Lagopus muta</i> )	B, NB	B, NB		1, 2, 5		LC		
Sandhill Crane ( <i>Antigone canadensis</i> )	NB			2		LC		
Black-bellied Plover ( <i>Pluvialis squatarola</i> )	NB			1, 2, 5		LC		MC
American Golden-plover ( <i>Pluvialis dominica</i> )	B, NB	B, NB		1, 2, 3, 5		LC	Red	HC
Semipalmated Plover ( <i>Charadrius semipalmatus</i> )		B, NB		2, 5		LC		LC
Upland Sandpiper ( <i>Bartramia longicauda</i> )		B		5	X	LC		LC
Whimbrel ( <i>Numenius phaeopus</i> )		NB		2	X	LC	Yellow	HC
Ruddy Turnstone ( <i>Arenaria interpres</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Stilt Sandpiper ( <i>Calidris himantopus</i> )	B, NB	B		1, 2		LC	Declining	LC



Sanderling ( <i>Calidris alba</i> )	NB			2		LC	Declining	MC
Dunlin ( <i>Calidris alpina</i> )	B, NB	B		1, 2, 3	X	LC	Red	HC
Baird's Sandpiper ( <i>Calidris bairdii</i> )	B	NB		1, 2		LC		LC
Buff-breasted Sandpiper ( <i>Calidris subruficollis</i> )	B	B		1, 2	X	Near Threatened	Red	HC
Pectoral Sandpiper ( <i>Calidris melanotos</i> )	B, NB	B, NB		1, 2, 3, 5, 6		LC	Red	HC
Semipalmated Sandpiper ( <i>Calidris pusilla</i> )	B, NB	B, NB		1, 2, 3, 5		Near Threatened		HC
Western Sandpiper ( <i>Calidris mauri</i> )	NB			1, 2		LC	Yellow	MC
Long-billed Dowitcher ( <i>Limnodromus scolopaceus</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Red-necked Phalarope ( <i>Phalaropus lobatus</i> )	B, NB	B		1, 2, 3, 5		LC	Declining	MC
Red Phalarope ( <i>Phalaropus fulicarius</i> )	B, NB	B, NB		1, 2, 3, 5		LC		MC
Pomarine Jaeger ( <i>Stercorarius pomarinus</i> )	B, NB	B, NB		1, 2, 5		LC		
Parasitic Jaeger ( <i>Stercorarius parasiticus</i> )	NB	NB		1, 2, 5		LC		
Long-tailed Jaeger ( <i>Stercorarius longicaudus</i> )	B, NB	B, NB		1, 2, 5		LC		
Glaucous Gull ( <i>Larus hyperboreus</i> )	B, NB	NB	B, NB	1, 2, 4, 5, 6		LC		
Arctic Tern ( <i>Sterna paradisaea</i> )	NB	NB	B	1, 2, 5, 6	X	LC	Declining	



Red-throated Loon ( <i>Gavia stellata</i> )	B, NB		NB	1, 2, 4, 5, 6	X	LC	Declining	
Pacific Loon ( <i>Gavia pacifica</i> )	B, NB	B, NB	NB	1, 2, 4, 5, 6		LC	Declining	
Yellow-billed Loon ( <i>Gavia adamsii</i> )	NB		NB	2	X	Near Threatened	Red	
Rough-legged Hawk ( <i>Buteo lagopus</i> )	NB	NB		2		LC		
Golden Eagle ( <i>Aquila chrysaetos</i> )	NB	NB		1, 2, 5		LC		
Snowy Owl ( <i>Bubo scandiacus</i> )	B, NB	B, NB		1, 2, 5		Vulnerable	Red	
Short-eared Owl ( <i>Asio flammeus</i> )	B	B		1, 2, 5	X	LC	Declining	
Peregrine Falcon ( <i>Falco peregrinus</i> )	NB			2	X	LC		
Common Raven ( <i>Corvus corax</i> )		NB		2		LC		
Eastern yellow Wagtail ( <i>Motacilla tschutschensis</i> )	B	B, NB		1, 2, 5		LC		
Common Redpoll ( <i>Acanthis flammea</i> )	B	B		1, 2, 5		LC		
Hoary Redpoll ( <i>Acanthis hornemanni</i> )	B	B		1, 2, 5				
Lapland Longspur ( <i>Calcarius lapponicus</i> )	B	B		1, 2, 5		LC	Declining	
Snow Bunting ( <i>Plectrophenax nivalis</i> )	B	B	B, NB	5, 6		LC	Declining	
American Tree Sparrow ( <i>Spizelloides arborea</i> )		B		1, 2, 5		NA	Declining	
Savannah Sparrow ( <i>Passerculus sandwichensis</i> )	B	B		1, 2, 5		LC	Declining	



White-crowned Sparrow ( <i>Zonotrichia leucophrys</i> )		B		1		LC	Declining	
--	--	---	--	---	--	----	-----------	--

## Bird References

- Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (*Buteo lagopus*). in A. F. Poole, and F. B. Gill, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Brown, S., J. Bart, R. B. Lanctot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the arctic national wildlife refuge. The Condor 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. Waterbirds 35:546-554.
- Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. University of California Publications in Zoology 63:151-290.
- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of beaufort sea deltas by hatch-year semipalmated sandpipers. Estuaries and Coasts 41:280-292.
- Dau, C. P., and K. S. Bollinger. 2009. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 1-5 July 2009.
- Garner, G. W., and P. E. Reynolds. 1987. 1985 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Garner, G. W., and P. F. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. Final report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*). in P. G. Rodewald, editor. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. in.
- Johnson, S., and D. Herter. 1989. The birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage, AK.
- Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, 2003-2004. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge.
- Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). in A. F. Poole, and F. B. Gil, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002-17. U.S. Geological Survey. Report 2331-1258.



- Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. *The Condor* 57:3-18.
- Saalfeld, S. T., and R. B. Lanctot. 2015. Conservative and opportunistic settlement strategies in Arctic-breeding shorebirds. *The Auk* 132:212-234.
- Stehn, R. A., W. W. Larned, and R. M. Platte. 2013. Analysis of aerial survey indices monitoring waterbird populations of the Arctic Coastal Plain, Alaska, 1986-2012. USFWS, Migratory Bird Management, Anchorage and Soldotna.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, F. Huettmann, D. A. Nigro, and S. J. Kendall. 2010. Distribution and community characteristics of staging shorebirds on the northern coast of Alaska. *Arctic* 63:451-467.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, S. J. Kendall, and D. A. Nigro. 2011. Residence time and movements of postbreeding shorebirds on the northern coast of Alaska. *The Condor* 113:779-794.
- U.S. Fish & Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. U.S. Fish and Wildlife Service.
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- U.S. Shorebird Conservation Plan Partnership. 2016. Shorebirds of Conservation Concern in the United States of America — 2016. Pages 12 *in* B. Andres, editor. U.S. Shorebirds of Conservation Concern — 2016. U.S. Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska.
- Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.



## Terrestrial Mammals

### Caribou

Caribou (*Rangifer tarandus*) are the most abundant large mammal in Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for brown bears and wolves. Caribou have been present in northeastern Alaska and the northern Yukon since the early Pleistocene. Human use of caribou in the region may date back thousands of years. Remnants of caribou fences and corral structures used by the Gwich'in people are found throughout the current southern range of the Porcupine caribou herd (Warbelow et al. 1975).

Large caribou herds tend to migrate over long distances using seasonally available forage resources that are often widely distributed. Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators. In the Arctic, caribou reproduction is highly synchronous and the majority of calving occurs in a two- to three-week period. Most adult females give birth to a single calf. Caribou calves are precocious, being able to stand and nurse within one hour after birth and follow their mothers within a few hours. The first 24 hours of life are critical, when a behavioral bond is formed between the calf and its mother. Disturbance of maternal groups on the calving grounds may interfere with bond formation and can increase calf mortality. After calving, small bands of cows with newborn calves gradually merge into larger groups and are joined by yearlings, barren females, and bulls arriving from wintering areas.

Summer weather conditions promote the emergence of mosquitoes, nose bots, warble flies, and other biting insects. Insect harassment drives caribou into densely packed groups. These post-calving aggregations often move toward the Arctic coast or to higher elevations in the mountains to find relief from insects. By August, large aggregations gradually disperse into widely interspersed smaller groups that move progressively toward winter ranges. Breeding takes place in late fall, and by mid-November, caribou arrive in areas where they will spend the winter.

Four caribou herds live in northern Alaska. Two of these, the Porcupine and Central Arctic herds, consistently use Arctic Refuge seasonally or throughout the year. In addition, some caribou from the Teshekpuk herd occasionally use the Arctic Refuge during winter. Caribou would be most susceptible to interaction and potential disturbance from winter exploration activities during their spring migration to calving grounds within the Arctic Refuge coastal plain and for those that overwinter in that area.

### Porcupine Caribou Herd

The Porcupine caribou herd ranges over 130,000 square mi (337,000 square km) of wild lands in northeastern Alaska and northwestern Canada (Lenart 2007). Porcupine caribou are an important resource used by residents of Arctic Village, Venetie, Stevens Village, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Many visitors come to Arctic Refuge during early summer with hopes of seeing large numbers of caribou.

During the 1960s and 1970s, the Porcupine caribou herd was thought to be relatively stable at about 100,000 animals. Herd numbers increased after 1978, peaked at 178,000 in 1989, and then declined to 123,000 caribou in 2001 (Lenart 2007). Between 2002 and 2009, no estimates of abundance were

**Commented [CMA16]:** This is one of the few places we talk about effects – is that appropriate here? Are we supposed to be addressing both affected environment and environmental consequences or is the consultant writing the environmental consequences section?



available. During this period, caribou left the coastal plain and northern foothills of Arctic Refuge earlier and did not form large post-calving aggregations, or weather conditions precluded flights to photograph groups. In 2010, 169,000 caribou were counted in a photo-census of the Porcupine caribou herd (Caikoski 2011). From 2013 to 2017 the population size was the largest observed for his herd since monitoring began in 1977, with an estimated population of 197,000 in 2013 and 218,000 in 2017 (Alaska Department of Fish and Game, 2017b).

The Porcupine herd migrates hundreds of miles from wintering grounds south of the Brooks Range to give birth on the coastal plain and northern foothills of Arctic Refuge and nearby Yukon Territory in Canada. The entire Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou (Griffith et al. 2002). Foothills and mountains of Arctic Refuge are also important summer, fall, and winter habitats, as well as spring and fall migration routes. As the summer progresses and willows (*Salix* sp.) emerge, caribou also use riparian habitats. The Porcupine caribou herd generally overwinters south of the Brooks Range in Arctic Refuge and in the Richardson and Ogilvie mountains of the Yukon Territory, Canada. Winter distribution varies by year but is primarily south of the Brooks Range (Caikoski 2011).

Spring migration to calving grounds begins in mid-April and continues through May. Pregnant caribou move northward from wintering areas toward calving grounds, where they give birth during the first week in June. Timing and routes of migration vary annually depending on where the caribou overwintered, snow conditions, and timing of the onset of spring weather. Caribou wintering in Alaska often follow a northeasterly route to the Arctic coast, crossing the southern flanks and valleys of the Brooks Range, eventually entering Canada near the Firth River and following it to the coast. Caribou wintering in Canada also converge in this region. In many years, migrating caribou then move westward along the coast to calving grounds within the Arctic Refuge, although some calving often occurs in the northern Yukon. Some caribou wintering in Alaska move in a more northerly direction, crossing the eastern Brooks Range and traveling more directly toward the Arctic coast.

Since intensive monitoring began in 1983, the Porcupine caribou herd has calved in a region extending from the northern foothills of the Brooks Range to the Arctic coast and from the Canning River in Arctic Refuge to the Babbage River in Canada, an area of nearly 8.9 million acres (Griffith et al. 2002). During the calving season in early June, Porcupine caribou selected areas of wet sedge, herbaceous tussock tundra and riparian vegetation types (Griffith et al. 2002). Emerging tussock cotton grass (*Eriophorum vaginatum*) flowers were an important source of high quality forage in areas used by calving caribou (Jorgenson et al. 2002). This plant species had greater biomass and forage quality in tussock tundra compared with other vegetation types. The distribution of tussock tundra and moist sedge-willow tundra was greater in calving areas in the Arctic Refuge coastal plain than in areas further south and east (Jorgenson et al. 2002).

### **Central Arctic Caribou Herd**

The annual range of the Central Arctic caribou herd overlaps that of the Porcupine caribou herd. Two main calving concentration areas have been identified for the Central Arctic caribou herd: a western area



between the Kuparuk and Colville rivers, and an eastern area between the Sagavanirktok and Canning rivers. The eastern area includes the Canning River delta region in northwest Arctic Refuge.

During most winters, scattered groups of animals range throughout the coastal plain west of the Katakaturuk River and adjacent uplands to the south. Between 2002 and 2009, the winter distribution of the Central Arctic caribou included areas both north and south of the Brooks Range in Arctic Refuge. In some years, this herd mixed with Porcupine caribou wintering in the same region. In 2010, almost all Central Arctic caribou wintered on the south side of the Brooks Range in Alaska, as did Porcupine caribou.

This herd was estimated at about 5,000 caribou in the mid-1970s when it was first identified as a distinct herd (Cameron and Whitten 1979). The herd grew to almost 13,000 by the early 1980s and over 25,000 by the late 1990s (Cameron et al. 2002). A photo-census in 2010 counted more than 70,000 caribou in the Central Arctic herd, but a late spring in 2013 resulted in high mortality and the population dropped to 50,000 animals (Alaska Department of Fish and Game 2017a). By 2016 the population estimate had decreased an additional 50 percent, to less than 23,000 caribou. The declines are attributed to high adult female mortality and loss of individuals to other herd units during mixing of the Central Arctic, Teshekpuk and Porcupine caribou herds.

#### **Mammal Species other than Caribou**

As established by ANILCA, one purpose of the Arctic Refuge is to “conserve fish and wildlife populations and habitats in their natural diversity.” Among the wildlife species specifically mentioned under this purpose are Dall’s sheep, muskoxen, moose, brown bear, wolf, wolverine, and caribou.

Dall’s sheep do not occur on the Coastal Plain, but are found in the Brooks Range Mountains to the south, where the species reaches its northernmost geographic extent. The eastern Sadlerochit Mountains, near the southern border of the Arctic Refuge coastal plain, contains habitat suitable for sheep, and the species has occasionally been seen there. Sheep are sensitive to disturbance from noise and aircraft traffic, particularly during the lambing season (mid to late May). Dall’s sheep populations throughout the Brooks Range peaked during the 1980s, declined steeply during the early 1990s (most likely due to adverse weather), increased slowly through approximately 2011, then declined again during 2012-2014 in association with a series of severe winters. Surveys during 2015-2017 suggested that lamb production and survival were relatively high, and the population may once again be increasing.

Populations of both muskoxen (*Ovibos moschatus*) and moose (*Alces alces*) have experienced marked changes over the last several decades. Muskoxen were reintroduced to the coastal plain in the Arctic Refuge in 1969 and 1970. The population subsequently grew through about 1985, then remained relatively stable for the next decade. Beginning in 1998, however, muskox numbers within the refuge dropped dramatically and have remained very low ever since. The overall muskox population in northeast Alaska and northwest Canada peaked in 1993, declined through 2006, and has remained relatively stable since then. Most of that decline was due to population losses from the Arctic Refuge. Today, most of the muskoxen in the area are either west or east of the Arctic Refuge (U.S. Fish and Wildlife Service 2015a). Female muskoxen do not typically breed until they are 4 or 5 years old, most



only breed every other year (or less frequently), and produce a single calf. Muskoxen subsist on generally low quality forage in winter, and to compensate, they conserve energy by reducing their winter activity. Calves are born between mid-April and mid-May, 4 to 6 weeks before snowmelt and the onset of growth of nutritious forage. As a result, late winter is a time of high vulnerability (U.S. Fish and Wildlife Service 2015a).

Moose distribution on the Coastal Plain is largely confined to patches of woody vegetation along streams during winter, but some of these moose spread out across the Coastal Plain during summer. Moose populations in northeast Alaska, including the Arctic Refuge, increased rapidly during the 1980s. This was followed by a decline of at least 50% from 1989 to 1994, leading to harvest closures. By the early 2000s, moose populations west of the refuge had started to increase, and by 2015 there was some indication that moose were beginning to increase within drainages along the northwestern part of the Refuge. However moose continue to occur at low density east of the Canning River on the coastal plain and in the northern foothills of the Refuge. Because of concerns about the small population size, harvest restrictions have been maintained (U.S. Fish and Wildlife Service 2015a).

Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Grizzly bear abundance on the coastal plain varies seasonally, with highest densities occurring during early summer, when caribou are present. Throughout the Arctic, grizzly bears have low rates of reproduction. They do not reproduce until they are approximately 9 years of age in the Arctic Refuge, average litter size is 2, bear cubs experience high first-year mortality, and the interval between successful litters is greater than 3 years. Bears emerge from their dens from late March through May. Females with cubs usually emerge later than adult males (U.S. Fish and Wildlife Service 2015a, 2015b). The den emergence period overlaps the late operation and entire demobilization phases of winter exploration activities. Human-bear conflicts would be possible at this time as recently-emerged and hungry bears are ranging widely in search of early spring food.

**Commented [CMA17]:** Another instance of talking about possible effects

Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Where both species occur, red foxes have been observed killing arctic foxes. Studies in Scandinavia suggest that red foxes may outcompete arctic foxes and may be the cause of declining arctic fox populations in some areas. The principal prey of both species during summer includes a variety of small mammals and ground nesting birds, but particularly brown and collared lemmings. Lemming populations in the Arctic cycle in abundance, with large peaks in abundance occurring approximately every 4 years, and arctic fox abundance generally cycles in response to changes in lemming abundance. There is evidence from Scandinavia and Utqiagvik, Alaska, that the magnitudes of these cycles have been reduced in recent years in association with a warming climate. Reduction or elimination of fox population cycles is predicted to have negative effects on alternate prey species, such as ground-nesting birds. In addition, provision of supplemental food, such as garbage, is likely to increase fox abundance near industrial infrastructure, and this may reduce survival of some ground nesting bird species. On the Alaskan North Slope, arctic foxes have a high incidence of rabies, but little is known about the relationship between disease and fox population dynamics or the potential for rabies to spread to other species.



Little is known about the abundance, distribution, and species composition of small mammal communities in northeastern Alaska. The limited small mammal surveys that have been carried out have identified at least one species, the holarctic least shrew, that until relatively recently was unknown in North America. Maintaining populations of rare, endemic species will require identifying their current distributions, habitat requirements, and sensitivity to disturbance. Of the more common species, arctic ground squirrels have a patchy distribution in the Arctic Refuge coastal plain because denning habitat is limited by a lack of well drained soils. In areas where ground squirrels occur, they are an important source of food for foxes, bears, wolves, wolverines and weasels. Microtine rodents, particularly brown lemmings, are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many species including bears, wolves, foxes, and wolverines in years when they are abundant. Extreme fluctuations in population abundance affect the abundance and distribution of lemming predators as well as predation on other species such as ground nesting birds.

### Terrestrial Mammal References

- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Caikoski, J.R. 2011. Units 25A, 25B, 25D and 26C caribou [Porcupine Herd]. Pp. 251-270 in P. Harper (ed.), Caribou management report of survey-inventory activities 1 July 2008-30 June 2010. Juneau, AK: Alaska Department of Fish and Game, Division of Wildlife Conservation.
- Cameron, R.D., and K.R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. *Journal of Wildlife Management* 43(3):626-33.
- Cameron, R.D., W.T. Smith, R.G. White and B. Griffith. 2002. The Central Arctic Caribou Herd. Pp. 38-45 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Jorgenson, J.C., M.S. Udevitz and N.A. Felix. 2002. Forage quantity and quality. Pages 6-50 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 in Harper, editor. Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact statement, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.

Warbelow, C., D. Roseneau, and P. Stern. 1975. The Kutchin caribou fences of northeastern Alaska and the Northern Yukon. In R.D. Jakimchuk, editor. Studies of large mammals along the proposed Mackenzie Valley Gas Pipeline Route from Alaska to British Columbia. Arctic Gas Biological Report Series. Volume 32. Renewable Resources Consulting Services, Canadian Arctic Gas Study, Limited, and Alaska Arctic Gas Company, Calgary, Alberta, Canada.

## Subsistence

Section 803 of ANILCA defines subsistence uses as: “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible by-products of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade” (16 U.S.C. § 3113).

Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes due to their close proximity within or adjacent to the Refuge boundaries (U.S. Fish and Wildlife Service 2015a, 2015b). Residents of Arctic Village, a Gwich'in community, and Kaktovik, an Inupiat community, use the Refuge most frequently. The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010).

Not only are subsistence opportunities critical to the cultural identities of these communities, the resources gained provide needed sustenance for residents. There are few year-round employment opportunities and food costs are high due to the cost of air transportation. Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl and fish return to the Refuge and coastal plain in abundance for another season.

Although both Arctic Village and Kaktovik rely heavily on the Refuge for subsistence resources, the resources used are significantly different. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys come primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on this resource, the Gwich'in people consider the Porcupine caribou herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988).

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea. The Kaktovikmiut's way of life continues to be heavily dependent on subsistence harvest of marine and



terrestrial animals and fish. Kaktovik bowhead whaling occurs only in the fall from late August to early October, when the whales migrate close to shore, because the spring migration passes too far offshore for hunts to occur. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35-68).

In addition to whales, Kaktovik residents also harvest a considerable number of Dall sheep and caribou, which contribute 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resource. Inland coastal areas are also accessed by walking, or to a limited extent by ATV use on private Kaktovik Inupiat Corporation lands.

**Demographic Characteristics** of the Communities near Arctic Refuge (derived from data in U.S. Fish and Wildlife Service. 2015a).

<b>Demographic Characteristic</b>	<b>Arctic Village</b>	<b>Chalkyitsik</b>	<b>Cold-foot</b>	<b>Fort Yukon</b>	<b>Kaktovik</b>	<b>Venetie</b>	<b>Wise-man</b>	<b>Prudhoe Bay</b>
Overall 2010 Census Population	152	69	10	583	239	166	14	2174
American Indian and Alaska Native	135	59	1	520	212	152	0	163
White	7	10	9	45	24	3	13	1804
Two or more races	10	0	0	10	3	10	1	41
Other races	0	0	0	8	0	1	0	166
Median age	29	27.5	43	33.7	30.5	30.5	28.5	50

**Commented [CMA18]:** Seems a little odd to present some of this data without talking about its relationship to subsistence – which is the subject of this section



Median household income	\$27,250 +/- \$9,667	\$38,750 +/- \$16,617	N/A	\$33,194 +/- \$7,432	\$58,125 +/- \$33,478	\$28,333 +/- \$21,379	N/A	94,906 +/- 11,207
<b>Employment in 2016</b>								
Employed (#)	87	48	11	266	125	103	5	1978
Employed in the Private Sector (#)	14	6	9	113	41	23	5	1978
Employed in local and/or state government (#)	73	42	2	153	84	80	0	0
Employed in all 4 Quarters (#)	31	27	9	138	93	40	0	1891

### Subsistence References

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaf.edu/pages/scientific.html>. Accessed July 27, 2012
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution). <http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



## Recreation

Management Guidance: Preserving unique recreational values currently found in the Coastal Plain is one of the original purposes of the Arctic National Wildlife Refuge, and an extensive body of sources provide the context for interpreting these recreational values (U.S. Fish and Wildlife Service 2015). This purpose encompasses a range of composite values allowing experiences unique on a national scale, including natural conditions (where plant and animal species and communities or biophysical processes had previously not been altered); and undeveloped setting characteristics (where immersion in an untrammeled landscape free from modern human manipulation remains). This, paired with the Refuge's extreme remoteness and wild character, provide a degree of physical and psychological separation from the reminders of modern civilization unsurpassed anywhere on American soil, and insure areas where enjoyment is earned through effort.

The Refuge's recreational management prioritizes maintaining opportunities to experience a sense of freedom, exploration, and discovery; and to encounter challenge, and experience true independence and self-reliance. According to the Arctic National Wildlife Refuge visitor study summary (Christensen 2009), the greatest positive influence on visits came from experiencing the components of "Wilderness" (92%), "A Sense of Vastness" (92%), "Remoteness and Isolation" (89%), "A Sense of Adventure" (84%), and "Natural Conditions" (84%). The Refuge purposes most frequently rated as "Very Important" were "Wildlife" (97%), "Wilderness" (96%), "A bequest to future generations" (89%), "Remoteness and isolation" (89%), and "A place where natural processes continue" (86%).

The Coastal Plain is located on lands within Alaska Department of Fish and Game (ADF&G) Game Management Unit (GMU) 26C. ADF&G regulates the hunting and fishing seasons, licenses, and bag limits. Nonresident brown bear and Dall sheep hunters must be accompanied in the field by a big game guide authorized to operate in the area. There are two registration brown bear hunting seasons in GMU 26C. Caribou hunting is open year round. Fishing season is open year-round, but limits have been set by species for lakes and flowing or salt waters.

Visitors from around the state, nation, and world recreate in the Coastal Plain, but so do subsistence users (Alaska Federation of Natives 2010), as well as do local residents that are not subsistence users as defined by Section 803 of ANILCA. While the latter groups are not considered visitors, they are mentioned in this section because they are also recreational users.

Activities: Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. More recently, shoulder season activities such as polar bear viewing, kite-skiing/boarding, and aurora viewing are also enjoyed. Occasionally, non-resident snow machine expeditions travel across the Coastal Plain, originating from the pack ice north of the Dalton Highway prohibition area, and anecdotal reports have been submitted of fat-tire biking expeditions.

The majority of visitors float rivers north from the Brooks Range Mountains or view polar bears from the Refuge's coastal lagoon waters immediately surrounding Kaktovik; while hiking/backpacking, and hunting/fishing comprise a smaller portion of the predominant visitor activities. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the



Marsh Fork-Canning, Main Stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen. The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. More than half of the commercially-supported visitation is guided (U.S. Fish and Wildlife Service 2011).

Detailed commercial use reporting, visitor registration/field contacts, and regular visitor use monitoring have not been conducted. Information about current characteristics of visitor use (amount, type, timing, and distribution of visitor activities and behaviors); and visitor experiences (perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area), are very limited. Generally, what is understood comes from the required reports of commercial motorboat and air operators (including hunt guides), and reports show commercially-supported visitor use has been low in numbers and dispersed geographically.

Access: Most visitors engaged in recreation away from Kaktovik within the Coastal Plain use small, fixed-wing aircraft for access. Motorized and non-motorized boats, as well as foot-based access methods are also commonly used. Recreational snowmachine use is occasional but increasing. Adequate snow cover to prevent resource damage is required for allowable snow machine access. Very occasionally, visitors experience helicopters, but helicopters are not used for recreational access. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated.

Visitor Use Numbers: Visitation to the Coastal Plain for traditional recreational activities has generally remained stable since the late 1980s, averaging around 1000 visitors annually (the calculated average of annual total known visitation between 2001 and 2009 was 1,126 people). Where locations are known, about 77% of overall commercially-supported visitation occurs north of the Brooks Range. The North Slope river drainages most commonly visited include the Kongakut River (21%), Canning River (Marsh Fork-Canning: just over 8%; Main Stem-Canning: over 4%), Hulahula River (just under 9%), and Jago River (5 %) (U.S. Fish and Service 2011).

While overall use for traditional activities has remained stable, the recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. In 2010, the Refuge formalized a commercial recreational guide polar bear viewing program on Refuge waters in response to interest from local business to offer these services (see submerged lands section for more information about Refuge jurisdiction over surface activities on coastal lagoons).

In addition to the stable estimate of visitor use numbers for traditional activities, it is now estimated that in 2015 and 2016, the polar bears around Kaktovik experienced approximately 2,500 views<sup>[7]</sup> by clients and guides taking part in commercially-operated water-based polar bear viewing (U.S. Fish and Wildlife Service 2017). These estimated views were made by an average of just over 42 viewers per day during an approximately 60-day viewing season in late August to early October (viewers includes clients and

Commented [CMA19]: Footnote a result of cut and paste?



guides). Visitor use from polar bear viewing tourism increased rapidly between 2011 and 2015, but may be reaching a stable level since 2015 because of the somewhat static availability of regularly-scheduled commercial flights, visitor housing and authorized boat guides. Still, the number of bear views per day has been increasing, indicating that operators are clustering their services around a core viewing season and taking an increasing number of trips each day. The increasing numbers of viewers (clients and guides) per day each season, with the average trip length remaining fairly constant, indicates the average number of hours spent daily on water by all guides combined has steadily increased. Since 2011, viewing has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017).

No visitor use numbers are known for the reported increases in numbers of spring caribou hunters, fat-tire bikers, snowmachiners, or aurora watchers.

Distribution: Multiple recreation areas/routes of known interest to visitors of the Coastal Plain include: caribou migration viewing June-July including the following unimproved landing areas: Jago Bitty, Lower Marsh Creek, Lower Canning River, Kaktatuiruk River, and Aichilik River; abundant and diverse bird sighting areas in June-July include the Lower Canning and Kaktatuiruk Rivers; routes from the Neruokpuk Lakes Complex through the Arctic Coastal Plain from March until September (includes spring ski touring); routes between the Sadlerochit Mountains and Brown Low Point along the Kaktatuiruk River (includes backpacking and packrafting); kayaking coastal lagoons June-October between the Hulahula and Kongakut River deltas, providing paddling within the Refuge's Marine Protected Area and access to Kaktovik during open water; and expedition-length packrafting routes with resupplies at major river crossings June-September, including Upper Marsh Fork to Kaktovik, Arctic Village to Kaktovik, Neruokpuk Lakes Complex to Kaktovik, and Turner River to Kaktovik.

Trends: There has been a steady increase in the number of commercial permits issued for air taxi operators providing access (as well as commercial filming permits in the Coastal Plain) and demand for recreational use of areas such as the Refuge's pristine night sky environment are expected to continue to increase. A planning effort is underway to ensure that the Refuge provides quality polar bear viewing opportunities that minimize threats to public safety, minimize potential disturbance to polar bears, and minimize conflicts with local residents.

## Recreation References

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom.
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- U.S. Fish and Wildlife Service. 2011. Arctic National Wildlife Refuge public use summary. Arctic Refuge, Fairbanks, Alaska, USA.
- <[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/pureportap2010.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/pureportap2010.pdf). (accessed May 29, 2018).

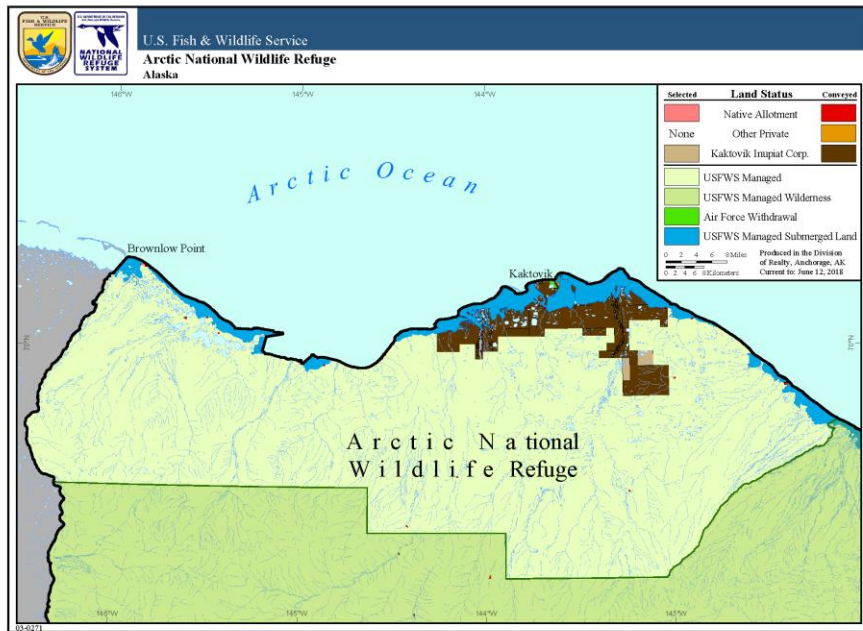


- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).

DRAFT



## Land Status Map





**To:** Karen Clark[karen\_clark@fws.gov]; Greg Siekaniec[greg\_siekaniec@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-06-22T20:53:19-04:00  
**Importance:** Normal  
**Subject:** Draft Affected Environment for Seismic EA for review  
**Received:** 2018-06-22T20:53:37-04:00  
[DRAFT Arctic Refuge Coastal Plain Seismic EA 062218.docx](#)  
[Coastal Plain Seismic EA Affected Environment transmittal.docx](#)  
[Coastal Plain Leasing EIS Affected Environment transmittal.docx](#)

Hi Greg and Karen,

Attached is the draft Affected Environment chapter prepared by FWS staff for the EA being prepared by BLM in response to the incoming seismic application from SAE. On Thursday 6/21/18, SAE presented an overview of their seismic operations to BLM and FWS (myself, Steve B and Joanna) at the BLM Arctic Field Office and provided written responses to the questions that BLM had submitted in order to move forward with SAE's request for a permit. It was reviewed by Mary, Eric and Mitch, while Sara was unavailable.

As the two transmittal memos indicate, this document will also be shared with Nicole Hayes at the BLM State Office for the Leasing EIS also. This should help BLM and their contractor as they begin to draft the Affected Environment section for that document as of 6/20/18.

Thank you,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



# **DRAFT Arctic Refuge Coastal Plain Seismic EA**

## **Chapter 3 Affected Environment**

Prepared by the US Fish and Wildlife Service

June 2018

### **Oil and Gas Resources**

USGS Open File Report 2009-1112 (Attanasi and Freeman 2009) provided an update of the economics of undiscovered oil and gas resources in the North Slope of Alaska, including the Arctic Refuge coastal plain. The study estimated there was a 95% probability the Arctic Refuge coastal plain contained at least 5.92 billion barrels of technically recoverable oil, and a 5% probability the technically recoverable volume of oil could be 15.16 billion barrels. The mean estimate of technically recoverable oil for the Arctic Refuge coastal plain was 10.35 billion barrels. Of this, 80 to 90 % was estimated to be economically recoverable at \$42/barrel. The threshold price to initiate exploration was estimated to be from \$20 to \$21 per barrel. The current price of West Coast crude is around \$75/barrel. The current price of West Texas Intermediate crude is around \$65/barrel. The U.S. Energy Information Agency forecasts the price of crude oil to steadily rise to over \$85 per barrel over the next 10 years (U.S. Energy Information Agency, 2018).

The USGS study projected that oil deposits are expected to occur in 10 areas (rather than a single large accumulation), which would require dispersed drilling sites to develop all the recoverable oil resources. Most of the oil deposits (over 80%) are thought to lie in the western Arctic Refuge coastal plain (eg. in the area known as the “undeformed area” west of the Marsh Creek anticline).

The USGS report did not include estimates related to the production of natural gas from the Arctic Refuge coastal plain.

### **Air Quality**

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, air quality monitoring occurs in the active oil fields of Pt. Thomson, Badami, Endicott and Prudhoe Bay. Data available from these sites confirm that pollutant concentrations in the study area are in compliance with the respective National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAQS) according to the Pt. Thomson EIS (U.S. Department of Defense 2012). With prevailing winds from the northeast, it is likely that air quality on the Arctic Refuge Coastal Plain would generally experience less impacts from existing industrial emissions from development to the west, except during instances when winds come from the west.

### **Climate**

The climate of the Arctic Refuge coastal plain is characterized by short and cool summers, and long, cold winters. The growing season lasts from June to August, although extending earlier and later over time. Subfreezing temperatures and snow may occur at any time during the year. The coastline and barrier



islands experience more frequent cloudiness and fog with high winds. Clear skies are more common, winds are variable, and summers are warmer and less cloudy with increasing distance from the coast. At Barter Island, temperatures average 40 °F in July (warmest month) and -20 °F in February (coldest month) (Table 4–2). Temperatures to the south on the coastal plain and in the northern foothills of the Brooks Range are more similar to those measured at weather stations at Kuparuk and Toolik Lake, ranging from means of 47 to 53 °F in July and -18 to -6 °F in February.

Snowfall measurements date back to 1949 on Barter Island, but the monitoring site was taken out of service in 1989, resulting in a discontinuous record of snow climatology. In 2000, three meteorological stations were established (Urban and Clow 2017) as part of the Global Terrestrial Network for Permafrost (DOI/GTN-P) in remote parts of the Arctic National Wildlife Refuge coastal plain. The limited data available from these stations are the only modern continuous record of snow accumulation in this region of Alaska. The average annual water equivalent of all precipitation is less than 10 inches, most of which falls as summer rainfall, but includes 32 to 46 inches of snowfall. Evaporation rates are low due to low temperatures and a short growing season. The length of the snow season impacts the timing of winter exploration activities as well as the breeding phenology of flora and fauna. In addition, the snowpack in the Brooks Range, and glacier mass, affect water availability in rivers and lakes for fish and wildlife habitat, as does the presence of frozen masses of emergent groundwater known as *aufeis*.

Surface winds along the Arctic coast average 9 to 15 miles per hour (mph), with occasional intense storms generating winds exceeding 70 mph. Winds are predominantly from the northeast, although the strongest winds come from the west. September and October are the windiest months on the coast, probably due to maximum amounts of open water (Wendler et al. 2010). During winter, winds are a major force affecting the distribution and amount of snow cover on the coastal plain. Higher, rolling terrain is often blown clear, or nearly so, while dense snow drifts accumulate in sheltered areas along stream banks.

## **Water Resources**

Ninety-nine percent of the Arctic Refuge coastal plain is considered wetlands; however, lakes are scarce and account for less than two percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre, and ninety percent are less than 12 acres. During winter, most waterbodies on the Arctic Refuge coastal plain freeze solid as they are typically not as deep as the depth of freeze (approximately 7 ft; Trawicki et al. 1991; Lyons and Trawicki 1994). Small pockets of unfrozen water occur in lakes with depths that exceed ice growth. By the end of the winter season, the volume of liquid water in these lakes has been estimated to be reduced by ninety-eight percent (Craig 1989b). Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. Up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer (Bowling et al. 2003), with the remainder coming from direct precipitation.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During



winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed reaches. During spring, snowmelt begins in the foothills and proceeds to the coastal plain providing as much as 50% of the annual flow to rivers (Clough et al. 1987, Sloan 1987).

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a). Spring systems on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakaturak springs.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), waters are considerably less salty and much warmer than sea water.

## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented and all are characterized by a cold temperature regime: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristsels, Typic Haplogelepts, and Typic Histoturbels (Soil Survey Staff 2014, 2016). Soil texture varies across topographic features. Uplands slope gently northward and are generally composed of silt, rocky silt and peat with some glaciated uplands containing a broader range of particle sizes. Lowlands such as the plains and floodplains have coarser textured soils composed of sand, gravel and peat. The majority of uplands are located in the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, uplands are primarily located along the southern boundary and extend approximately one-third of the way to the coast.

Permafrost is any soil that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces on the north slope and as much as 88% of the Arctic Refuge Coastal Plain is underlain by ice rich permafrost (>50% water). Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Permafrost on the coastal plain is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of



permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain, the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). Nearly all the biological activity in soils takes place within the active layer and it is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018).

## Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west. The varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

The three major ecoregions in the Arctic Refuge coastal plain are the coast, coastal plain, and foothills. The coast has bays and inlets, lagoons with barrier islands, exposed peat bluffs, drained breached lake basins, and deltas. The Beaufort Coastal Plain ecoregion is a smooth treeless plain rising gradually from the Arctic Ocean to the foothills of the Brooks Range. This ecoregion is mainly undulating coastal plains and vast floodplains, with a small proportion of thaw lake plains. The dominant vegetation along the coast and within the coastal plain is mainly Moist sedge-willow or Moist sedge-Dryas tundra; however, salt marshes are found in coastal depressions along the coast while wet graminoid occupy basins on the coastal plain. Permafrost-related features include extensive networks of ice-wedge polygons, beaded streams, oriented lakes, peat ridges, and frost boils. On the southern end of the Arctic Refuge coastal plain, the Brooks Range Foothills ecoregion has rolling hills and plateaus, with better defined drainages and fewer lakes than in the Coastal Plain. The foothills reach north all the way to the coast along 10 miles of the coast in the western half of the Arctic Refuge coastal plain. Permafrost features are common. Vegetation in the foothills is mainly Moist tussock tundra. There are few if any known non-native or invasive species within the coastal plain.

## Fisheries

The Arctic Refuge coastal plain hosts few species of fish due to limited availability of freshwater habitats. Common species present in freshwater lakes and rivers within the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*,



burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius*. Round whitefish and burbot are present in the Canning River, but nowhere else in the Arctic Refuge coastal plain (Früge and Palmer 1994). Dolly Varden occur as two forms: anadromous populations that rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; and dwarf populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs (Craig and McCart 1974; Früge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

The lagoons are very productive environments for marine and anadromous species during summer. Lagoons become hypersaline and very cold environments under ice. As winter approaches and the lagoons begin freezing, anadromous fishes return to freshwater and marine fishes retreat to offshore environments. Common anadromous species that occur in the nearshore marine environments adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, and rainbow smelt *Osmerus mordax* (Craig 1984; Früge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Arctic cisco, broad whitefish, humpback whitefish, least cisco, and rainbow smelt feed along the coast but have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species are thought to be strays from southern Chukchi or northern Bering Sea populations (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009).

While there are numerous marine species in the Beaufort Sea, only four are abundant in the nearshore marine environments adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species migrate along shore in the southern Beaufort Sea, marine species migrate towards shore during summer and away from shore during winter (Craig 1984).

## Birds

The Arctic Refuge Coastal Plain and adjacent marine waters are recognized as Important Bird Areas by the American Bird Conservancy, Audubon, and Birdlife International. In the Arctic Refuge's northern foothills, coastal plain, and adjacent marine waters, at least 158 species of migratory birds have been recorded (U.S. Fish and Wildlife Service 2015a). At least 57 species regularly occur as breeding, non-breeding, or both in the Coastal Plain (summarized in Pearce et al. 2018).

Although some Arctic Refuge Coastal Plain bird species have been fairly well studied [e.g., Golden Eagles (*Aquila chrysaetos*) and Snow Geese (*Chen caerulescens*), Douglas et al. 2002], distribution and abundance data are incomplete for many and contemporary information is lacking for most. Of the 57 species known to regularly occur in the Coastal Plain, nine are U.S. Fish and Wildlife Birds of Conservation Concern and nine are listed as Near Threatened by the International Union for Conservation of Nature or are on the Audubon Alaska Red List (Table 1, IUCN 2017; U.S. Fish and Wildlife Service



2008; Warnock 2017). The only bird species known to occur on the Coastal Plain listed under the Endangered Species Act (ESA) are the threatened Alaska-breeding population of the Steller's eider (*Polysticta stelleri*) and threatened spectacled eider (*Somateria fischeri*). Both species primarily occur west of Arctic Refuge with Steller's eider listed as a "rare visitor" and spectacled eider as a "rare breeder" in the Coastal Plain (U.S. Fish and Wildlife Service 2015a). Steller's and spectacled eiders will be addressed under section 7 consultation pursuant to the ESA.

## Terrestrial Mammals

The Arctic Refuge coastal plain provides habitat for many species of terrestrial mammals, including caribou (*Rangifer tarandus*), muskoxen (*Ovibos moschatus*), moose (*Alces alces*), grizzly bears (*Ursus arctos*), wolves (*Canis lupus*), foxes Arctic (*Alopex lagopus*) Red (*Vulpes vulpes*), wolverines (*Gulo gulo*), and a variety of rodents and other small mammals. Muskoxen were reintroduced to the region in 1969 and 1970. The population increased and spread across the coastal plain through about 1998, then declined steeply through 2006. Currently, few muskoxen reside within the Refuge year-round (U.S. Fish and Wildlife Service 2015a) but populations are stable or increasing in nearby areas to the east and west. Moose on the coastal plain are largely restricted to patches of woody vegetation along streams during winter, but moose spread out across the area during summer. Moose populations in the Arctic Refuge increased rapidly during the 1980s, then declined during the 1990s. More recently, moose abundance has increased along the northwestern part of the Refuge, but not along most of the coastal plain east of the Canning River (U.S. Fish and Wildlife Service 2015a). Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Some grizzly bears den on the coastal plain during winter, but bear abundance in the area is highest in early summer during caribou calving. Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Arctic fox abundance cycles in response to changes in lemming abundance, which has pronounced effects on alternate prey species, such as ground-nesting birds. Little is known about the abundance, distribution, and species composition of most small mammal communities in northeastern Alaska. Of the more common species, arctic ground squirrels (*Spermophilus parryii*) have a patchy distribution on the coastal plain because denning habitat is limited. Microtine rodents, particularly brown lemmings (*Lemmus sibiricus* (*trimucronatus*)), are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many predators in years when they are abundant.

## Caribou

Caribou are the most abundant large mammal in the Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters in Arctic Village, Venetie, Stevens Village, Beaver, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for grizzly bears and wolves. The two caribou herds most commonly occurring in the Arctic Refuge are the Porcupine and Central Arctic herds. The Porcupine herd is one of the two largest herds in North America. In 2017, this herd was estimated to comprise 219,000 caribou (Alaska Department of Fish and Game 2017b). The Porcupine herd ranges over 130,000 square mi (337,000 square km) in northeastern Alaska and northwestern Canada (Lenart 2007). The Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou in many years (Griffith et al. 2002), and some



caribou are found there during winter. The Central Arctic herd currently numbers about 23,000 caribou (2016 estimate; Alaska Department of Fish and Game 2017a). The annual range of this herd overlaps that of the Porcupine caribou herd in the western part of the Refuge. Most calving by Central Arctic caribou occurs on State lands west of the Refuge, but the western coastal plain of the Refuge is often used by the Central Arctic herd during post calving, summer, and fall. Some caribou from this herd and the neighboring Teshekpuk herd occasionally use the Refuge coastal plain during winter.

## **Threatened and Endangered Species**

Alaska-breeding Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), and polar bear (*Ursus maritimus*) are listed as threatened pursuant to the ESA of 1973, as amended. All three of these species may occur in the Arctic Refuge coastal plain, although listed eiders are not present during the winter months and the Arctic Refuge is at the eastern edge of their current range.

The proposed action is within the range of the Southern Beaufort Sea (SBS) subpopulation of polar bear, a species globally listed as threatened under the federal ESA in addition to being protected under the Marine Mammal Management Protection Act (MMPA). The SBS subpopulation had an estimated population size of approximately 900 bears in 2010. This estimate represents a significant reduction from previous estimates of approximately 1,800 in 1986, and 1,526 in 2006. Although there was some evidence in the 2010 estimate that the population might be beginning to increase, analyses of over 20 years of data on the size and body condition of bears in this subpopulation demonstrated declines for most sex and age classes.

Declining sea ice conditions in the Beaufort Sea have led to an increase in the proportion of the subpopulation coming onshore in summer and autumn (from 5.8% during 1986-1999 to 20% during 2000-2014) and a 30 day increase in time spent on land. Bears in the SBS subpopulation are drawn to bowhead whale remains from subsistence harvest, particularly adjacent to the community of Kaktovik, Alaska, where ~60% of bears coming onshore will reside in late summer/fall.

The Arctic Refuge coastal plain has also been documented to be an important area for denning by polar bears and will likely increase in importance as the percent of bears denning on land increases with sea ice loss. Designated critical denning habitat overlaps with 77% of the 1002 area of the Arctic National Wildlife Refuge. The Arctic Refuge coastal plain contains 38% more denning habitat than the region immediately west of the refuge. Polar bears have been shown to den in the Arctic Refuge coastal plain area with greater frequency than expected based on available habitat, with 22% of identified dens for bears from 2000-2010 in the SBS subpopulation occurring within the area. ,.

## **Prehistoric and Historic Cultural Resource Sites**

Knowledge of prehistoric and historic cultural resource sites in the study area is mostly derived from investigations conducted in the latter half of the 20<sup>th</sup> Century. From the most relevant studies (Solecki et al. 1973, Hall 1982, Jacobson and Wentworth 1982, Wilson 1991, and Grover and Laughlin 2012), it is understood that human use of the area north of the Brooks Range has been occurring for more than 10,000 years. An examination of the Alaska Heritage Resource Survey database (Office of History and



Archaeology 2018), indicates there are 70 recorded sites located on lands managed by the U.S. Fish and Wildlife Service within the Arctic Refuge coastal plain (Table 1).

Cultural Period	Location:			Total
	Coastal	Inland adjacent to rivers and creeks	Inland on elevated dry ground	
Prehistoric	1	23	3	27
Historic	28	14		42
Multi-Component		1		1
Total	29	38	3	70

Table 1. Cultural Resource Sites within the Arctic Refuge coastal plain.

As indicated above, these sites are predominantly located along river corridors and the coast of the Beaufort Sea. All of the recorded sites are exposed and most, especially those along the coast, are subject to active erosion caused by sea storms.

Prehistoric sites generally consist of stone tent rings and lithic scatters (or artifacts) embedded and partially exposed in the tundra. Tent ring sites, with or without surface-distributed artifacts, are generally located on well drained, stable river banks or occasionally on higher bluffs near water courses. Sites characterized solely by the presence of artifacts generally consist of small amounts of lithic debris from stone tool manufacture and utilization. The known artifact sites occur in two major settings: the tops of rises (such as ridges and knolls) which give a good view of the surrounding terrain; and in blowouts in stabilized sand dunes near river mouths.

Historic sites consist of standing structures or above-ground tangible evidence of such structures. These sites include log cabins, sod houses, graves, ice cellars, drying racks, and remnant features associated with Cold War Era Distant Early Warning line sites. The majority of the historic sites are located immediately adjacent to the Beaufort Sea coast, although a few have been found on river courses several miles inland.



## Subsistence

One of the purposes of the Arctic Refuge is to provide the opportunity for continued subsistence uses by local residents in a manner consistent with the purposes of conserving fish and wildlife populations and habitats and fulfilling international treaty obligations with respect to fish and wildlife. Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes (U.S. Fish and Wildlife Service 2015a, 2015b). The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010). Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl, and fish return to the Refuge and coastal plain in abundance for another season.

The communities of Arctic Village and Kaktovik rely heavily on the Arctic Refuge, including the nearshore marine environment, for subsistence resources due to their close proximity within or adjacent to the Refuge boundaries. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys came primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on Porcupine caribou, the Gwich'in people consider the herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988). Other important species include whitefish, pike, lake trout, Dall sheep (*Ovis dalli*) and ducks.

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea which is heavily dependent on subsistence harvest of marine and terrestrial animals and fish. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35-68). Dall sheep and caribou are harvested which contributes 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs mostly in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resources. Kaktovik residents harvests of Arctic cisco, Dolly Varden, sculpin, Arctic cod, arctic flounder, grayling, and chum salmon accounted for 11 percent of the estimated total edible pounds in 1994-1995 (Brower et al. 2000:37).

## Recreation



Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the Marsh Fork-Canning, main stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen. The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were recommended to Congress for inclusion in the Wild and Scenic River System in 2015 because of their recreation and cultural values.

Visitor use monitoring has not been conducted, although calculated averages of known visitation based on commercial operator reports between 2001 and 2009 were 1,126 people annually. These reports showed that 77% of commercially-supported visitor use occurs north of the Brooks Range. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary.

The recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. Since 2011, polar bear viewing in the lagoons surrounding Kaktovik has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017). No visitor use numbers for other emerging uses on the Coastal Plain such as spring caribou hunting, fat tire biking and aurora-watching are known.

## **Acoustic Environment**

Little data on the acoustic qualities of the Arctic Refuge coastal plain are available, with the exception of short-term data collected in the extreme northwest corner in support of the Point Thomson EIS (U.S. Army Corps of Engineers 2012). Natural sound levels were found to be low, and they dominated the sound environment in both winter and summer. These sounds include atmospheric/meteorological phenomena, water features, insects, birds, and other animals. Natural sound levels were greater in summer due to the influence of water features such as the Canning River. Natural sound levels were found to be "lower than typical residential noise environments and comparable to an unoccupied building." Sections of the Arctic Refuge coastal plain that are away from the windy coastline and running water would be expected to be even quieter, with the predominance of natural sounds coming from wildlife and insects.

Both natural quiet and natural sound are intrinsic elements of the wilderness characteristics of the area and of the adjacent designated Wilderness. As such, their perpetuation is important for meeting the Refuge's purposes, goals, objectives, and special values. Noise from human activities in the Arctic Refuge coastal plain is essentially absent, with the exception of high altitude jet aircraft and occasional single and twin engine aircraft overflights.

Resources within the Arctic Refuge coastal plain that may be particularly sensitive to noise include polar bears, especially during denning; caribou, especially during calving and post-calving activities; and,



migratory birds, especially during breeding and brood-rearing activities. People who may be adversely affected by noise in the area include residents of Kaktovik, especially those engaged in subsistence activities on the coastal plain beyond the village itself, and recreational visitors, most of whom seek a wilderness experience free of noise.

## **Wilderness Characteristics and Values**

The Arctic Refuge, including the coastal plain, was initially proposed by the National Park Service as “The Last Great Wilderness” (Kaye 2006), and Public Land Order 2214 (1960) which established the original Arctic Range and identified three purposes of preservation of wilderness values, wildlife and recreational values and is still applicable to Refuge management. ANILCA section 101(b) outlines the intent “to preserve in their natural state extensive unaltered arctic tundra...ecosystems; and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on free flowing rivers...”. Further, ANILCA 304(g)(2)(B) requires the Secretary of the Interior to identify and describe “the special values of the refuge, as well as...wilderness value of the refuge” when developing plans. Consistent with the purpose and ANILCA, the Refuge’s 2015 Comprehensive Conservation Plan recommend the Arctic Refuge coastal plain for Wilderness designation because it exemplifies wilderness qualities.

Studies of Refuge visitors (Christensen and Christensen 2009) and the broader national public’s values and interests related to the Refuge (Bengston et al. 2010) show that these wilderness qualities are highly prominent in the public’s perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge’s Special Values (U.S. Fish and Wildlife Service 2015a) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain’s wilderness purpose and its function within the larger Refuge. Wilderness associated values include ecological, scientific, wildlife, aesthetic, recreational, and symbolic values.

Landres et al. (2015) defined the four primary qualities of Wilderness described in the Wilderness Act as: (1) undeveloped - free from roads, structures, and other evidence of modern human occupation or improvements, where the land essentially retains its original character and ecological function; (2) untrammeled - essentially unrestricted and free from modern human control or manipulation; (3) natural - when ecological systems are substantially free from the effects of modern civilization; and (4) primitive or unconfined recreation in wilderness settings - characterized by freedom from management restrictions on visitor behavior. Refuge management in the coastal plain has been consistent with these qualities. There are no roads, structures or improvements on Refuge lands within the coastal plain, natural processes are allowed to play out unfettered by management actions, and opportunities for solitude, primitive and unconfined recreation exist across the entire area.

## **Wild and Scenic Rivers**

The Wild and Scenic Rivers Act mandates protections for rivers that are designated rivers of the National Wild and Scenic River System (NWSRS), and for those that are recommended for inclusion in the



NWSRS. Based on level of infrastructure, a river's preliminary classification as Wild, Scenic, or Recreational and Wild and Scenic Values (free flowing condition; water quality at time the river was found Eligible); and Outstandingly Remarkable Values (ORV) for each river segment) must be maintained. Numerous rivers bisecting the Coastal Plain were found to be eligible during the Wild and Scenic River Review completed as part of the 2015 Revised Refuge CCP (See CCP Table 3-1. Eligible Rivers). Protections are required once a river or river segment is found eligible, but once an eligible river is found non-suitable, there is no legal mandate to protect the values that made the river eligible. The Atigun, Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be suitable.

The recommendation for inclusion of these four rivers in the NWSRS was carried forward to Congress in 2015, three of which could be affected by development activities on the Coastal Plain. The Hulahula River, was recommended based on recreational and cultural ORVs, begins in the mountains south of the coastal plain and flows through the center of the 1002 area. The Marsh Fork-Canning, was recommended for its recreational ORV, also originates in the mountains south of the Coastal Plain and joins the main stem of the Canning River before flowing along the western edge of the Refuge boundary and edge of the 1002 area. The Kongakut, recommended for its recreational, scenic, and geologic ORVs, ends in the easternmost coastal lagoons included in the 1002 area, which are part of the recreational corridor for river trips that include navigation from the mouth of the river, along the lagoons and ending in Kaktovik. All of the Recommended rivers were given a preliminary classification of "Wild", meaning their condition at the time of eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted.

Permanent structures generally are not allowed, with the exception of historic and cultural resources and, in certain limited circumstances, subsistence or administrative cabins and associated structures. Cabins, temporary structures, and hardened sites should not be visible from the river; where this is impractical, facilities and structures are to be rustic or unobtrusive in appearance. Public use facilities would provide opportunities for low-impact, backcountry recreation experiences.

## **Other Special Land Designations**

### **Marine Protected Areas**

Policy Framework: Marine Protected Areas (MPA)s are defined as "...any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." Executive Order 13158 on Marine Protected Areas (MPA) 13158 (2000) is intended to strengthen and expand the nation's system of MPAs. The Arctic National Wildlife Refuge meets the U.S. criteria for a MPA.

National System of MPAs: In 2005, the Refuge was nominated by the DOI and subsequently accepted for inclusion in the national system of MPAs: a voluntary association of federal, state, territorial and tribal MPAs coordinated by NOAA and DOI as part of their partnership under EO13158. Membership status in the national system does not currently convey any additional protections or restrictions beyond the Refuge's current management authorities.



**Spatial Extent:** All marine waters located within Refuge boundaries, approximately 100,000 acres of marine waters and lagoons located off the northern coast of the Refuge, are listed as part of the National MPA System (see MPA Inventory page of NOAA's National Marine Protected Areas Center website). Shifting shorelines and marine-freshwater boundaries at river mouths create some variability in the acreage estimate for the Refuge's contribution to the national system of MPAs, on the order of plus or minus several hundred acres.

## Land Status

The Alaska Native Claims Settlement Act of 1971 (ANCSA) and ANILCA determined the current land ownership patterns in and surrounding Arctic Refuge. ANCSA authorized the formation of Alaska Native village and regional corporations, enabling northeast Alaska's Native Iñupiat and Athabascan peoples to select and gain title to Federal lands that were originally part of their ancestral homelands. Map X (to be numbered in full document) shows, by general ownership, the approximate area of non-Refuge lands within the coastal plain.

## Submerged Lands

In 1997, the Supreme Court ruled that submerged lands, including tidally influenced lands, within the Arctic Range boundary did not transfer to the State of Alaska at statehood (United States v. Alaska, No. 84 Original). The Court's decision recognized that the application to create the Arctic Range which predated statehood clearly intended these submerged lands, including rivers, lakes, and lagoons, to be included as part of the Range. Arctic Refuge, therefore, contains navigable and non-navigable waters. Submerged lands within the boundaries of the original Arctic Range, including river beds, were retained in Federal ownership on the date Alaska was granted statehood.

## Chapter 3 Affected Environment References

- Attanasi, E.D., and Freeman, P.A., 2009, Economics of undiscovered oil and gas in the North Slope of Alaska: economic update and synthesis: U.S. Geological Survey Open-File Report 2009-1112, 59 p. available only online.
- Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellanum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.  
<http://www.nativefederation.org/frames/subsistence.html>.
- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005.



- Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaf.edu/pages/scientific.html>. Accessed July 27, 2012
- Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. *International Journal of Wilderness*. 16: 13-20.
- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brower, H.K., T.P. Olemaun, and T.R. Hepa. 2000:37. North Slope Borough subsistence harvest documentation project: data for Kaktovik. Department of Wildlife, North Slope Borough, Barrow, Alaska.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416. doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Craig, P.C. 1977. Arctic char in the Sadlerochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 35:48-52.
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. *Transactions of the American Fisheries Society* 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. *Biological papers of the University of Alaska* 24:131-152.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. *Arctic*. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 In P.C. Craig (ed.), Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Douglas, D., P. Reynolds, and E. Rhode. 2002. Arctic refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.



- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362–378.
- Frugé, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994–1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.
- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature*: 1973.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), *Arctic Refuge coastal plain terrestrial wildlife research summaries*. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Grover, Margan Allyn and Erin Laughlin. 2012. *Archaeological Survey of the Mid-Beaufort Sea Coast: An Examination of the Impacts of Coastal Changes on Cultural Resources*. Prepared for the Kaktovik Tribal Partnership Program. U.S. Army Corps of Engineers, Alaska District.
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution).  
<http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Hall, Edwin S., Jr. 1982. *Preliminary Archaeological and Historic Resource Reconnaissance of the Coastal Plain Area of the Arctic National Wildlife Refuge, Alaska*. Technical Memorandum # 1, Edwin S. Hall and Associates, Brockport, N.Y.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. (1991). Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110.  
doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009. Salmon in the Arctic and how they avoid lethal low temperatures. *North Pacific Anadromous Fish Commission Bulletin*. 5:39-50.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. In Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from  
<http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kane, D.L., Slaughter, C.W. 1973. Seasonal regime and hydrological significance of stream icings in central Alaska. *The Role of Snow and Ice in Hydrology: proceedings of the Banff Symposia*, Volume 1:528-540.
- Kaye, R. 2006. *Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge*. University of Alaska Press, Fairbanks, Alaska.
- Landres, Peter; Barns, Chris; Boutcher, Steve; Devine, Tim; Dratch, Peter; Lindholm, Adrienne; Merigiano, Linda; Roeper, Nancy; Simpson, Emily. 2015. Keeping it wild 2: an updated interagency strategy to monitor trends in wilderness character across the National Wilderness



- Preservation System. Gen. Tech. Rep. RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 114 p.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 *in* Harper, editor. Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 30:1215–1220.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- Office of History and Archaeology. 2018. Alaska Heritage Resource Survey database, State of Alaska, Department of Natural Resources.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleux and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Soil Survey Staff. (2014). *Keys to soil taxonomy* (12th ed.). Washington DC: USDA-Natural Resources Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*. Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Solecki, Ralph S., Bert Salwen, and Jerome Jacobson. 1973. *Archaeological Reconnaissances: North of the Brooks Range in Northeastern Alaska*. Department of Archaeology, University of Calgary, Occasional Papers No. 1.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. *Arctic* 59:37–46.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- Urban, F.E., and Clow, G.D., 2017, DOI/GTN-P Climate and active-layer data acquired in the National Petroleum Reserve–Alaska and the Arctic National Wildlife Refuge, 1998–2015: U.S. Geological Survey Data Series 1021, 546 p., <https://doi.org/10.3133/ds1021>.



- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.
- U.S. Energy Information Agency. 2018. Annual Energy Outlook 2018: Table 12: Petroleum and Other Liquids Prices, Reference case. Retrieved from [https://www.eia.gov/outlooks/aeo/tables\\_ref.php](https://www.eia.gov/outlooks/aeo/tables_ref.php)
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska
- Wendler, G., M. Shulski, and B. Moore. 2010. Changes in the climate of the Alaskan North Slope and the ice concentration of the adjacent Beaufort Sea. *Theoretical and Applied Climatology* 99(1-2):67-74.
- Wilson, Curtis James. 1991. *An indigenous Nineteenth-Century Settlement/Subsistence System in the Area of Demarcation Bay, Alaska*. Ph.D. dissertation, Department of Anthropology, State University of New York at Binghamton.



## **Specialist Reports/Appendices**



## Air Quality

There is currently no air quality monitoring data for the Arctic Refuge Coastal Plain. To the west of the Refuge, air quality monitoring occurs in the active oil fields of Pt. Thomson, Badami, Endicott and Prudhoe Bay. Data available from these sites confirm that pollutant concentrations in the study area are in compliance with the respective National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS) according to the Pt. Thomson EIS (U.S. Department of Defense 2012). With prevailing winds from the northeast, it is likely that air quality on the Arctic Refuge Coastal Plain would generally experience less impacts from existing industrial emissions from development to the west, except during instances when winds come from the west.

The North Slope is subject to a condition known as "arctic haze." Arctic haze is a condition of reduced visibility in arctic regions. Arctic haze peaks in the spring and is most severe when stable, high-pressure systems produce clear, calm weather (NSIDC 2011). Sources of pollutants creating haze have been attributed to industrial pollutants (sulfur compounds and black carbon particles-the products of iron, nickel and copper smelters and inefficient coal-burning plants) from Eurasia, soot from forest fires and burning of farm fields in Eurasia, and submicron organic particles sampled have shown characteristics of emissions from northern Asia, Siberia, and, to a lesser extent, interior regions of Alaska and Canada (U.S. Department of Defense 2012). The haze is worse in spring due to stagnant air and the lack of precipitation. Conditions improve in the summer as the atmosphere mixes more and precipitation washes the pollutants from the air.

### Air Quality References

- US Department of the Interior (DOI), Bureau of Land Management. 2012. National Petroleum Reserve-Alaska Final Integrated Activity Plan/ Environmental Impact Statement. Anchorage, AK.
- NSIDC (National Snow and Ice Data Center). 2011. Arctic Climatology and Meteorology Website. University of Colorado Boulder. [http://nsidc.org/arcticmet/quickfacts/arctic\\_haze.html](http://nsidc.org/arcticmet/quickfacts/arctic_haze.html). (Accessed June 15, 2018)
- U.S. Department of Defense (USDOD), U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement, Pt. Thomson Project EIS. U.S. Army Corps of Engineers, and Environmental Research and Technology, Alaska District, Anchorage, AK.

## Water Resources

Aquatic habitats on the Arctic Refuge coastal plain are underlain by permanently frozen ground and fed by precipitation, snowmelt, groundwater springs, and meltwater from overflow ice and glaciers (Lyons and Trawicki 1994, Childers et al. 1997). These habitats include lagoons and bays; mountain, tundra, and spring-fed streams and rivers; riparian corridors; lakes; wet meadow zones; and other wetlands.

Ninety-nine percent of the Arctic Refuge coastal plain is considered wetland; however, lakes are very scarce (less than two percent of the land surface area) compared to the eastern NPR-A where lakes cover approximately twenty percent of the land surface area. Lakes are not evenly distributed across the Arctic Refuge coastal plain, but are concentrated near the mouth of the Canning River and in the region of the



Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre and ninety percent are less than 12 acres. Most lakes are surrounded by extensive wet meadow zones that are important to several species of water birds (Bayha 1996). A study of 115 of the largest lakes indicated most lakes are shallow and freeze to the bottom during winter (Trawicki et al. 1991). The estimated volume of liquid water in these lakes is 1.1 billion gallons by the end of the winter season. Eighty percent of this volume is concentrated in seven lakes in the Canning River Delta and one of these lakes is known to have salinity concentrations close to that of seawater. The recharge capacity of many lakes is generally limited to snowmelt and direct precipitation in the vicinity of the lake.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Arctic Refuge coastal plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed reaches.

The perennial springs in the Arctic Refuge coastal plain are unique when compared to the coastal plain to the west, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation and produce extensive fields of *aufeis*, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be twenty feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a), an important subsistence fish. Springs on the Arctic Refuge coastal plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the coastal plain of the Arctic Refuge coastal plain are the Canning, Hulahula, Sadlerochit, Itkilyariak, and Katakturuk springs.

Tall willow shrublands grow along the riparian corridors of rivers, streams, and spring-fed reaches. Vegetation along riparian corridors provides stream bank stability, delivers organic matter to aquatic habitats, provides cover and nesting habitat to numerous bird species, and supports exceptionally high species diversity in a relatively species-poor arctic environment. During winter, riparian vegetation provides denning habitat for polar bears and grizzly bears, and forage and cover for caribou, moose and muskox.

Sixteen lagoons and bays line the coast and support numerous invertebrate species (Dunton et al. 2012). There are 12 known species of marine fishes that are commonly encountered in nearshore brackish environments adjacent to the Arctic Refuge coastal plain, only four of which are relatively abundant during the summer season (Craig 1984; Brown 2008). During winter, liquid water below ice in lagoons tends to be hyper saline unless fed by groundwater.

With the exception of spring-fed systems, the hydrology of the Arctic Refuge's aquatic habitats is strongly influenced by the climate, which is characterized by extremely low winter temperatures; short, cool summers; and exceptionally low year-round precipitation (averaging 6.3 inches per year). Fish and



wildlife use of aquatic habitats on the Arctic Refuge coastal plain is tightly intertwined with the harsh constraints and abundant benefits imposed by seasonal hydrology.

Winter is the harshest and most critical time for species relying on aquatic habitats, but unique features of these habitats allow for sustenance of life. Shortened daylight hours and extreme cold temperatures cause most waterbodies on the Arctic Refuge coastal plain to freeze solid (Lyons and Trawicki 1994), reducing the volume of liquid water by ninety-eight percent (Craig 1989a). As ice growth continues throughout the winter, dissolved oxygen concentrations decrease while ion concentrations increase. Small pockets of unfrozen water only occur in lakes that are more than seven-feet deep, small isolated pools beneath riverine ice hummocks, spring-fed river reaches (Lyons and Trawicki 1994), and below ice covering coastal lagoons and bays. Fish and other aquatic organisms are constrained to these isolated pockets of liquid water for the next several months until temperatures warm and ice breakup occurs in late May and June (Craig 1989a).

The spring season brings about major shifts in hydrology that recharge aquatic habitats and enhance fish migration. Snowmelt starts earliest in the foothills and then proceeds to the coastal plain. During this time, sheets of snowmelt water flow over frozen ground, as much as 50% of the annual flow of rivers takes place (Clough et al. 1987, Sloan 1987), extensive fields of aufeis play an important role directing river flow paths over land and into new channels, and snowmelt and flood waters create ephemeral connections between aquatic habitats and recharge floodplain lakes and wet meadow zones. On the North Slope, up to forty percent of snowmelt serves to recharge the evaporation deficit from the previous summer and immediately following snowmelt, surface waters are at their maximum extent (Bowling et al. 2003). Meanwhile, fish take advantage of the elevated water levels to begin migrating to summer feeding habitats and migratory water birds arrive to take advantage of the abundant food sources and nesting habitats in the wet meadow zones surrounding lakes and shallow ponds. Within two weeks of snowmelt, overland flow ceases and many hydrologic systems become disconnected (Bowling et al. 2003).

During the short Arctic summer, aquatic habitats are teeming with life and provide habitat for millions of water birds, twelve species of marine fish, eighteen species of anadromous and freshwater fish (U.S. Fish and Wildlife Service 2015), and numerous invertebrate species that are important to upper trophic levels. A lack of precipitation and relatively high evapotranspiration causes flow to cease in some streams and rivers (Lyons and Trawicki 1994), thaw of frozen soils and evapotranspiration leads to significant drawdown of lakes and wetlands (Bowling et al. 2003), water birds and fish begin migrating to critical overwintering habitats, and aquatic invertebrates move to deeper water or burrow down into sediments to avoid freezing.

## **Water Resources References**

- Afonina, O.M. and A. Breen. 2009. *Dicranum dispersum* (Dicranaceae) and *Sciuro-hypnum ornellatum* (Brachytheciaceae), new to North America. *The Bryologist*. 112(2): 268-272.
- Bayha, Keith D. 1996. Criteria for instream water rights for selected 1002 area lakes, Arctic National Wildlife Refuge. Water Resources Branch, U.S. Fish and Wildlife Service. Anchorage, Alaska. WRB 96-05.
- Bowling, L.C., D.L. Kane, R.E. Gieck, L.D. Hinzman, D.P. Letternmaier. 2003. The role of surface water storage in a low-gradient Arctic watershed. *Water Resources Res.* 39(4).



- Childers, J.M., C. E. Sloan, J.P. Meckel, and J.W. Nauman. 1977. Hydrologic reconnaissance of the eastern north slope, Alaska, 1975. U.S. Geological Survey Open-File Report 77- 492 U.S. Geological Survey, Anchorage, Alaska, USA.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.t
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Dunton, K.H., S.V. Schonberg, L.W. Cooper. 2012. Food web structure of the Alaskan nearshore shelf and estuarine lagoons of the Beaufort Sea. *Estuaries and Coasts*. 35(2): 416-435.
- Lyons, S.M., and J.M. Trawicki 1994. Water resource inventory and assessment, coastal plain, Arctic National Wildlife Refuge: 1987-1992. WRB 94-3 Final Report. U.S. Fish and Wildlife Service, Water Resource Branch, Anchorage, Alaska, USA.
- Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. In *Alaska North Slope Geology*, I. Tailleir and P. Weimer (Eds.). Society of Economic Paleontologist and Mineralogists, Pacific Section, and Alaska Geological Society.
- Trawicki, J.M., S. M. Lyons, and G. V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 Area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska, USA.
- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.



## Soils and Permafrost

Soil types have only been generally described and mapped within the Arctic Refuge coastal plain (Carter et al. 1986; Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristsels, Typic Haploglepts, Typic Histoturbels (Soil Survey Staff 2016). Climate is the dominant soil-forming factor in coastal plain soils. The cold climate inhibits certain soil-forming processes such as weathering by removal of calcium components and movement of clay downward through the soil (Tedrow 1977), while organic matter accumulation is heightened due to the reducing conditions caused by saturation, slowed decomposition in the cold, wet conditions, and churning of the surface organic materials to the lowest parts of the active layer and upper permafrost (Ovenden 1990; Ping et al 2004; Ping et al 2008).

Soil texture varies by physiographic feature across three ecoregions, Brooks foothills, Beaufort coastal plain, and the Beaufort Sea coast (Carter et al. 1986; Jorgenson et al. 2015). The Brooks foothills dominate the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, the foothills are primarily located along the southern boundary and extend approximately one-third of the way to the coast. Physiographic features include uplands, glaciated uplands, floodplains, and lowlands. Uplands generally contain fine grain soils composed of silt or peat and rocky silt. Glaciated uplands contain a broader range of particles sizes with peat, silt, and diamicton. Lowland and floodplain soils in the foothills are coarser textured and composed of peat, sand and gravel or silt, sand, and gravel respectively.

The Beaufort coastal plain is the dominant ecoregion in the east and the major physiographic features are coastal plain and floodplain. Soils here are coarser and similar to the NPR-A. Coastal plain features are generally composed of peat and pebbly silty sand or peat sand and gravel. Floodplains are similar to the foothills and are composed of silt, sand, and gravel.

The Beaufort Sea coast lies across the northern margin of the coastal plain and includes the barrier islands. A wide range of soil textures can be encountered here and range from mud to sand and gravel. River deltas along the coast are classified as floodplains and have finer grain soils than the inland floodplains. Soils of coastal floodplains are composed of peat, silt, and sand

Permafrost is any ground (soil, rock or sediment) that remains below 32°F for at least two consecutive years. Permafrost underlies most of the land surfaces in the region and is generally between 650–1,300 ft thick (Gold and Lachenbruch 1973). Increases in permafrost thickness and extent are driven by climatic cooling, maturation of vegetation, increased albedo (reflectance), and decreased snow cover. Climatic warming, removal or compaction of vegetation, and mass wasting will decrease the thickness or extent of the permafrost (U.S. Army Corps of Engineers 2012). As much as 88% of the planning area is underlain by ice rich permafrost (>50% water) which occurs as pore, segregated, and massive ice. Massive ice occurs in the form of ice wedges, buried glacial ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Ice wedges are the most common type of massive ice and polygonal ground is the common surface feature across the coastal plain (Clough et al. 1987; Kanevskiy et al. 2013). In areas of silty soils, volumetric ice content can be as high as 89% with 50% as ice wedges and no surface formation of polygonal ground (Kanevskiy et al. 2013).



The presence of this ice rich permafrost along with some soil types results in approximately 34% of the area being comprised of soils with maximum potential settlement of up to 98 feet (30 meters) (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

The top layer of the soil surface that typically thaws and refreezes annually is known as the active layer. Within the coastal plain the active layer is generally between 1 to 4 ft thick (U.S. Fish and Wildlife Service 2015a). The cold climate results in a lack of weathering and infiltration of organic acids that results in reduced the nutrient availability (Everett 1979; Everett and Brown 1982); however, nearly all the biological activity in soils of the far north takes place within this zone. The active layer is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018). Additionally, some studies have shown that nonacidic soils tend to have a deeper active layer than acidic soils (Nelson et al. 1998; Walker et al. 2003) and that there is a strong soil pH-vegetation relationship (Walker et al. 2003).

## Soils and Permafrost References

- Alaska Department of Natural Resources. 2018. North Slope Areawide oil and gas lease sales. Written Finding of the Director.
- Burn, C. R. 1998. The active layer: two contrasting definitions. *Permafrost and Periglacial Processes*, 9(4), 411-416.  
doi:doi:10.1002/(SICI)1099-1530(199810/12)9:4<411::AID-PPP292>3.0.CO;2-6
- Carter, L. D., Ferrians Jr, O. J., & Galloway, J. P. 1986. *Engineering-geologic maps of northern Alaska coastal plain and foothills of the Arctic National Wildlife Refuge* (86-334). Retrieved from <http://pubs.er.usgs.gov/publication/ofr86334>
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, Washington, D.C., USA.
- Everett, K.R. 1979. Evolution of the Soil Landscape in the Sand Region of the Arctic Coastal Plain as Exemplified at Atkasook, Alaska. *Arctic* 32(3):207-223.
- Everett, K.R., and J. Brown. 1982 Some Recent Trends in the Physical and Chemical Characterization and Mapping of Tundra Soils, Arctic Slope of Alaska. *Soil Science Society Journal* 133(5):264-280.
- Gold, L. W., & Lachenbruch, A. H. (1973). *Thermal conditions in permafrost - a review of North American literature: 1973*.
- Hinzman, L. D., Kane, D. L., Gieck, R. E., & Everett, K. R. 1991. Hydrologic and thermal properties of the active layer in the Alaskan Arctic. *Cold Regions Science and Technology*, 19(2), 95-110. doi:[https://doi.org/10.1016/0165-232X\(91\)90001-W](https://doi.org/10.1016/0165-232X(91)90001-W)
- Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. (2015). *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*.



- U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Kanevskiy, M., Shur, Y., Jorgenson, M. T., Ping, C. L., Michaelson, G. J., Fortier, D., Stephani, E., Dillion, M., and Tumskey, V. 2013. Ground ice in the upper permafrost of the Beaufort Sea coast of Alaska. *Cold Regions Science and Technology*, 85, 56-70.  
doi:<https://doi.org/10.1016/j.coldregions.2012.08.002>
- Nelson, F.E., K.M. Hinkel, N.I. Shiklomanov, G.R. Mueller, L.L. Miller, and D.A. Walker. 1998. Active-layer Thickness in North-Central Alaska: Systematic Sampling, Scale, and Special Autocorrelation. *Journal of Geophysical Research-Atmospheres* 103:28,963-28,973.
- Ovenden, L. 1990. "Peat Accumulation in Northern Wetlands." *Quaternary Research* 13:377-386
- Ping, C.L., H.M. Clark, and D.K. Swanson. 2004. "Cryosols in Alaska." In *Cryosols: Permafrost-Affected Soil*, ed. J.M. Kimble. Berlin: Springer-Verlag
- Ping, C.L., G.J. Michaelson, J.M. Kimble, V.E. Romanovsky, Y.L. Shur, D.K. Swanson, and D.A. Walker. 2008. "Cryogenesis and Soil Formation along a Biogradient in Arctic North America." *Journal of Geophysical Research* 113:G03S12.
- Rieger, S., Schoephorster, D. B., & Furbush, C. E. (1979). *Exploratory Soil Survey of Alaska*. U.S. Department of Agriculture, Soil Conservation Service.
- Soil Survey Staff. (2016). U.S. General Soil Map (STATGO2). *U.S.D.A-Natural Resources Conservation Service*.  
Retrieved from <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
- Tedrow, J.C.F. 1977. *Soils of the Polar Landscapes*. New Brunswick, NJ: Rutgers University Press.
- U.S. Army Corps of Engineers (USACE). 2012. Point Thomson project, final environmental impact statement. Available online at: <http://www.arlis.org/docs/vol1/E/808730793/index.html> (accessed February 8, 2018).
- Walker, D.A., G.J. Jia, H.E. Epstein, M.K. Reynolds, F.S. Chapin III, C. Copass, L.D. Hinzman, J.A. Knudson, H.A. Maier, G.J. Michaelson, F. Nelson, C.L. Ping, V.E. Romanovsky, and N. Shiklomanov. 2003. "Vegetation-Soil-Thaw-Depth Relationships along a Low-Arctic Bioclimate Gradient, Alaska: Synthesis of Information from the ATLAS Studies." *Permafrost and Periglacial Processes* 14:103-123.



## Vegetation

Vegetation in the Arctic Refuge coastal plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The geography of the Arctic Refuge coastal plain is six to eight times steeper than the coastal lands further west (Figure 1). The more varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types more sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Arctic Refuge CCP (U.S. Fish and Wildlife Service 2015a).

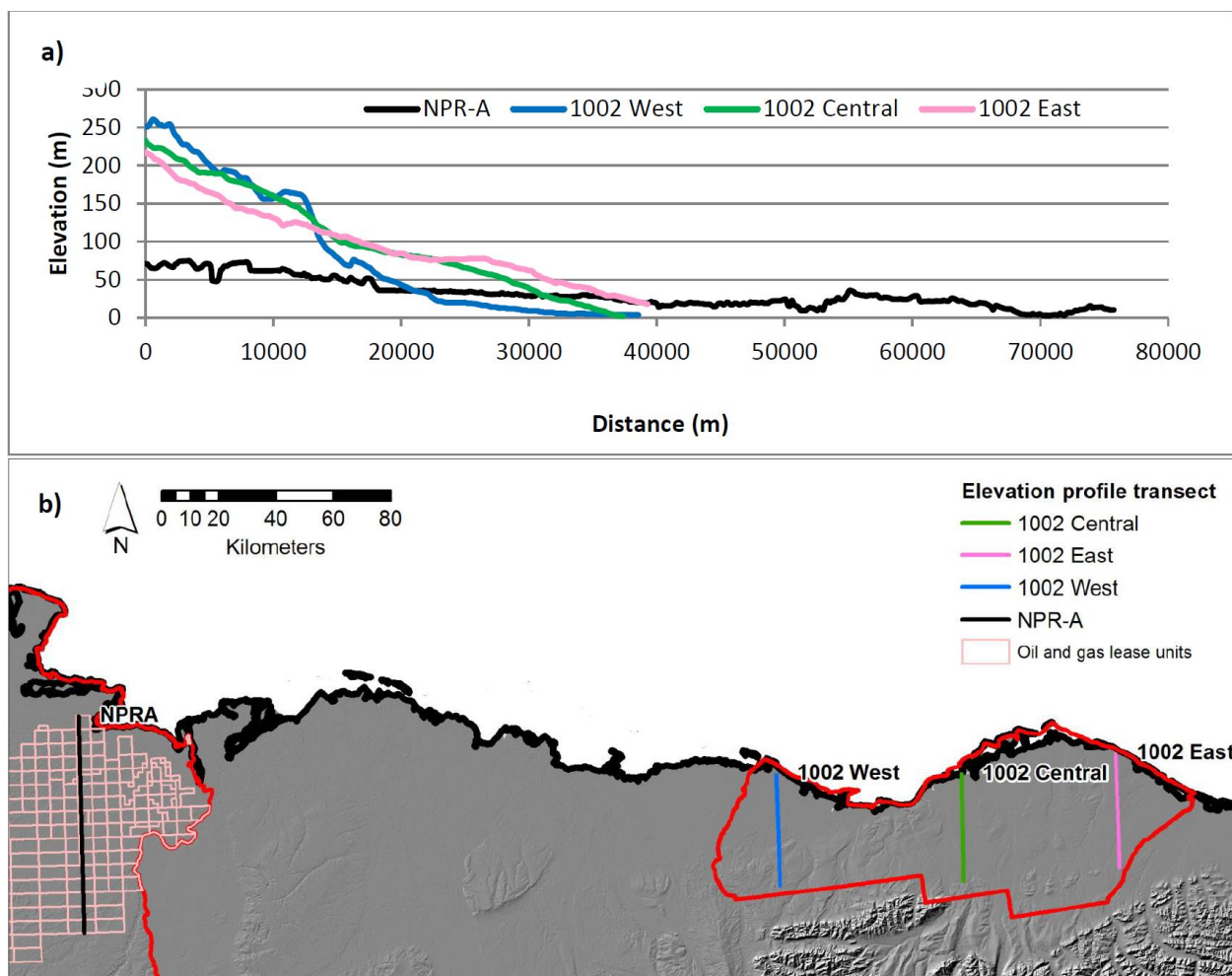


Figure 1: a) Hillslope profiles and b) transect locations within the coastal plain and NPR-A. Hillslope profiles derived from 30m digital elevation model.

Foothills of the Brooks Range cover 45% of the area (Walker et al. 1982). Broad uplands are dissected by north-flowing rivers. Hilly coastal plains cover 22% of the area and have gently undulating tundra with small thaw lakes. Flat thaw lake plains with large lakes cover 3% of the area. River floodplains cover 25% of the area. Vegetation is a nearly continuous, highly interspersed mosaic of plants less than 0.5 m



tall, mainly sedges, low shrubs, and mosses. Shrubs are taller along drainages. Soil texture and moisture are important determinants of the different tundra vegetation types (Table 1), which were based on Walker et al. (1982).

Table 1. Vegetation types of the coastal plain of the Arctic NWR, Alaska, USA, based on Walker et al. (1982). From Jorgenson et al. 2010.

Type	Description
Wet sedge tundra (13% of area)	Low-lying flats and drainages with the sedges <i>Carex aquatilis</i> and <i>Eriophorum angustifolium</i> and little moss or shrub cover. The poorly drained soils are saturated throughout the summer and have a thick, fibrous organic horizon.
Sedge–willow tundra (30%)	Low-lying flats and gentle slopes with the sedges <i>Eriophorum angustifolium</i> and <i>Carex aquatilis</i> and the willows <i>Salix pulchra</i> and <i>S. reticulata</i> . Mosses include <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Aulacomnium</i> spp., <i>Sphagnum</i> spp., and <i>Campylium stellatum</i> . On fine-grained retransported, laciofluvial, and abandoned floodplain deposits. Soils have moderately thick organic layer and are saturated at intermediate depths but generally free of surface water.
Sedge– <i>Dryas</i> tundra (13%)	Moderately well-drained sites dominated by the dwarf shrub <i>Dryas integrifolia</i> and the sedge <i>Carex bigelowii</i> , with the willows <i>Salix richardsonii</i> , <i>S. phlebophylla</i> , and <i>S. reticulata</i> and mosses such as <i>Tomenthypnum nitens</i> , <i>Hylocomium splendens</i> , <i>Distichium capillaceum</i> , and <i>Ditrichum flexicaule</i> . Forbs (e.g., <i>Lupinus arcticus</i> ), lichens (e.g., <i>Cetraria</i> spp.), and horsetails (e.g., <i>Equisetum variegatum</i> ) are common. Found on moist calcareous slopes and pebbly glacial and marine sediments. Notable for a hummocky surface topography, patches of exposed mineral soil, and extremely variable organic horizons resulting from active and stabilized frost boils.



Tussock tundra (28%)	Moderately well-drained slopes dominated by the tussock-forming sedge <i>Eriophorum vaginatum</i> , with shrubs <i>Salix pulchra</i> , <i>Betula nana</i> , <i>Ledum palustre</i> ssp. <i>decumbens</i> , and <i>Vaccinium vitis-idaea</i> . Bryophytes include <i>Hylocomium splendens</i> , <i>Sphagnum</i> spp., <i>Aulacomnium turgidum</i> , <i>Ptilidium ciliare</i> , and <i>Tomenthypnum nitens</i> . Occurs on deposits of loess or colluvial material on top of coarser, residual materials or glacial drift.
Shrub tundra (5%)	Dominated by low and dwarf shrubs, with <i>Betula nana</i> or <i>Salix pulchra</i> and understory species similar to tussock tundra. In the study area, occurs only on raised areas with high-centered polygon surface morphology.
Riparian shrubland (2%)	Willow shrublands on river floodplains and stream banks, dominated by <i>Salix alaxensis</i> , <i>S. glauca</i> , and <i>S. richardsonii</i> , commonly with a forb understory. Willows have an average height of 0.5 m and maximum of about 1.5 m. Occurs on both young floodplain deposits with mixed gravel and fine-grained material, and older terraces with a thin, fine-grained alluvium layer over gravel.
Dryas terrace (3%)	Infrequently flooded river terraces with <i>Dryas integrifolia</i> and other dwarf shrubs, forbs, horsetails, mosses, and lichens similar to sedge– <i>Dryas</i> tundra. Well-drained soils with a very thin organic mat over river deposits.

### Vegetation References

- Jorgenson, J.C., J.M. Ver Hoef, and M.T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications* 20(2): 205-221.
- Pastick, N. J., M. T. Jorgenson, B. K. Wylie, S. J. Nield, K. D. Johnson, and A. O. Finley. 2015. Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions. *Remote Sensing of Environment* 168: 301-315. Doi: 10.1016/j.rse.2015.07.019. <http://www.sciencedirect.com/science/article/pii/S0034425715300778> (Accessed May 16, 2017).
- Walker, D. A., K. R. Everett, W. Acevedo, L. Gaydos, J. Brown, and P. J. Webber. 1982. Landsat-assisted environmental mapping in the Arctic National Wildlife Refuge, Alaska. CRREL Report 82-27. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, USA.







## Fisheries

### Overview

The eastern North Slope in Alaska is endowed with limited freshwater options for fish. As a result, there are only a few species that occupy the freshwater habitats that are available. Lake density is very low in the Arctic Refuge coastal plain, east of the Canning River drainage, but increases progressively to the west (White et al. 2008; Arp and Jones 2009). Several mountain streams cross the Arctic Refuge coastal plain between the Canning and Aichilik rivers (Craig and McCart 1975). These streams flow during summer with snowmelt, rainfall, perennial springs, and for some streams, melting glaciers (Craig and McCart 1975; Rabus and Echelmeyer 1998; Kane et al. 2013), however, only the perennial springs provide flow during winter (Craig and McCart 1975). Craig (1989a) estimated that winter habitat in the area was only about 5% of what was available for fishes during summer.

The nearshore environment in the southern Beaufort Sea, adjacent to the Arctic Refuge coastal plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons are very productive environments for marine and anadromous species during summer. In winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, some lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.

Freshwater species present in the Arctic Refuge coastal plain include Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, and ninespine stickleback *Pungitius pungitius* (Frue and Palmer 1994). Round whitefish and burbot are present in the Canning River but nowhere else in the Arctic Refuge coastal plain (Craig 1977c; Frue and Palmer 1994). Dolly Varden are present in three life history forms: 1) anadromous populations in which most members rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; 2) residual dwarf males of the anadromous populations that choose to stay in freshwater rivers rather than migrate to sea; and 3) dwarf resident populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977c; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs that are used for overwintering habitat (Craig and McCart 1974; Frue and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Arctic Refuge coastal plain.

Anadromous species known to occur in or adjacent to the Arctic Refuge coastal plain include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, and rainbow smelt *Osmerus mordax* (Craig 1984; Frue and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Arctic Refuge coastal plain. Dolly Varden are known to migrate long distances along the coast during their summer feeding forays, east to the Mackenzie River and west to the Colville River or beyond (Kruger et al. 1999), and some individuals



migrate into offshore waters as well (Courtney et al. 2018). Arctic cisco have natal origins in the Mackenzie River but disperse as juveniles to coastal habitats including the Colville River delta, where many overwinter in brackish environments (Galloway et al. 1983; Fechhelm et al. 2007). Rearing Arctic cisco make annual feeding migrations along shore during summer and eventually return to the Mackenzie River to spawn. Broad whitefish, humpback whitefish, and least cisco that are encountered in nearshore environments adjacent to the Arctic Refuge coastal plain have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species that occur in nearshore waters adjacent to the Arctic Refuge coastal plain or in rivers within the Arctic Refuge coastal plain are thought to be strays from southern Chukchi or northern Bering Sea populations, although some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage (Stephenson 2006; Irvine et al. 2009). Rainbow smelt are known to spawn in the Mackenzie and Colville rivers as well as in the Kuk River drainage farther west (Craig 1984). Dolly Varden and Arctic cisco are the primary food fishes for people in north east Alaska (Craig 1989b; Pederson and Linn 2005).

There are about 12 species of marine fishes that are commonly encountered in nearshore brackish environments adjacent to the Arctic Refuge coastal plain, only four of which are relatively abundant during the summer season (Craig 1984; Brown 2008). These are fourhorn sculpin *Myoxocephalus quadricornis*, Arctic flounder *Pleuronectes glacialis*, saffron cod *Eleginus gracilis*, and Arctic cod *Boreogadus saida*. While anadromous species tend to migrate along shore in the southern Beaufort Sea, marine species are thought to follow a very different migratory pattern; moving towards shore and into shallow water during summer and away from shore and into deeper water during winter (Craig 1984). It is not uncommon to find these four common marine species in brackish environments during summer, or even in the very lower reaches of the rivers in the area.

### Species accounts

Some of the fish species of ecological and/or subsistence value in or adjacent to the Arctic Refuge coastal plain are discussed below. Information about distribution, life history characteristics, and subsistence use is presented when available.

**Broad whitefish** *Coregonus nasus* are large, primarily benthic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They are present but uncommon in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Broad whitefish populations may exhibit either anadromous or freshwater resident life histories (Reist and Bond 1988; Chudobiak 1995; Brown et al. 2007). Because rivers flowing through the Arctic Refuge coastal plain do not support spawning or overwintering habitats for broad whitefish, they spawn and overwinter in aquatic habitats in the lower Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, all broad whitefish encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the Beaufort Sea and occasionally in the lower reaches of the larger rivers (Ward and Craig 1974; Craig 1984; Brown 2008).

Age at maturity for broad whitefish ranges from about five years old for the earliest maturing populations, such as those in the Peel (VanGerwen-Toyne et al. 2008) and Yukon (Carter 2010) rivers, to about eight years old for the latest maturing populations, such as those in the Selawik River in western Alaska (Brown 2004) and in the Teshekpuk Lake region in northern Alaska (Moulton et al. 2007). Broad whitefish spawn in flowing water over gravel in late October and November (Chang-Kue and Jessop



1997; Shestakov 2001; Carter 2010), which is three to four weeks later than other whitefish species. They survive spawning and may spawn multiple times during their lives. Once mature, spawning may be annual (Tallman et al. 2002) or less frequently (Prasolov 1989; Brown 2004). Broad whitefish are capable of living for 20 years or more (Brown 2004; VanGerwen-Toyne et al. 2008), and the oldest individuals in a population may exceed 30 years (Bond and Erickson 1985; Reist and Bond 1988). Broad whitefish are a very good food fish (McPhail and Lindsey 1970; Morrow 1980) and are harvested at times in nearshore waters adjacent to the Arctic Refuge coastal plain (Pedersen and Linn 2005).

**Humpback whitefish** *Coregonus clupeaformis* are medium size, primarily benthic-feeding whitefish that are widely distributed in rivers, lakes, and estuaries of northern North America (McPhail and Lindsey 1970). Many similar forms have been described across North American and Asia and substantial taxonomic debate continues regarding appropriate species designations (Lindsey 1963; Alt 1979; Bodaly et al. 1988; Bernatchez and Dodson 1994). McPhail and Lindsey (1970) considered humpback whitefish to be part of a complex of three species that included *C. clupeaformis*, *C. pidschian*, and *C. nelsoni*, distinguished based on slight differences of modal gill raker counts on the first gill arch. A recent meristic, morphometric, and genetics analysis of the three humpback whitefish forms across North America concluded that the complex should be considered a single species, *C. clupeaformis*, differentiated at the subspecies level (McDermid et al. 2007). Humpback whitefish encountered in Alaska have traditionally been classified as *C. pidschian* in interior (Alt 1979) and Arctic habitats (Craig 1984), while in Canada they have been classified as *C. clupeaformis* (Bryan 1973; Craig 1984; Reist and Bond 1988). All humpback whitefish forms are referred to here as *C. clupeaformis*, per McDermid et al. (2007).

Humpback whitefish are rare in the nearshore waters of the Beaufort Sea adjacent to the Arctic Refuge coastal plain (Craig 1984; Brown 2008). Similar to the situation with broad whitefish, spawning and overwintering habitats of humpback whitefish are in the lower Sagavanirktok River and farther west and in the Mackenzie River and farther east, so humpback whitefish encountered in or near the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea.

Age at maturity for humpback whitefish range from about age 5 for the earliest maturing populations, such as those in southern Hudson Bay in eastern Canada (Morin et al. 1982) and in the Kuskokwim River (Harper et al. 2007), to age 11 for a much later maturing population in Dease Inlet in western Arctic Alaska (Moulton et al. 1997). River spawning humpback whitefish spawn in flowing water over gravel in late September and early October (Stein et al. 1973; Alt 1979; Brown 2006; Harper et al. 2009). Lake resident populations spawn over rock, gravel, and sand substrates between mid-October and late December, much later than river spawning populations (Bidgood 1974; Bryan and Kato 1975; Anras et al. 1999). Humpback whitefish in some populations may spawn two or more years in a row (Brown 2006, 2009), while in other populations alternate year spawning may be more common (Lambert and Dodson 1990; Moulton et al. 1997). Humpback whitefish are capable of living for 20 years or more (Moulton et al. 2007; Harper et al. 2007; VanGerwen-Toyne et al. 2008) and the oldest individuals within a population often exceed 30 years (Barnes and Power 1984; Howland et al. 2001; Brown and Fleener 2001). Humpback whitefish are considered to be a good food fish. They have been exploited in commercial food fisheries in North America more than any other whitefish species (Bodaly 1986; Ebener 1997; Tallman and Friesen 2007) and are routinely harvested in subsistence fisheries in Alaska and northwestern Canada (Corkum and McCart 1981; Georgette and Shiedt 2005).



**Least cisco** *Coregonus sardinella* are relatively small, pelagic-feeding whitefish found in many Arctic and sub-Arctic waters of Asia and North America (McPhail and Lindsey 1970; Morrow 1980). They have been documented in estuaries, rivers, and lakes from various locations in Alaska and northwest Canada (Alt 1980; Mann and McCart 1981; Reist and Bond 1988; Moulton et al. 1997; Seigle 2003). Because rivers within the Arctic Refuge coastal plain do not support spawning or overwintering habitats for least cisco, they spawn and overwinter in aquatic habitats in the Sagavanirktok River and farther west, or in the Mackenzie River and farther east (Craig 1984, 1989a; Reist and Bond 1988). Therefore, least cisco encountered in or adjacent to the Arctic Refuge coastal plain are anadromous fish foraging in nearshore and estuarine habitats of the southern Beaufort Sea (Craig 1984; Brown 2008).

Age at maturity for least cisco varies throughout Alaska, with interior and Kuskokwim River fish maturing as early as age 3 (Brown and Fleener 2001; Harper et al. 2007; Brown 2009), age 5 in the Selawik region (Brown 2004), and age 7 in Arctic Alaska (Moulton et al. 1997). Least cisco as old as 25 years or more have been reported (Mann 1974; Moulton et al. 1997). Least cisco are known to undertake extensive spawning migrations from lower drainage or estuarine rearing habitats to spawning habitats that may be several hundred kilometers upstream (Reist and Bond 1988; Brown et al. 2007). Spawning is thought to be either annual (Brown 2004) or less frequent (Mann 1974; Moulton et al. 1997), taking place from late September to early October (Kepler 1973; Mann 1974; Alt 1980). Eggs are broadcast in flowing water over gravel for riverine populations (Alt 1980, 1983; Brown 2009). Isolated populations in lakes are evidently capable of spawning in the absence of flowing water (Doxey 1991), however, actual spawning habitats within lakes have not been identified. Least cisco are harvested in subsistence fisheries as human or dog food, but they are generally captured incidentally to other larger whitefish species (Georgette and Shiedt 2005; Moulton and Seavey 2005).

**Arctic cisco** *Coregonus autumnalis* are relatively small, pelagic-feeding whitefish, with a near circumpolar distribution in Arctic waters (McPhail and Lindsey 1970; Moskalenko 1971). Populations have been documented in several large rivers in northern Europe and Asia, and in the Mackenzie River in northwestern Canada. All evidence indicates that Arctic cisco observed in Alaskan waters originate in the Mackenzie River drainage in Canada (Galloway et al. 1983; Fechhelm et al. 2007; Zimmerman et al. 2013), where several spawning populations have been identified (McLeod and O'Neil 1983; Dillinger et al. 1992). Juveniles disperse throughout the Beaufort Sea coastal waters of northwest Canada and Alaska for rearing and feeding (Fechhelm and Fissil 1988; Fechhelm and Griffiths 1990; Fechhelm et al. 2007). Overwintering habitats include brackish environments in the Sagavanirktok and Colville River deltas in the west and the Mackenzie and Anderson River deltas in the east (Craig 1984; 1989a; Fechhelm et al. 2007). Arctic cisco encountered in nearshore habitats adjacent to the Arctic Refuge coastal plain are either foraging or if mature, are migrating from overwintering habitats in the Colville River delta back to the Mackenzie River to spawn (Craig 1989a; Fechhelm et al. 2007; Brown 2008).

Arctic cisco are fully anadromous and are not known to exist as freshwater residents (Reist and Bond 1988). Age at maturity, based on minimum ages of Arctic cisco sampled from spawning migrations in the Mackenzie River drainage, has been estimated at seven to eight years (Stein et al. 1973; Van Gerwen-Toyne et al. 2008). Arctic cisco are capable of spawning more than once and some may live for as long as 20 years or so (Reist and Bond 1988; Van Gerwen-Toyne et al. 2008). The spawning migration into the Liard River, in the upper Mackenzie River drainage, entails an upstream migration of over 2,000 km (McLeod and O'Neil 1983). During summer, Arctic cisco are one of the most abundant species in nearshore waters of the Beaufort Sea, including areas adjacent to the Arctic Refuge coastal plain (Craig



1984; Brown 2008), and one of the primary species taken in the Kaktovik subsistence fishery (Griffiths et al. 1977; Pedersen and Linn 2005).

**Round whitefish** *Prosopium cylindraceum* are a relatively small, primarily benthic-feeding whitefish common in northern North America and northeastern Asia (McPhail and Lindsey 1970). While anadromous populations of round whitefish exist in certain coastal drainages (Morin et al. 1982), most round whitefish populations are freshwater resident forms, occupying freshwater rivers and lakes (Morrow 1980; Stewart et al. 2007). Round whitefish are present in several drainages and lakes on the North Slope of Alaska (McCart et al. 1972; Alt 1976), but within the Arctic Refuge coastal plain they occur only in the Canning River and not farther east (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983).

Age at maturity for round whitefish ranges from as young as age 3 for early maturing populations, such as those in southeast Canada (Morin et al. 1982), to age 8 or older for later maturing populations such as those in the northeast Asia (Gudkov 1999) and in the upper Chandalar River drainage (Craig and Wells 1975). Spawning for riverine round whitefish takes place in flowing water over gravel in late September and October (Craig and Wells 1975; Zyus'ko et al. 1993). Lake resident populations spawn over a mixed substrate composed of rocks, gravel, and mud in November or December (Normandeau 1969; Bryan and Kato 1975, Haymes and Kolenosky 1984). Round whitefish may spawn every year following maturity, as suggested by Craig and Wells (1975), but most reports suggest that spawning takes place less frequently (Jessop and Power 1973; Zyus'ko et al. 1993; Gudkov 1999). Round whitefish are capable of living for 20 years or more (Craig and Wells 1975; Plumb 2006) and the oldest individuals within a population may exceed 30 years (Gudkov 1999). Round whitefish have been exploited as a food fish for many years in the Laurentian Great Lakes (Mraz 1964; Fleischer 1992). They are occasionally harvested in subsistence fisheries in Alaska, but are usually a minor component of the catch (Pedersen and Linn 2005).

**Dolly Varden** (*Salvelinus malma*) is a coldwater species distributed on the Arctic coast of North America from the Mackenzie River west and south through Alaska to British Columbia and on the western side of the Pacific from the Chukotka Peninsula of Russia south to Japan and Korea (Scott and Crossman 1973; Reist et al. 1997; DeCicco 1997). Previous to 1997, Dolly Varden in northern Alaska were often referred to as Arctic char (*Salvelinus alpinus*), although for many decades there has been an understanding that there were morphological differences between char to the east of the Mackenzie River and those to the west (McCart 1980). Reist et al. (1997) conducted detailed morphology and genetics analyses and formally established anadromous char in northern Alaska and northwest Canada as Dolly Varden.

Dolly Varden are widely distributed within the northern part of the Arctic NWR and several rivers flowing through the Arctic Refuge coastal plain support spawning populations including the Canning (Craig 1977c), Hulahula (Daum et al. 1984; Brown et al. 2014), and Aichilik (Craig and McCart 1974; West and Wiswar 1985) rivers. In addition, several isolated resident populations have been documented in springs and lakes in the Canning (McCart and Craig 1973; Craig 1977c), Sadlerochit (Craig 1977b; Wiswar 1994), and Jago (Daum et al. 1984) River drainages. It should be noted that it isn't clear at this point whether the lake resident char in the Jago River valley (Daum et al. 1984) are Dolly Varden or Arctic char.

Resident and anadromous forms of Dolly Varden exhibit a number of distinct life history characteristics (Craig and McCart 1974; McCart 1980). Resident fish rarely achieve seven years of age and typically do



not exceed 250 mm in length (Craig 1977b; Craig 1978; Armstrong and Morrow 1980). Resident fish primarily feed on dipteran larvae and other macroinvertebrates, achieve sexual maturity between the ages of two and four, and with few exceptions, utilize spring habitat exclusively for all life history stages (Craig 1977b; McCart 1980). Alternatively, anadromous fish may live to 10 years of age or more and grow to over 800 mm in length (Armstrong and Morrow 1980; Craig and Haldorson 1981; Underwood et al. 1996). Sexual maturity may be attained as early as 4 years for certain precocious individuals, although the majority of anadromous fish don't mature until 6 or 8 years at lengths of 400 mm or greater (McCart 1980; Underwood et al. 1996). First migration to sea occurs between the ages of 2 and 5 years, with the majority of individuals migrating at 3 to 4 years (Yoshihara 1973; McCart 1980; Underwood et al. 1996). In late spring or early summer, Dolly Varden migrate to brackish, nearshore coastal areas of the Beaufort Sea from overwintering habitats in deep pools and spring-fed areas in coastal rivers (Craig 1989a; Fechhelm et al. 1997; Jarvela and Thorsteinson 1997). While at sea, individuals move extensively along the Arctic coast within mixed-stock aggregates feeding heavily upon mysid shrimp and amphipods with some incidence of piscivory (Craig 1984, 1989a; Krueger et al. 1999). Additionally, recent satellite telemetry data indicate that at least some Dolly Varden migrate as much as 60 km or more offshore, a migratory phenomenon that was previously unknown (Courtney et al. 2018). Anadromous Dolly Varden return to freshwater in late summer or early fall to spawn and overwinter (Craig 1984; Craig 1989a). Catch data indicate that the majority of returning spawners are female, suggesting different rates of mortality among the sexes. However, because virtually all individuals of the anadromous populations that remain resident are male (Furniss 1975; Craig 1978; McCart 1980), and those residual males can be very numerous on spawning grounds, it is thought that they account for the proportional differences between males and females observed returning from the sea. Spawning is thought to occur most often in non-consecutive years with mature females building redds within spring-fed areas of tributary streams and rivers where males compete for access (Furniss 1975; McCart 1980). Genetic structure within drainage systems indicates that spawning fish display a high level of fidelity to natal drainages (Everett et al. 1997; Krueger et al. 1999; Crane et al. 2005). Some individuals are known to overwinter in non-natal drainages during nonspawning years (McCart 1980; Brown et al. 2014). Fry emerge from nests under ice cover in May and June and are believed to remain in close proximity to spawning beds throughout the first year of life (McCart 1980).

Anadromous Dolly Varden are the primary species caught in subsistence fisheries by residents of Kaktovik, in a winter fishery at Fish Hole 2 on the Hulahula River and in coastal areas during the summer (Craig 1989b; Pederson and Linn 2005). There is also evidence of recreational use and harvest on some of the more popular rivers that flow through the Arctic Refuge coastal plain (Arvey 1991; Jennings et al. 2010).

**Arctic char** (*Salvelinus alpinus*) inhabit freshwater and marine habitats and exhibit a circumpolar distribution within the Holarctic (Johnson 1980; Reist et al. 1997). While both anadromous and freshwater-resident forms are present within Alaska, only lake-resident populations exist within the Arctic NWR (Reist et al. 1997). Within North Slope drainages, populations have been documented in a few lakes within the upper Canning and Sagavanirktok River drainages (McCart et al. 1972; Craig 1977c) and in Peters and Schrader lakes in the upper Sadlerochit River drainage (Ward and Craig 1974; Craig 1977c). It is also possible that isolated lake-resident char in the Jago River drainage are Arctic char, but meristic data necessary to make that determination is not available (Daum et al. 1984). At this time, Arctic char have not been documented in waterbodies within the Arctic Refuge coastal plain.



Arctic char body size and growth varies dramatically among areas, but in general, lake-resident Arctic char are smaller and grow at slower rates relative to anadromous forms (Craig 1977c). For example, lake-resident Arctic char in Big Lake, located in the headwaters of the Canning River, were found not to exceed 190 mm in length, while populations in adjacent lakes reached sizes upwards of 400 mm (Craig 1977c). Sexual maturity is attained between the ages of 3 and 8 with maximum ages greater than 10 years (Craig 1977c). Spawning is thought to occur during fall in deeper portions of lacustrine habitats to avoid ice scouring (Armstrong and Morrow 1980). Individuals feed non-selectively on insect larvae, amphipods, planktons, and fish where available (Craig 1977c; Armstrong and Morrow 1980). No data regarding abundance or harvest are currently available.

**Lake trout** (*Salvelinus namaycush*) inhabit deep, coldwater lakes and are widely distributed throughout northern North America from the Alaskan peninsula east across Canada to Nova Scotia and south to northern New York (Scott and Crossman 1973). Within the Refuge, lake trout are present in some coastal and headwater lakes where suitable overwintering habitat exists (Scott and Crossman 1973). On the North Slope, lake trout have been documented in Elusive Lake in the Sagavanirktok River drainage, two unnamed coastal lakes in the Canning River drainage, and Okpilak, Wahoo, Peters, and Schrader lakes (Ward and Craig 1974; Daum et al. 1984; Bendock and Burr 1985; West and Fruge 1989). At this time, Lake trout have not been documented in waterbodies within the Arctic Refuge coastal plain.

Lake trout are long-lived (40+ years) and can reach sizes upwards of 1,000 mm fork length (Furniss 1974; Craig and Wells 1975; Morrow 1980). Individuals feed on invertebrates early in life, eventually shifting to a piscivorous diet as gape expands with increasing body size. Forage likely consists of any co-occurring fish species, with documented consumption of Arctic char, ninespine stickleback, slimy sculpin, Arctic grayling, and whitefish (*Coregonus* spp.) in Alaska (Burr 1990; McDonald and Hershey 2006; Swanson et al. 2010). Lake trout become sexually mature between the ages of 5 and 13 with the majority of individuals maturing at 7 or 8 years (Craig and Wells 1975; Morrow 1980). In general, lake trout spawn in the fall over large boulder or rubble substrate at depths less than 13 m (Scott and Crossman 1973). Time of and length at emergence varies depending on habitat conditions with eggs typically requiring a 4 to 5 month incubation period (Martin 1957).

The Schrader Lake population of lake trout was estimated to contain roughly 7,000 individuals in 1995, with the majority of fish ranging between 390 and 500 mm in length (Lubinski et al. 1999). Lake trout from Peter and Schrader lakes are harvested in subsistence fisheries by residents of Kaktovik (Craig 1989b; Pederson and Linn 2005). Elusive Lake, located in the Ribdon River drainage supports a small lake trout sport fishery, however no specific sport harvest data could be found for Refuge waters (Bendock and Burr 1985; Jennings et al. 2010).

**Chum salmon** (*Oncorhynchus keta*) are distributed on the western coast of North America from southern California to the Arctic and in Asia from Siberia south to Japan (Scott and Crossman 1973). Chum salmon are semelparous and anadromous, with adults typically ranging between 550 and 650 mm in length (Horne-Brine et al. 2009). Fry emerge from gravel nests in early spring and shortly thereafter begin to disperse to the marine environment. At sea, juveniles prey upon various copepods and amphipods until growth permits the consumption of fish (Salo 1991). Individuals return to freshwater to spawn in natal tributaries beginning in summer and fall between the ages of two and six, with the majority of fish returning as four and five year olds (Gilk et al. 2009; Horne-Brine 2009). On the spawning grounds, females construct gravel nests where eggs are deposited and subsequently covered with gravel (Morrow 1980).



Within North Slope waters of the Arctic NWR, chum salmon have been captured in low numbers in the Sadlerochit, Sagavanirktok, and Canning rivers as well as nearshore coastal areas (Smith and Glesne 1983; Craig and Haldorson 1986; Brown 2008). Some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage while others consider all encountered in the Beaufort Sea to be strays originating from more southerly drainages (Craig and Haldorson 1986; Irvine et al. 2009b). Residents of Kaktovik infrequently harvest chum salmon in subsistence fisheries in nearshore areas surrounding Barter Island in the southern Beaufort Sea (Pedersen and Linn 2005).

**Chinook salmon** (*Oncorhynchus tshawytscha*) are distributed along the west coast of North America from southern California to Point Hope, Alaska and in Asia from Siberia south to Japan (Scott and Crossman 1973). Within the northern part of the Arctic NWR, Chinook salmon are rarely encountered in nearshore environments and have not been captured in any of the rivers, despite occasional catches in the Colville River to the west and Mackenzie River to the east (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009a). Chinook salmon are anadromous, semelparous, and the largest of the Pacific salmon species. Adults commonly reach lengths of 430 to 860 mm, but may grow to upwards of 1000 mm on occasion (Horne-Brine et al. 2009). Fry emerge in spring and usually spend the first year of life in freshwater habitats feeding on aquatic and terrestrial invertebrates (Wipfli 2009). Smolts migrate to sea in spring where growth rates subsequently increase as individuals shift to a primarily piscivorous diet (Bradford et al. 2009). In the ocean, the majority of Chinook salmon occupy habitats in the southern Bering Sea where they spend between one and five years before returning to natal freshwater streams to spawn in mid-July to late August (Healey 1991). On the spawning grounds, females construct gravel nests in flowing water where eggs are deposited and covered with substrate.

**Arctic grayling** (*Thymallus arcticus*) reside in lakes and rivers of northern North America from Hudson Bay to the western shores of Alaska and in Asia from Siberia to North Korea (Scott and Crossman 1973). In Beaufort Sea drainages of the Arctic NWR, including those flowing across the Arctic Refuge coastal plain, Arctic grayling are widespread and abundant (Garner and Reynolds 1986; Craig and Wells 1975). Sexual maturity is attained between the ages of four and eight with individuals typically reaching 300 to 350 mm in length and between 450 and 750 grams in weight (McCart et al. 1972; Craig and Poulin 1975; Morrow 1980). Spawning occurs annually shortly after break up in early spring in small river and lake tributaries over areas of sandy gravel (Bishop 1971). When stream habitat is not available, spawning may also occur in larger substrates in rivers and lakes (Scott and Crossman 1973). Males are territorial on the spawning grounds, however no nest is constructed (Kratt and Smith 2006). The incubation period is relatively short and juvenile fish emerge from the substrate roughly 9 to 21 days following spawning, depending on water temperature (Morrow 1980; Kratt and Smith. 1977). Adults feed on aquatic and terrestrial invertebrates and may undertake extensive inter- and intra-drainage movements between overwintering sites (deep pools, lakes, spring-fed areas) and summer feeding habitats following reproduction (Craig and Poulin 1975; West et al. 1992). Arctic grayling are, at least for short periods, tolerant of saline conditions, as individuals are sometimes captured in estuarine waters during inter-drainage movements in coastal systems (West et al. 1992). Additional biological information regarding Arctic grayling inhabiting North Slope rivers and lakes within the Arctic NWR are present in a number of publications (Furniss 1975; Garner and Reynolds 1986; Deschermeier et al. 1986; Wiswar 1991, 1992, 1994; West et al. 1992). Recreational harvest is likely to occur throughout the Refuge, although, no specific data are available (Jennings et al. 2010).



**Burbot** (*Lota lota*) inhabit deep areas of rivers and lakes of the circumpolar north extending south into some temperate areas of Europe, Asia, and North America (Morrow 1980). Within North Slope waters of the Arctic NWR, burbot have been documented in lakes and main-stem areas of the Canning River, including the segment along the western boundary of the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977c; Smith and Glesne 1983) and in the Sagavanirktok River but not in any other rivers or lakes within the Arctic Refuge coastal plain (Bendock 1980; Bendock and Burr 1985). Burbot are rarely observed in nearshore environments (Craig 1984).

Burbot typically reach lengths of 400 to 550 mm and weigh between 0.5 and 1 kg, however, individuals greater than 1,500 mm and weighting over 30 kg have been reported (Chen 1969; Evenson 1990). Most individuals are sexually mature by the age of seven (earlier in southern latitudes) and spawn under the cover of ice between the months of November and February (Chen 1969). Spawning may not be an annual event and generally takes place over gravel and sand substrate in relatively shallow areas of rivers and lakes (Chen 1969; Breeser et al. 1988). Eggs and sperm are released simultaneously by a mating pair with fertilized eggs settling into spaces in the substrate and developing over the next one to two months without parental care. Juvenile burbot feed on insect larvae and other invertebrates until roughly the third or fourth year after which they feed primarily on fish (Chen 1969). Seasonal movements ranging from a few kilometers to over 250 kilometers have been reported within riverine populations most likely associated with the connection of spawning and foraging habitats (Percy 1975; Breeser et al. 1988; Evenson 1990).

**Ninespine stickleback** (*Pungitius pungitius*) are distributed in North America from Cook Inlet, Alaska, north to the Arctic Ocean and southeast through Canada terminating on the Atlantic Coast of New England (Scott and Crossman 1973; Morrow 1980). Within North Slope waters of the Arctic NWR, ninespine stickleback are present in the lower reaches of most of the major drainages including those that flow through the Arctic Refuge coastal plain (Ward and Craig 1974; Craig 1977a; Wilson et al. 1977; Bendock and Burr 1985). Furthermore, ninespine stickleback are commonly found in coastal brackish lagoons (Griffiths et al. 1977; West and Wiswar 1985; Wiswar et al. 1995; Brown 2008) and coastal lakes where they are often the only species present (West and Fruge 1989; Trawicki et al. 1991; Wiswar 1994).

Ninespine stickleback are tolerant of salinities < 20 ppt and may move between fresh and saltwater throughout the year as access and conditions permit (Wootton 1984). Individuals attain sexual maturity by the age of two, seldom live beyond the age of five, and typically reach 65 mm in length with some as large as 90 mm (Scott and Crossman 1973; Heins et al. 2003). Spawning occurs in freshwater between the months of May and July in shallow areas containing aquatic vegetation (Wootton 1984). Males construct nests from algae and small debris where females deposit eggs. After fertilization, males protect nesting areas from predators and fan oxygenated water over the clutch of eggs. Young emerge roughly a week to a month later at which time males continue to provide care by preventing them from straying from nursery areas. Little is known regarding seasonal movements, however, spawning individuals likely move from shallow (littoral, tributary, or slough habitat) to deep (river deltas, coastal areas, lake bottoms) areas in fall (Wootton 1984). Ninespine stickleback prey on aquatic insects and small crustaceans and are an important prey item of predatory fish and birds (Palmer 1962; Morrow 1980). Additional biological data on ninespine stickleback are available in numerous publications (Yoshihara 1972; Ward and Craig 1974; Craig 1977a; Griffiths et al. 1977; Wilson et al. 1977; Bendock and Burr 1985; West and Wiswar 1985; West and Fruge 1989; Trawicki et al. 1991; Wiswar et al. 1995; Jarvela and Thorsteinson 1999;



Brown 2008). While they are commonly found in most North Slope coastal habitats of the Refuge, catch rates vary dramatically among areas and years.

**Arctic cod** (*Boreogadus saida*) is a marine species distributed throughout the entire northern polar basin, around Greenland and Iceland, into Hudson Bay, and in the North Bering Sea (Cohen et al. 1990). Arctic cod are commonly encountered and sometimes abundant in nearshore coastal areas adjacent to the Arctic NWR in the southern Beaufort Sea (Craig et al. 1982; Brown 2008).

Arctic cod prefer cold (0-6°C), saline (20-30 ppt) habitats, but are at least temporarily tolerant of fluctuating temperatures, salinities, and turbidities as they are found in both in- and off-shore marine areas, estuaries, and occasionally in the lower reaches of coastal rivers (Lowry and Frost 1981; Craig et al. 1982; Cohen et al. 1990). Adults typically range between 60 and 170 mm in length with some individuals reaching 250 mm (Craig et al. 1982). Sexual maturity is attained between the ages of two and three with maximum ages of six to seven years (Lear 1979; Craig et al. 1982). During late summer and fall, Arctic cod may aggregate into large schools and move into nearshore coastal areas that are transitioning from estuarine to marine conditions (Craig et al. 1982; Hop et al. 1997). Seasonal movements and schooling behavior may be associated with spawning, foraging, predator avoidance, or habitat availability as Arctic cod are often found associated with the edges of pack ice (Welch et al. 1993; Hop et al. 1997). Spawning occurs under ice between the months of November and March, presumably close to shore (Lowry and Frost 1981; Craig et al. 1982). Arctic cod prey on amphipods, copepods, and mysid shrimp and are an important prey item for many species of marine mammals, birds, and fish (Palmer 1962; Craig et al. 1982; Craig et al. 1984; Frost and Lowry 1984).

Arctic cod may be the most abundant and widely distributed fish species in the Beaufort Sea (Lowry and Frost 1981; Craig et al. 1982; Craig 1984). Catch data suggest Arctic cod are more abundant in coastal areas west of the Arctic NWR with one estimate, during the summer of 1978 in Simpson lagoon, numbering in the millions (Craig et al. 1982; Jarvela and Thorsteinson 1999). Within waters adjacent to the Arctic NWR, catch rates of Arctic cod are variable within and among years and areas, but tend to increase during late summer and fall (Griffiths et al. 1977; Fruge et al. 1989; West and Fruge 1989; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). There is some evidence that Arctic cod are harvested in subsistence fisheries in Kaktovik and Jago lagoons by residents of Kaktovik (Griffiths et al. 1977).

**Saffron cod** (*Eleginus gracilis*) is a marine species distributed throughout the North Pacific from the Yellow Sea in Asia to Southeast Alaska and north in the Arctic Ocean from eastern Siberia to northwestern Canada (Morrow 1980; Cohen et al. 1990). Saffron cod are widely distributed in the Beaufort Sea including coastal areas adjacent to the Arctic NWR (Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008).

Saffron cod inhabit both in- and off-shore marine and estuarine areas and are occasionally found in the lower reaches of coastal rivers (Morrow 1980). Average adult lengths range between 250 and 350 mm, with some individuals reaching up to 500 mm (Craig and Haldorson 1981). Sexual maturity is attained between the ages of two and three, with maximum ages reported between 10 and 12 years old (Cohen et al. 1990). Fish tend to move inshore in fall and winter to spawn, then move offshore in spring and summer to feed in deeper habitats (Morrow 1980). Forage consists of mysid shrimp, amphipods, and decapods, with larger individuals ingesting fish (Ellis 1962; Craig and Haldorson 1981).



Biological data pertaining to saffron cod are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths 1984, Wiswar and West 1987; Fruge et al. 1989; Wiswar et al. 1995; Brown 2008) and in other locations (Bendock 1977; Craig et al. 1985; Griffiths et al. 1998; Fecheml et al. 2006). Catch rates vary substantially among years and areas.

**Fourhorn sculpin** (*Myoxocephalus quadricornis*) is a marine species distributed throughout the circumpolar north from the Baltic Sea, east across northern Siberia to the Arctic coast of Canada and south to Norton Sound, Alaska (Andriyashev 1954; Morrow 1980). Fourhorn sculpin are often abundant in nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008).

Fourhorn sculpin rarely descend below 15-20 meters in depth and inhabit cold nearshore marine and estuarine coastal areas year-round, occasionally moving into the lower reaches of coastal streams and rivers (Griffiths et al. 1977; Morrow 1980). Adults typically reach 280 mm in length but may grow to 365 mm and live to 14 years of age (Andriyashev 1954; Percy et al. 1974; Griffiths et al. 1975). Sexual maturity is attained between the ages of three and nine with the majority of fish mature by the age of six (Griffiths et al. 1975; Griffiths et al. 1977). Spawning is thought to occur in winter, although evidence of summer spawning also exists (Goldberg et al. 1987), with males excavating shallow depressions in soft substrate where females deposit eggs (Westin 1969). After fertilization, males remain in close proximity to the nest site, cleaning and fanning oxygenated water over the eggs. Young emerge two to three months later, depending on water temperature, and move into shallow waters close to shore (Westin 1970). Seasonal on- and off-shore movements by adults may be common with individuals feeding on invertebrates such as mysids, amphipod, isopods, and occasionally small fish (Griffiths et al. 1975; Griffiths et al. 1977).

Biological data pertaining to fourhorn sculpin are largely limited to catch data and are available for nearshore areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; West and Wiswar 1985; Wiswar and West 1987; Underwood et al. 1995; Wiswar et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008) and in other locations (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999). While catches vary among years and areas, fourhorn sculpin are typically one of the most abundant marine species in nearshore areas of the Arctic NWR.

**Arctic flounder** (*Pleuronectes glacialis*) is a marine species distributed from Queen Maude Gulf in Arctic Canada west along the coast of North America to Siberia and south to Bristol Bay, Alaska (Andriyashev 1954; Morrow 1980). Fishbase (Froese and Pauly 2017), a world-wide, web-based, fish taxonomy guide, classifies Arctic flounder as *Liopsetta glacialis* while the American Fisheries Society classifies the species as *Pleuronectes glacialis* (Page et al. 2013). We use the American Fisheries Society classification here. Arctic flounder are found throughout nearshore coastal areas of the Beaufort Sea adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Jarvela and Thorsteinson 1999; Brown 2008).

Arctic flounder typically remain close to shore, inhabiting shallow brackish water habitats and river deltas, occasionally entering rivers and delta lakes (Craig 1977c; Wilson et al. 1977). Adults range between 150 and 250 mm in length, attain sexual maturity between the fourth and fifth years, and generally live to between 9 and 12 years of age, however, specimens as old as 19 have been reported (Andriyashev 1954; Griffiths et al. 1975; Griffiths et al. 1977; Bendock 1979; Morrow 1980). Spawning



is thought to occur in coastal areas between January and March but possibly as late as May in some areas (Andriyashev 1954; Morrow 1980). Young emerge roughly 40 days after fertilization depending on water temperature (Aronovich et al. 2003). Seasonal on- and off-shore movements are thought to occur with forage consisting mainly of amphipods, mollusks, crustaceans, and small fish (Griffiths et al. 1975; Morrow 1980; Wiswar 1986).

Relative to Arctic cod and fourhorn sculpin, Arctic flounder are less frequently captured, but still common in nearshore areas of the Beaufort Sea coast (Percy et al. 1974; Griffiths et al. 1975; Craig and Haldorson 1981; Jarvela and Thorsteinson 1999; Fechem et al. 2006), including areas adjacent to the Arctic NWR (Griffiths et al. 1977; Wiswar 1986; Underwood et al. 1995; Jarvela and Thorsteinson 1999; Brown 2008). In addition, Arctic flounder are infrequently captured in subsistence fisheries by the residents of Kaktovik in waters surrounding Barter Island (Pedersen and Linn 2005).

## Fisheries References

- Alt, K.T. 1976. Sport Fish Investigations of Alaska: Inventory and cataloging of North Slope waters. Alaska Fish and Game, Division of Sport Fish, Annual Performance Report. Project F-9-8, Vol. 17, G-I, Juneau (pages 129-150).
- Alt, K.T. 1979. Contributions to the life history of the humpback whitefish in Alaska. Transactions of the American Fisheries Society 108: 156-160.
- Alt, K.T. 1980. A life history study of sheefish and whitefish in Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1980-1981, Project F-9-12, Vol. 21, R-II, Juneau (pages 1-31).
- Alt, K.T. 1983. Inventory and cataloging of sport fish and sport fish waters of western Alaska. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1982-1983, Project F-9-15, Vol. 24, G-I-P-B, Juneau (pages 34-78).
- Andriyashev, A.P. 1954. Fishes of the northern seas of the U.S.S.R. keys to the fauna of the U.S.S.R. No. 53, 617p. Israel Program for Scientific Translations.
- Anras, M.L.B., P.M. Cooley, R.A. Bodaly, L. Anras, R.J.P. Fudge. 1999. Movement and habitat use by lake whitefish in a boreal lake: Integrating acoustic telemetry and geographic information systems. Transactions of the American Fisheries Society 128: 939-952.
- Armstrong, R.H., and J.E. Morrow. 1980. The Dolly Varden char, *Salvelinus malma*. Pages 99-140 in U.K. Balon (ed.) Charrs: Salmonid Fishes of the Genus *Salvelinus*. Dr. W. Junk bv Publishers.
- Aronovich, T.M., S.I. Doroshev, L.V. Spectorova, and V.M. Makhotin. 2003. Egg incubation and larval rearing of navaga (*Eleginus navaga* Pall.), polar cod (*Boreogadus saida* lepechin) and arctic flounder (*Liopsetta glacialis* Pall.) in the laboratory. Aquaculture, 6:233-242.
- Arp, C.D., and B.M. Jones. 2009. Geography of Alaska lake districts: identification, description, and analysis of lake-rich regions of a diverse and dynamic state. U.S. Geological Survey, Scientific Investigations Report 2008-5215.
- Arvey, W.D. 1991. Stock status of anadromous Dolly Varden in waters of Alaska's North Slope. Alaska Department of Fish and Game. Fishery Manuscript Number 91-3.
- Barnes, M.A., and G. Power. 1984. A comparison of otolith and scale ages for western Labrador lake whitefish, *Coregonus clupeaformis*. Environmental Biology of Fishes 10: 297-299.



- Bendock, T. 1977. Beaufort Sea estuarine fishery study. Final Report of the Principal Investigators, Outer Continental Shelf Environmental Assessment Program, Volume 4. National Oceanic and Atmospheric Administration, Anchorage.
- Bendock, T. 1979. Beaufort Sea estuarine fishery study. Final report. Pages 670-729 in Environmental assessment of the Alaskan continental shelf. BLM/NOAA, OCSEAP. No. 4. 804 p.
- Bendock, T. 1980. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1979-1980, Project F-9-12, Vol. 21, G-I-I, Juneau.
- Bendock, T. N., and J. M. Burr. 1985. Inventory and cataloging of Arctic area waters. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1984-1985, Project F-9-17, Vol. 26, G-I-I, Juneau.
- Bernatchez, L., and J.J. Dodson. 1994. Phylogeographic relationships among Palearctic and Nearctic whitefish (*Coregonus* sp.) populations as revealed by mitochondrial DNA variation. Canadian Journal of Fisheries and Aquatic Sciences 51 (Supplement 1): 240-251.
- Bidgood, B.F. 1974. Reproductive potential of two lake whitefish (*Coregonus clupeaformis*) populations. Journal of the Fisheries Research Board of Canada 31: 1631-1639.
- Bishop, F.G. 1971. Observations on spawning habits and fecundity of the Arctic grayling. The Progressive Fish Culturist. 33:12-19.
- Bodaly, R.A. 1986. Biology, exploitation and culture of coregonid fishes in Canada. Advances in Limnology 22: 1-30.
- Bodaly, R.A., J.W. Clayton, and C.C. Lindsey. 1988. Status of the Squanga whitefish, *Coregonus* sp., in the Yukon Territory, Canada. Canadian Field-Naturalist 102(1): 114-125.
- Bond, W.A., and R.N. Erickson. 1985. Life history studies of anadromous Coregonid fishes in two freshwater lake systems on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences Number 1336. 71p.
- Bradford, M.J., A.V. Vinster, and P.A. Milligan. 2009. Freshwater life history, habitat, and the production of Chinook salmon from the upper Yukon Basin. Pages 19-38 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Breeser, S.W., D.F. Stearns, M.W. Smith, R.L. West, and J.B. Reynolds. 1988. Observations of movements and habitat preferences of burbot in an Alaskan glacial river system. Transactions of the American Fisheries Society. 117:506-509.
- Brown, R.J. 2004. A biological assessment of whitefish species harvested during the spring and fall in the Selawik River Delta Selawik National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 77, Fairbanks, Alaska.
- Brown, R.J. 2006. Humpback whitefish *Coregonus pidschian* of the upper Tanana River drainage. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 90, Fairbanks, Alaska.
- Brown, R.J. 2008. Life history and demographic characteristics of Arctic cisco, Dolly Varden, and other fish species in the Barter Island region of northern Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 101, Fairbanks, Alaska.
- Brown, R.J. 2009. Distributions and demographics of whitefish species in the upper Koyukuk river drainage, Alaska, with emphasis on seasonal migrations and important habitats of broad whitefish and humpback whitefish. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report No. 104, Fairbanks, Alaska.



- Brown, R.J., N. Bickford, and K. Severin. 2007. Otolith trace element chemistry as an indicator of anadromy in Yukon River drainage Coregonine fishes. *Transactions of the American Fisheries Society* 136: 678-690.
- Brown, R.J., and C. Fleener. 2001. Beaver dam influence on fish in lentic and lotic habitats in the Black River drainage, Alaska. U.S. Fish and Wildlife Service, Study No. FIS-00-004.
- Brown, R.J., M.B. Loewen, and T.L. Tanner. 2014. Overwintering locations, migrations, and fidelity of radio-tagged Dolly Varden in the Hulahula River, Arctic National Wildlife Refuge, 2007–09. *Arctic* 67:149–158.
- Bryan, J.E. 1973. The influence of pipeline development on freshwater fishery resources of northern Yukon Territory, aspects of research conducted in 1971 and 1972. Pacific Region Department of the Environment, Northern Operations Branch Fisheries Service, Task Force on Northern Oil Development Report No. 73-6 (Information Canada Catalog No. R72-9773).
- Bryan, J.E., and D.A. Kato. 1975. Spawning of lake whitefish, *Coregonus chupeaformis*, and round whitefish, *Prosopium cylindraceum*, in Aishihik Lake and East Aishihik River, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 32: 283-288.
- Burr, J.M. 1990. Stock assessment and biological characteristics of lake trout populations in interior Alaska, 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-33. 59p.
- Carter, W.K. 2010. Life history and spawning movements of broad whitefish in the middle Yukon River. Master's Thesis, University of Alaska Fairbanks, Fairbanks, AK.
- Chang-Kue, K.J.T., and E.F. Jessop. 1997. Broad whitefish radiotagging studies in the lower Mackenzie River and adjacent coastal region, 1982-1993. Pages 117-146 in R.F. Tallman, and J.D. Reist, editors. The proceedings of the broad whitefish workshop: the biology, traditional knowledge and scientific management of broad whitefish (*Coregonus nasus* (Pallas)) in the lower Mackenzie River. Canadian Technical Report of Fisheries and Aquatic Sciences 2193, Winnipeg.
- Chen, L. 1969. The biology and taxonomy of the burbot *Lota lota*, in interior Alaska. Biological Papers of the University of Alaska. No. 11.
- Chudobiak, D. H. 1995. An examination of lacustrine and estuarine populations of Mackenzie broad whitefish (*Coregonus nasus* Pallas): the role of migration and commercial exploitation on life history variation. M. Sc. Thesis, Univ. Manitoba, Winnipeg. 135 pp.
- Cohen, D.M., T. Inada, T. Iwamoto, and N. Scialabba. 1990. FAO species catalogue. Vol. 10. Gadiform fishes of the world. An annotated and illustrated catalogue of cods, hakes, grenadiers, and other gadiform fishes known to data. FAO Fisheries Symposium Number 125, Vol. 10. 442 pp.
- Corkum, L.D., and P.J. McCart. 1981. A review of the fisheries of the Mackenzie delta and nearshore Beaufort Sea. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1613, Winnipeg.
- Courtney, M.B., B. Scanlon, R.J. Brown, A.H. Rikardsen, C.P. Gallagher, and A.C. Seitz. 2018. Offshore ocean dispersal of adult Dolly Varden *Salvelinus malma* in the Beaufort Sea. *Polar Biology* (<https://doi.org/10.1007/s00300-017-2246-5>).
- Craig, P.C. 1977a. Fisheries investigations in the Shaviovik River drainage, Alaska, with emphasis on Arctic char in the Kavik River (Chapter 3). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1977b. Arctic char in the Saderochit Spring, Arctic National Wildlife Refuge. (Chapter 2). In P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska



- with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1977c. Ecological studies of anadromous and resident populations of Arctic char in the Canning river drainage and adjacent coastal waters of the Beaufort Sea, Alaska. Pages 1-116 (Chapter 1) *In* P. McCart (ed.), Fisheries Investigations along the North Slope and Beaufort Sea coast in Alaska with emphasis on Arctic char, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 41.
- Craig, P.C. 1978. Movements of stream-resident and anadromous Arctic char (*Salvelinus alpinus*) in a perennial spring on the Canning River, Alaska. *Journal of the Fisheries Research Board of Canada* 35:48:52
- Craig, P.C. 1984. Fish use of the coastal waters of the Alaskan Beaufort Sea: a review. *Transactions of the American Fisheries Society* 113: 265-282.
- Craig, P.C. 1989a. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24: 27-54.
- Craig, P.C. 1989b. Subsistence fisheries at coastal villages in the Alaskan Arctic, 1970-1986. *Biological papers of the University of Alaska* 24:131-152.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1982. Ecological studies of Arctic cod (*Boreogadus saida*) in Beaufort Sea coastal waters, Alaska. *Canadian Journal of Fisheries and Aquatic Sciences* 39:395-406.
- Craig, P.C., W.B. Griffiths, S.R. Johnson, and D.M. Schell. 1984. Trophic dynamics in an Arctic lagoon. Pages 347–380 *in* The Alaskan Beaufort Sea: ecosystems and environments. P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Craig, P.C., W.B. Griffiths, L. Haldorson, and H. McElderry. 1985. Distributional patterns of fishes in an Alaskan Arctic lagoon. *Polar Biology* 4:9-18.
- Craig, P.C., and L. Haldorson. 1981. Fish. *In* Beaufort Sea Barrier Island-Lagoon Ecological Process Studies: Final Report, Simpson Lagoon, Part 4. Environmental Assessment of the Alaskan Continental Shelf, Final Report of Principal Investigators Vol. 8: Biological Studies. Boulder, Colorado: National Oceanic and Atmospheric Administration, Outer Continental Shelf Environment Assessment Program, and Bureau of Land Management. 384–678.
- Craig, P.C., and L. Haldorson. 1986. Pacific salmon in the North American Arctic. *Arctic*. 39:2-7.
- Craig, P.C., and P.J. McCart. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta 1972-1973. Chapter 3 *In* P.C. Craig (ed.), Fisheries Research Associated with Proposed Gas Pipeline Routes in Alaska, Yukon and Northwest Territories. Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 15.
- Craig, P. C., and P. J. McCart. 1975. Classification of stream types in Beaufort Sea drainages between Prudhoe Bay, Alaska, and the Mackenzie Delta, N.W.T., Canada. *Arctic and Alpine Research* 7:183–198.
- Craig, P.C., and V.A. Poulin. 1975. Movements and growth of Arctic grayling (*Thymallus arcticus*) and juvenile Arctic char (*Salvelinus alpinus*) in a small arctic stream, Alaska. *Journal of the Fisheries Research Board of Canada*. 32: 689-697.
- Craig, P.C., and J. Wells. 1975. Fisheries investigations in the Chandalar River region, northeast Alaska. Pages 1-114 (Chapter 1) *In* P.C. Craig (ed.), Fisheries Investigations in a Coastal Region of the Beaufort Sea, Aquatic Environments Limited, Arctic Gas Biological Report Series, Volume 34.



- Craig, P.C., and J. Wells. 1976. Life history notes for a population of Slimy Sculpin (*Cottus cognatus*) in an Alaskan Arctic stream. *Journal of the Fisheries Research Board of Canada* 33:1639–1642.
- Crane, P., T. Viavant, and J. Wenburg. 2005. Overwintering patterns of Dolly Varden *Salvelinus malma* in the Sagavanirktok River in the Alaskan North Slope inferred using mixed-stock analysis. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report Number 84.
- Daum, D., P. Rost, and M.W. Smith. 1984. Fisheries studies on the North Slope of the Arctic National Wildlife Refuge, 1983. In G.W. Gamer and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1983 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage. 66p.
- DeCicco, A.L. 1997. Movements of postsmolt anadromous Dolly Varden in Northwest Alaska. *American Fisheries Society Symposium*. 19:175-183.
- Deschermeier, S.J., T.M. Stevens, D.W. Wiswar, and R.L. West. 1986. Fisheries investigations in the Kongakut River, Arctic National Wildlife Refuge, Alaska, 1985. in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Dillinger, R.E., T.P. Birt, and J.M. Green. 1992. Arctic cisco, *Coregonus autumnalis*, distribution, migration and spawning in the Mackenzie River. *The Canadian Field-Naturalist* 106(2): 175-180.
- Doxey, M. 1991. A history of fisheries assessments and stocking programs in Harding Lake, Alaska, 1939-1989. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Manuscript Number 91-2, Anchorage.
- Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in Arctic coastal food webs. *Progress in Oceanography* 71:362–378.
- Ebener, M.P. 1997. Recovery of lake whitefish populations in the Great Lakes. *Fisheries* 22(7): 18-20.
- Ellis, D.V. 1962. Observations on the distribution and ecology of some Arctic fish. *Arctic*, 15:179–189.
- Evenson, M.J. 1990. Movement, abundance, and length composition of burbot in rivers of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series Number 90-3. 33p.
- Everett, R.J., R.L. Wilmont, and C.C. Krueger. 1997. Population genetic structure of Dolly Varden from Beaufort Sea drainages of Northern Alaska and Canada. *American Fisheries Society Symposium*. 19:240-249.
- Fechhelm, R.G., J.D. Bryan, W.B. Griffiths, and L.R. Martin. 1997. Summer growth patterns of northern Dolly Varden (*Salvelinus malma*) smolts from the Prudhoe Bay region of Alaska. *Canadian Journal of Fisheries and Aquatic Sciences*. 54:1103-1110.
- Fechhelm, R.G., G.B. Buck, and M.R. Link. 2006. Year 24 of the long-term monitoring of nearshore Beaufort Sea fishes in the Prudhoe Bay region, 2006. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska. 82 p.
- Fechhelm, R.G., and D.B. Fissel. 1988. Wind-aided recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into Alaskan waters. *Canadian Journal of Fisheries and Aquatic Sciences*. 45:906-910.
- Fechhelm, R.G., and W.B. Griffiths. 1990. Effect of wind on the recruitment of Canadian Arctic cisco (*Coregonus autumnalis*) into the central Alaskan Beaufort Sea. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 2164-2171.



- Fechhelm, R.G., B. Streever, and B.J. Gallaway. 2007. The arctic cisco (*Coregonus autumnalis*) subsistence and commercial fisheries, Colville River Alaska: a conceptual model. *Arctic* 60(4): 421-429.
- Froese, R. and D. Pauly. Editors. 2017. FishBase. World Wide Web electronic publication. [www.fishbase.org](http://www.fishbase.org), version (10/2017).
- Fleischer, G.W. 1992. Status of coregonine fishes in the Laurentian Great Lakes. *Polish Archives of Hydrobiology* 39: 247-259.
- Frost, K.J., and L.F. Lowry. 1984. Trophic relationships of vertebrate consumers in the Alaskan Beaufort Sea. Pages 381–401 *in* P.W. Barnes, D.M. Schell, and E. Reimnitz, editors. Academic Press, Orlando, Florida.
- Fruge, D.J., and D.E. Palmer. 1994. Fishery management plan, Arctic National Wildlife Refuge, FY 1994–1998. U.S. Fish and Wildlife Service, Fishery Resource Office, Fairbanks, Alaska.
- Fruge, D.J., D.W. Wiswar, L.J. Dugan, and D.E. Palmer. 1989. Fish population characteristics of Arctic National Wildlife Refuge coastal waters, summer 1988. Progress Report. U.S. Fish and Wildlife Service, Fairbanks.
- Furniss, R.A. 1974. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-6. 45p.
- Furniss, R.A. 1975. Inventory and cataloging of Arctic area waters. Federal Aid in Fish Restoration, Annual Report of Progress. Alaska Department of Fish and Game Project F-9-7. 45p.
- Galloway, B.J., W.B. Griffiths, P.C. Craig, W.J. Gazey, and J.W. Helmericks. 1983. An assessment of the Colville River delta stocks of Arctic cisco – migrants from Canada? *Biological Papers of the University of Alaska* 21: 4-23.
- Garner, G.W., and P.E. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. final report; baseline study of the fish, wildlife, and habitats. U.S. Fish and Wildlife Service, Anchorage.
- Georgette, S., and A. Shiedt. 2005. Whitefish: traditional ecological knowledge and subsistence fishing in the Kotzebue Sound region, Alaska. Division of Subsistence, Alaska Department of Fish and Game, Technical Paper Number 290, Juneau.
- Gilk, S.E., D.B. Molyneaux, T. Hamazaki, J.A. Pawluk, and W.D. Templin. 2009. Biological and genetic characteristics of fall and summer chum salmon in the Kuskokwim River, Alaska. Pages 161-179 *in* C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Goldberg, S.R., W.T. Yasutake, and R. West. 1987. Summer spawning in the fourhorn sculpin, *Myoxocephalus quadricornis*, from Alaska. *Canadian Field-Naturalist* 101:457
- Griffiths, W.B. 1984. Fish. Chapter three *in* J.C. Truett editor. Environmental characterization and biological use of lagoons in the eastern Beaufort Sea. Outer Continental Shelf Environmental Assessment Program Final reports of Principal Investigators Vol. 24. U.S. Department of Commerce, Anchorage Alaska.
- Griffiths, W.B., P.C. Craig, G. Walder, and G. Mann. 1975. Fisheries investigations in a coastal region of the Beaufort Sea (Nunaluk Lagoon, Yukon Territory). *In* P.C. Craig, editor. Fisheries investigations in a coastal region of the Beaufort Sea. Biological Report Series, Volume 34. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W.B., J.K. DenBeste, and P.C. Craig. 1977. Fisheries investigations in a coastal region of the Beaufort Sea (Kaktovik Lagoon, Alaska). *In* P. McCart, editor. Fisheries investigations along



- the North Slope from Prudhoe Bay, Alaska to the Mackenzie Delta, N.W.T. Biological Report Series, Volume 40. Canadian Arctic Gas Study Limited/Alaskan Arctic Gas Study Company, Calgary.
- Griffiths, W. B., R.G. Fechhelm, B.J. Gallaway, L.R. Martin, and W.J. Wilson. 1998. Abundance of selected fish species in relation to temperature and salinity patterns in the Sagavanirktok delta, Alaska, following construction of the Endicott Causeway. *Arctic* 51:94–104.
- Gudkov, P.K. 1999. Relict population of round whitefish *Prosopium cylindraceum* from the eastern Chukotski Peninsula. *Journal of Ichthyology* 39(4): 294-300.
- Hale, D.A. 1991. A description of the physical characteristics of nearshore and lagoonal waters in the eastern Beaufort Sea, 1989. U.S. Department of Commerce, NOAA, National Ocean Service, Ocean Assessments Division, Alaska Office, Anchorage.
- Harper, K.C., F. Harris, R.J. Brown, T. Wyatt, and D. Cannon. 2007. Stock Assessment of Broad Whitefish, Humpback Whitefish and Least Cisco in Whitefish Lake, Yukon Delta National Wildlife Refuge, Alaska, 2001-2003. U. S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 88. Kenai, AK.
- Harper, K.C., F. Harris, S.J. Miller, and D. Orabutt. 2009. Migration timing and seasonal distribution of broad whitefish, humpback whitefish, and least cisco from Whitefish Lake and the Kuskokwim River, Alaska, 2004 and 2005. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Technical Report No. 105. Kenai, AK.
- Haymes, G.T., and Kolenosky, D.P. 1984. Distribution and characteristics of spawning round whitefish in Lake Ontario, 1976-1981. Ontario Fisheries Technical Report 14: ii + 9 pp.
- Healey, M.C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 311-3394 in C. Groot and L.Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia.
- Heins, D.C., J.M. Johnson, and J.A. Baker. 2003. Reproductive ecology of the ninespine stickleback from south-central Alaska. *Journal of Fish Biology* 63:1131–1143.
- Hop, H., H.E. Welch, and R.E. Crawford. 1997. Population structure and feeding ecology of Arctic cod schools in the Canadian high Arctic. *American Fisheries Society Symposium* 19:68–80.
- Horne-Brine, M.M., J. Bales, and L. DuBois. 2009. Salmon age and sex composition and mean lengths for the Yukon River Area, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 09-26, Anchorage.
- Howland, K.L., M.A. Treble, and R.F. Tallman. 2001. A biological analysis and population assessment of northern pike, inconnu and lake whitefish from the Mackenzie River delta exploratory fishery, 1989-1993. Canadian Technical Report of Fisheries and Aquatic Sciences 2330.
- Irvine, J.R., E. Linn, K. Gillespie, C. McLeod, and J.D. Reist. 2009a. Pacific salmon in Canada's Arctic draining rivers, with emphasis on those in Brithish Columbia and the Yukon. Pacific Fisheries Resource Conservation Council. Vancouver, B.C.
- Irvine, J.R., R.W. Macdonald, R.J. Brown, L.Godbout, J.D. Reist, and E.C. Carmack. 2009b. Salmon in the Arctic and how they avoid lethal low temperatures. *North Pacific Anadromous Fish Commission Bulletin*. 5:39-50.
- Jarvela, L.E., and L.K. Thorsteinson. 1997. Movements and temperature occupancy of sonically tracked Dolly Varden and Arctic ciscoes in Camden Bay, Alaska. *American Fisheries Society Symposium*. 19:165-174.



- Jarvela, L.E., and L.K. Thorsteinson. 1999. The epipelagic fish community of Beaufort Sea coastal waters, Alaska. *Arctic* 52:80-94.
- Jennings, G.B., K. Sundet, and A.E. Bingham. 2010. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2008. Alaska Department of Fish and Game, Fishery Data Series No. 10-22, Anchorage.
- Jessop, B.M., and G. Power. 1973. Age, growth, and maturity of round whitefish (*Prosopium cylindraceum*) from the Leaf River, Ungava, Quebec. *Journal of the Fisheries Research Board of Canada* 30: 299-304.
- Johnson, L. 1980. The Arctic charr, *Salvelinus alpinus*. Pp. 19-98 in E.K. Balon, ed. Charrs: salmonid fishes of the genus *Salvelinus*. Dr. W. Junk. The Hague.
- Kane, D.L., K. Yoshikawa, and J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrogeology Journal* 21:41–52.
- Kepler, P. 1973. Sport fish investigations of Alaska: Population studies of northern pike and whitefish in the Minto Flats complex with emphasis on the Chatanika River. Alaska Department of Fish and Game, Division of Sport Fish, Annual Performance Report, 1972-1973, Project F-9-5, Vol. 14, G-II-J, Juneau (Pages 59-81).
- Kratt, L.F., and R.J.F. Smith. 1977. A post-hatching sub-gravel stage in the life history of the Arctic grayling. *Transactions of the American Fisheries Society* 106:241-243
- Kratt, L.F., and R.J.F. Smith. 2006. An analysis of the spawning behavior of the Arctic grayling *Thymallus arcticus* with observations on mating success. *Journal of Fish Biology* 17:661-666.
- Krueger, C.C., R.L. Wilmot, and R.J. Everett. 1999. Stock origins of Dolly Varden collected from Beaufort Sea coastal sites of Arctic Alaska and Canada. *Transactions of the American Fisheries Society* 128:49-57.
- Lambert, Y., and J.J. Dodson. 1990. Freshwater migration as a determinant factor in the somatic cost of reproduction of two anadromous coregonines of James Bay. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 318-334.
- Lear, W.H. 1979. Distribution, size and sexual maturity of Arctic cod (*Boreogadus saida*) in the northwest Atlantic during 1959-1978 St. John's, Newfoundland. Canadian Atlantic Fisheries Science Advisory Commission. Research Document 79/58. 40 p.
- Lindsey, C.C. 1963. Sympatric occurrence of two species of humpback whitefish in Squanga Lake, Yukon Territory. *Journal of the Fisheries Research Board of Canada* 20: 749-767.
- Lowry, L.F., and K. Frost. 1981. Distribution, growth and foods of Arctic cod (*Boreogadus saida*) in the Bering, Chukchi and Beaufort Seas. *Canadian Field Naturalist* 95:186-191.
- Lubinski, B.R., M.J. Millard, R. Schneidervin, and J.L. Melegari. 1999. A mark-recapture experiment to estimate abundance of lake trout in Lake Schrader, Arctic National Wildlife Refuge, Alaska, 1995. U.S. Fish and Wildlife Service. Unpublished Fisheries Technical Report. 14p.
- Mann, G.J. 1974. Life history types of the least cisco (*Coregonus sardinella*, Valenciennes), in the Yukon Territory, North Slope, and east Mackenzie River Delta drainages. In P.J. McCart [ed] Life histories of three species of freshwater fish in Beaufort Sea Drainages, Yukon Territory. *Arctic Gas Biological Report Series* 18(3): 160 pp.
- Mann, G.J., and P.J. McCart. 1981. Comparison of sympatric dwarf and normal populations of least cisco (*Coregonus sardinella*) inhabiting Trout Lake, Yukon Territory. *Canadian Journal of Fisheries and Aquatic Sciences* 38: 240-244.



- Martin, N.V. 1957. Reproduction of lake trout in Algonquin Part, Ontario. Transactions of the American Fisheries Society. 86:231-244.
- McCart, P. J. 1980. A Review of the systematic and ecology of Arctic char, *Salvelinus alpinus*, in the western Arctic. Canadian Technical Report of Fisheries and Aquatic Sciences. No. 935: 89 p.
- McCart, P., and P. Craig. 1973. Life history of two isolated population of Arctic char (*Salvelinus alpinus*) in spring-fed tributaries of the Canning River, Alaska. Journal of the Fisheries Research Board of Canada 30:1215–1220.
- McCart, P., P. Craig, and H. Bain. 1972. Report on fisheries investigations in the Sagavanirktok River and neighboring drainages. Alyeska Pipeline Service Company, 170 pp.
- McDermid, J.L., J.D. Reist, and R.A. Bodaly. 2007. Phylogeography and postglacial dispersal of whitefish (*Coregonus clupeaformis* complex) in northwestern North America. Archiv Für Hydrobiologie, Special Issues: Advances in Limnology 60: 91-109.
- McDonald, M.E., and A.E. Hershey. 2006. Shifts in abundance and growth of slimy sculpin in response to changes in the predator population in an Arctic Alaskan lake. Hydrobiologia. 240:219-233.
- McLeod, C.L., and J.P. O’Neil. 1983. Major range extension of anadromous salmonids and first record of Chinook salmon in the Mackenzie River drainage. Canadian Journal of Zoology 61: 2183-2184.
- McPhail, J.D., and C.C. Lindsey. 1970. Freshwater Fishes of Northern Canada and Alaska. Fisheries Research Board of Canada Bulletin 173: 381 pp.
- Morin, R., J.J. Dodson, and G. Power. 1982. Life history variations of anadromous cisco (*Coregonus artedii*), lake whitefish (*C. clupeaformis*), and round whitefish (*Prosopium cylindraceum*) populations of eastern James-Hudson Bay. Canadian Journal of Fisheries and Aquatic Sciences 39: 958-967.
- Morrow, J.E. 1980. The Freshwater Fishes of Alaska. Alaska Northwest Publishing Co., Anchorage, AK. 300 pp.
- Moskalenko, B.K. 1971. The whitefishes of Siberia. Pishchevaya Promyshlennost, Report SFWFR-TR-73-05, Moscow (translated from Russian in 1972 by R.M. Howland and G. Kavanagh, U.S. Department of the Interior, Division of Fishery Research, Washington D.C.).
- Moulton, L.L., W.A. Morris, C. George, J. Bacon, J.R. Rose, and M. Whitman. 2007. Surveys of fish habitats in the Teshekpuk Lake region, 2003-2005. Final Report to the North Slope Borough, Department of Wildlife Management, Barrow.
- Moulton, L.L., L.M. Philo, and J.C. George. 1997. Some reproductive characteristics of least ciscoes and humpback whitefish in Dease Inlet, Alaska. Page 119-126 in J. Reynolds, editor. Fish ecology in Arctic North America. American Fisheries Society 19, Bethesda, Maryland.
- Moulton, L.L., and B.T. Seavey. 2005. Harvest estimate and associated information for the 2004 Colville River fall fishery. A report prepared by MJM Research for ConocoPhillips Alaska, Inc., Anchorage.
- Mraz, D. 1964. Age and growth of the round whitefish in Lake Michigan. Transactions of the American Fisheries Society 93: 46-52.
- Normandeau, D.A. 1969. Life history and ecology of the round whitefish *Prosopium cylindraceum* (Pallas), of Newfound Lake, Bristol, New Hampshire. Transactions of the American Fisheries Society 98: 7-13.
- Page, L.M., H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, N. E. Mandrak, R.L. Mayden, and J.S. Nelson. 2013. Common and scientific names of fishes from the United States, Canada, and Mexico, seventh edition. American Fisheries Society Special Publication 34, Bethesda, Maryland.



- Palmer, S.R. 1962. Handbook of North American Birds Vol. 1. Yale University Press, New Haven Connecticut.
- Pedersen, S., and A. Linn, Jr. 2005. Kaktovik 2000-2001 Subsistence Fishery Harvest Assessment. Federal Subsistence Fishery Monitoring Program, Final Project Report No. FIS 01-101. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information, Services Division, Anchorage, Alaska.
- Percy, R. 1975. Fishes of the outer Mackenzie Delta. Canadian Department of the Environment. Beaufort Sea Project. Technical Report 8. 114p.
- Percy, R., W. Eddy, and D. Munro. 1974. Anadromous and freshwater fishes of the outer Mackenzie Delta. Fisheries and Marine Service, Environment Canada. Interim Report of Beaufort Sea Project Study B2. 51p.
- Plumb, M.P. 2006. Ecological factors influencing fish distribution in a large subarctic lake system. Master's Thesis, University of Alaska Fairbanks.
- Prasolov, P.P. 1989. On the biology of the broad whitefish, *Coregonus nasus*, from the lower Ob River basin. Journal of Ichthyology 29: 47-53.
- Rabus, B.T., and K.A. Echelmeyer. 1998. The mass balance of McCall Glacier, Brooks Range, Alaska, U.S.A.; its regional relevance and implications for climate change in the Arctic. Journal of Glaciology 44(147):333-351.
- Reist, J.D., and W.A. Bond. 1988. Life history characteristics of migratory coregonids of the lower Mackenzie River, Northwest Territories, Canada. Finnish Fisheries Research 9: 133-144.
- Reist, J.D., J.D. Johnson, and T.J. Carmichael. 1997. Variation and specific identity of char from Northwestern Arctic Canada and Alaska. American Fisheries Society Symposium. 19:250-261.
- Salo, O. 1991. Life history of chum salmon (*Oncorhynchus keta*). Pages 231-310 in C. Groot and L.Margolis editors. Pacific Salmon Life Histories. UBC Press, Vancouver, British Colombia.
- Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.
- Seigle, J. 2003. Determination of marine migratory behavior and its relationship to selected physical traits for least cisco (*Coregonus sardinella*) of the Western Arctic Coastal Plain, Alaska. Master's thesis. Oregon State University, Corvallis, Oregon.
- Shestakov, A.V. 2001. Biology of the broad whitefish *Coregonus nasus* (Coregonidae) in the Anadyr basin. Journal of Ichthyology 4(9): 746-754.
- Smith, M.W., and R.S. Glesne. 1983. Aquatic studies on the North Slope of the Arctic National Wildlife Refuge, 1981 and 1982. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report Number 83-01, Fairbanks, Alaska.
- Stein, J.N., C.S. Jessop, T.R. Porter, and K.T.J. Chang-Kue. 1973. Fish resources of the Mackenzie River Valley. Fisheries Service, Department of the Environment, Winnipeg, Manitoba.
- Stephenson, S.A. 2006. A review of the occurrence of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian western Arctic. Arctic 59:37-46.
- Stewart, D.B., T.J. Carmichael, C.D. Sawatzky, N.J. Mochnacz, and J.D. Reist. 2007. Fish life history and habitat use in the Northwest Territories: round whitefish (*Prosopium cylindraceum*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2795, Winnipeg.
- Swanson, H.K., K.A. Kidd, and J.D. Reist. 2010. Effects of Partially Anadromous Arctic Char (*Salvelinus alpinus*) Populations on Ecology of Coastal Arctic Lakes. Ecosystems. 13:261-274



- Tallman, R.F., M.V. Abrahams, and D. H. Chudobiak. 2002. Migration and life history alternatives in a high latitude species, the broad whitefish, *Coregonus nasus* Pallas. *Ecology of Freshwater Fish* 11: 101–111.
- Tallman, R.F., and M.K. Friesen. 2007. A review of population trends in length and age of lake whitefish (*Coregonus clupeaformis*) harvested from Great Slave Lake between 1972 and 1995. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2819, Winnipeg, MB.
- Trawicki, J.M., S.M. Lyons, and G.V. Elliot. 1991. Distribution and quantification of water within the lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska.
- Underwood, T.J., J.A. Gordon, M.J. Millard, L.A. Thorpe, and B.M. Osborne. 1995. Characteristics of selected fish populations of Arctic Wildlife Refuge coastal waters, final report, 1988-1991. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 28.
- Underwood, T.J., M.J. Millard, and L.A. Thorpe. 1996. Relative abundance, length frequency, age, and maturity of Dolly Varden in near-shore waters of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 125:719-728.
- VanGerwen-Toyne, M., J. Walker-Larson, and R.F. Tallman. 2008. Monitoring spawning populations of migratory coregonids in the Peel River, NT: The Peel River study 1998-2002. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2851, Winnipeg, MB.
- Ward, P., and P. Craig. 1974. Catalogue of streams, lakes, and coastal areas in Alaska along routes of the proposed gas pipeline from Prudhoe Bay, Alaska to the Alaska/Canadian border. Biological Report Series, Volume 19. Canadian Arctic Gas Study Ltd/Alaska Arctic Gas Study Co., Calgary.
- Welch, H.E., R.E. Crawford, and H. Hop. 1993. Occurrence of arctic cod (*Boreogadus saida*) schools and their vulnerability to predation in the Canadian High Arctic. *Arctic* 46:331 – 339.
- West, R.L., and D.J. Fruge. 1989. A review of coastal plain fish surveys and the results of 1986 fish surveys of selected coastal lakes and streams, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report Number 4. 22p.
- West, R.L., M.W. Smith, W.E. Barber, J.B. Reynolds, and H. Hop. 1992. Autumn migration and overwintering of Arctic grayling in coastal streams of the Arctic National Wildlife Refuge, Alaska. *Transactions of the American Fisheries Society*. 121:709-715
- West, R.L., and D.W. Wiswar. 1985. Fisheries investigations on the Arctic National Wildlife Refuge, Alaska, 1984. Pages 729-777 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1984 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Westin, L. 1969. The mode of fertilization, parental behavior and time of egg development in fourhorn sculpin. Report from the Institute of Freshwater Research Drottningholm. 49:175–182.
- Westin, L. 1970. The food ecology and the annual food cycle in the Baltic population of four-horn sculpin *Myoxocephalus quadricornis* Pisces. Report from the Institute of Freshwater Research Drottningholm. 50:168-210.
- White, D.M., P. Prokein, M.K. Chambers, M.R. Lilly, and H. Toniolo. 2008. Use of synthetic aperture radar for selecting Alaskan lakes for winter water use. *Journal of the American Water Resources Association* 44:276–284.



- Wilson, W.J., E.H. Buck, G.F. Player, and L.D. Dreyer. 1977. Winter water availability and use conflicts as related to fish and wildlife in Arctic Alaska-a synthesis of information. FWS/OBS-77/06. U.S. Fish and Wildlife Service, Washington, DC.
- Wipfli, M.S. 2009. Food supplies of stream-dwelling salmonids. Pages 39-52 in C.C. Krueger and C.E. Zimmerman, editors. Pacific salmon: ecology and management of western Alaska's populations. American Fisheries Society, Symposium 70, Bethesda, Maryland.
- Wiswar, D.W. 1986. Notes on the age, growth, distribution and summer feeding habits of Arctic flounder in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. U.S. Fish and Wildlife Service. Fairbanks Fishery Resources Progress Report Number FY86-3.
- Wiswar, D.W. 1991. Summer distribution of fishes in the Okpilak and Akutoktak rivers, Arctic National Wildlife Refuge, Alaska, 1989. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 11.
- Wiswar, D.W. 1992. Summer distribution of Arctic fishes in the Okpilak, Akutoktak, and Jago rivers, Arctic National Wildlife Refuge, Alaska, 1990. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 17.
- Wiswar, D.W. 1994. Summer distribution of Arctic fishes in the 1002 Area of the Arctic National Wildlife Refuge, Alaska, 1991 with emphasis on selected lakes, tundra streams, and the Sadlerochit River drainage. U.S. Fish and Wildlife Service. Alaska Fisheries Technical Report No. 27.
- Wiswar, D.W., and R.L. West. 1987. Fisheries investigations in Beaufort Lagoon, Arctic National Wildlife Refuge, Alaska, 1985. Pages 778-800 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service, Anchorage.
- Wiswar, D.W., R.L. West, and W.N. Winkleman. 1995. Fisheries Investigation in Oruktalik Lagoon, Arctic National Wildlife Refuge, Alaska, 1986. U. S. Fish and Wildlife Service, Fairbanks Fisheries Resource Office, Alaska Fisheries Technical Report No. 30. Fairbanks, AK.
- Wootton, R.J. 1984. A functional biology of sticklebacks. University of California Press. Berkley, CA.
- Yoshihara, H.T. 1972. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1971-1972. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-4, Job G-III-A. 49 p.
- Yoshihara, H.T. 1973. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages in Annual Report of Progress, 1972-1973. Federal Aid in Fish Restoration. Sport Fish Investigations of Alaska. Alaska Department of Fish and Game. Project F-9-5, Job G-III-A. 86 p.
- Zimmerman, C.E., A.M. Ramey, S.M. Turner, F.J. Mueter, S.M. Murphy, J.L. Nielsen. 2013. Genetics, recruitment, and migration patterns of Arctic cisco (*Coregonus autumnalis*) in the Colville River, Alaska, and Mackenzie River, Canada. Polar Biology 36:1543–1555.
- Zyus'ko, A.Y., V.V. Rusanov, and Z.A. Chernyayev. 1993. Biological data on round whitefish, *Prosopium cylindraceum*, from the Chara River. Journal of Ichthyology 33(2): 37-48.



## Birds

### Waterfowl and Waterbirds

Fourteen waterfowl and eight waterbird species regularly occur in the Coastal Plain (Table 1). Waterfowl and waterbirds generally arrive in late May and June and initiate nests from late May through July (Johnson and Herter 1989; U.S. Fish and Wildlife Service, unpublished data). Waterfowl and waterbirds are an important subsistence resource for local rural residents (summarized in U.S. Fish and Wildlife Service 2015a).

Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution for the Coastal Plain unreliable. In 2015, a ground survey conducted across most Arctic Refuge barrier islands found over 800 Common Eider (*Somateria mollissima*) nests (U.S. Fish and Wildlife Service, unpublished data). During fall, Snow Geese occur in large numbers; at times more than 300,000 stage on the Refuge coastal plain prior to fall migration (Garner and Reynolds 1986; Kendall 2006). Post-breeding and molting waterbirds use Coastal Plain lagoons in the fall with over 28,000 Long-tailed Ducks (*Clangula hyemalis*) counted along the Refuge coast in some years (Lysne et al. 2004).

### Shorebirds

Seventeen shorebird species regularly occur on the Coastal Plain (Table 1). Of these, six are listed as high conservation concern by the U.S. Shorebird Conservation Plan Partnership (2016). Shorebirds arrive to the Coastal Plain in mid-May through June (R. Lancot, pers. comm.) with most initiating nests in June, though a small number begin laying eggs in late May and into early July (Saalfeld and Lancot 2015). Brown et al. (2007) conducted surveys of breeding shorebirds during June of 2002 and 2004 and encountered 14 shorebird species and estimated that 230,000 (95-percent CI: 104,000–363,000) shorebirds occupied the Coastal Plain during the breeding season. Species richness and density were typically highest in wetland and riparian habitats. Among wetland plots, densities were highest near the Canning River Delta on the western edge of the Coastal Plain. Shorebirds stage along Coastal Plain river deltas after breeding as they prepare for fall migration to wintering areas in the Americas and Asia (Brown et al. 2012; Churchwell et al. 2018; Taylor et al. 2010; Taylor et al. 2011).

### Raptors

Five raptor species regularly occur on the Coastal Plain (Table 1). Golden Eagles are protected under the Bald and Golden Eagle Protection Act. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995). Some Snowy Owls (*Bubo scandiacus*) winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (*Falco peregrinus*), Rough-legged Hawks (*Buteo lagopus*), and Short-eared Owls (*Asio flammeus*) arrive to the Arctic and initiate nesting in May and early June (summarized in Bechard and Swem 2002; Cade 1960; Pitelka et al. 1955).



## Landbirds

Ten landbird species regularly occur on the Coastal Plain (Table 1). Three are considered permanent residents: Willow Ptarmigan (*Lagopus lagopus*), Rock Ptarmigan (*L. muta*), and Common Raven (*Corvus corax*) (U.S. Fish and Wildlife Service 2015).

**3.2.4 Table 1.** List of 57 fairly common, common, and abundant breeding and nonbreeding bird species for the coast, inland, and barrier island and lagoon regions of the Coastal Plain of the Arctic National Wildlife Refuge, Alaska from Pearce et al. (2018). Source references used are: 1. Garner and Reynolds 1986; 2. Garner and Reynolds 1987; 3. Brown et al. 2007; 4. Dau and Bollinger 2009; 5. U.S. Fish and Wildlife Service 2015; 6. Kendall 2005; 7. U.S. Fish and Wildlife Service 2008; 8. IUCN 2017; 9. Warnock 2017; 10. U.S. Shorebird Conservation Plan Partnership 2016. Generalized categories of abundance were used by most references since few quantitative surveys have been conducted in the 1002 Area. For Dau and Bollinger (2009), we did not include species with less than or equal to 15 average sightings per year. In cases where habitat area is given as “coastal plain” by a reference, both coast and inland areas are included. Abbreviations: B, breeding, NB, non-breeding, LC, least concern, MC, moderate concern, HC high concern.

	Region of Coastal Plain							
Species	Coast	Inland	Barrier Islands and Lagoons	Reference	Birds of Conservation Concern (2008) <sup>7</sup>	IUCN Status (2017) <sup>8</sup>	Audubon Watchlist (2017) <sup>9</sup>	Shorebird Conservation Plan Status List (2017) <sup>10</sup>
Greater White-fronted Goose ( <i>Anser albifrons</i> )	NB	NB		1, 2, 5		LC		
Snow Goose ( <i>Anser caerulescens</i> )	NB	NB		1, 2, 5		LC		
Brant ( <i>Branta bernicla</i> )	B, NB		NB	1, 2, 4		LC	Yellow	
Cackling Goose ( <i>Branta hutchinsii</i> )	B, NB	B, NB		1, 2, 5		LC	Yellow	
Tundra Swan ( <i>Cygnus columbianus</i> )	B, NB	B, NB		1, 2, 5, 6		LC		
American Wigeon ( <i>Mareca americana</i> )	NB			1		LC		
Northern Pintail ( <i>Anas acuta</i> )	B, NB	B, NB	NB	1, 2, 4, 5		LC		
Greater Scaup ( <i>Aythya marila</i> )	NB		NB	1, 4		LC	Red	



King Eider ( <i>Somateria spectabilis</i> )	B, NB		NB	2, 4, 5		LC	Yellow	
Common Eider ( <i>Somateria mollissima</i> )	NB		B, NB	1, 2, 4, 5, 6		Near Threatened		
Surf Scoter ( <i>Melanitta perspicillata</i> )			NB	1, 4		LC	Declining	
White-winged Scoter ( <i>Melanitta fusca</i> )	NB		NB	4, 5, 6		LC		
Long-tailed Duck ( <i>Clangula hyemalis</i> )	B, NB	B	NB	1, 2, 4, 5, 6		Vulnerable	Declining	
Red-breasted Merganser ( <i>Mergus serrator</i> )	NB	B	NB	1, 2, 4, 5, 6		LC		
Willow Ptarmigan ( <i>Lagopus lagopus</i> )	B, NB	B, NB		1, 2, 5		LC		
Rock Ptarmigan ( <i>Lagopus muta</i> )	B, NB	B, NB		1, 2, 5		LC		
Sandhill Crane ( <i>Antigone canadensis</i> )	NB			2		LC		
Black-bellied Plover ( <i>Pluvialis squatarola</i> )	NB			1, 2, 5		LC		MC
American Golden-plover ( <i>Pluvialis dominica</i> )	B, NB	B, NB		1, 2, 3, 5		LC	Red	HC
Semipalmated Plover ( <i>Charadrius semipalmatus</i> )		B, NB		2, 5		LC		LC
Upland Sandpiper ( <i>Bartramia longicauda</i> )		B		5	X	LC		LC
Whimbrel ( <i>Numenius phaeopus</i> )		NB		2	X	LC	Yellow	HC
Ruddy Turnstone ( <i>Arenaria interpres</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Stilt Sandpiper ( <i>Calidris himantopus</i> )	B, NB	B		1, 2		LC	Declining	LC



Sanderling ( <i>Calidris alba</i> )	NB			2		LC	Declining	MC
Dunlin ( <i>Calidris alpina</i> )	B, NB	B		1, 2, 3	X	LC	Red	HC
Baird's Sandpiper ( <i>Calidris bairdii</i> )	B	NB		1, 2		LC		LC
Buff-breasted Sandpiper ( <i>Calidris subruficollis</i> )	B	B		1, 2	X	Near Threatened	Red	HC
Pectoral Sandpiper ( <i>Calidris melanotos</i> )	B, NB	B, NB		1, 2, 3, 5, 6		LC	Red	HC
Semipalmated Sandpiper ( <i>Calidris pusilla</i> )	B, NB	B, NB		1, 2, 3, 5		Near Threatened		HC
Western Sandpiper ( <i>Calidris mauri</i> )	NB			1, 2		LC	Yellow	MC
Long-billed Dowitcher ( <i>Limnodromus scolopaceus</i> )	B, NB	B, NB		1, 2, 5		LC		MC
Red-necked Phalarope ( <i>Phalaropus lobatus</i> )	B, NB	B		1, 2, 3, 5		LC	Declining	MC
Red Phalarope ( <i>Phalaropus fulicarius</i> )	B, NB	B, NB		1, 2, 3, 5		LC		MC
Pomarine Jaeger ( <i>Stercorarius pomarinus</i> )	B, NB	B, NB		1, 2, 5		LC		
Parasitic Jaeger ( <i>Stercorarius parasiticus</i> )	NB	NB		1, 2, 5		LC		
Long-tailed Jaeger ( <i>Stercorarius longicaudus</i> )	B, NB	B, NB		1, 2, 5		LC		
Glaucous Gull ( <i>Larus hyperboreus</i> )	B, NB	NB	B, NB	1, 2, 4, 5, 6		LC		
Arctic Tern ( <i>Sterna paradisaea</i> )	NB	NB	B	1, 2, 5, 6	X	LC	Declining	



Red-throated Loon ( <i>Gavia stellata</i> )	B, NB		NB	1, 2, 4, 5, 6	X	LC	Declining	
Pacific Loon ( <i>Gavia pacifica</i> )	B, NB	B, NB	NB	1, 2, 4, 5, 6		LC	Declining	
Yellow-billed Loon ( <i>Gavia adamsii</i> )	NB		NB	2	X	Near Threatened	Red	
Rough-legged Hawk ( <i>Buteo lagopus</i> )	NB	NB		2		LC		
Golden Eagle ( <i>Aquila chrysaetos</i> )	NB	NB		1, 2, 5		LC		
Snowy Owl ( <i>Bubo scandiacus</i> )	B, NB	B, NB		1, 2, 5		Vulnerable	Red	
Short-eared Owl ( <i>Asio flammeus</i> )	B	B		1, 2, 5	X	LC	Declining	
Peregrine Falcon ( <i>Falco peregrinus</i> )	NB			2	X	LC		
Common Raven ( <i>Corvus corax</i> )		NB		2		LC		
Eastern yellow Wagtail ( <i>Motacilla tschutschensis</i> )	B	B, NB		1, 2, 5		LC		
Common Redpoll ( <i>Acanthis flammea</i> )	B	B		1, 2, 5		LC		
Hoary Redpoll ( <i>Acanthis hornemanni</i> )	B	B		1, 2, 5				
Lapland Longspur ( <i>Calcarius lapponicus</i> )	B	B		1, 2, 5		LC	Declining	
Snow Bunting ( <i>Plectrophenax nivalis</i> )	B	B	B, NB	5, 6		LC	Declining	
American Tree Sparrow ( <i>Spizelloides arborea</i> )		B		1, 2, 5		NA	Declining	
Savannah Sparrow ( <i>Passerculus sandwichensis</i> )	B	B		1, 2, 5		LC	Declining	



White-crowned Sparrow ( <i>Zonotrichia leucophrys</i> )		B		1		LC	Declining	
--	--	---	--	---	--	----	-----------	--

## Bird References

- Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (*Buteo lagopus*). in A. F. Poole, and F. B. Gill, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Brown, S., J. Bart, R. B. Lancot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the arctic national wildlife refuge. The Condor 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. Waterbirds 35:546-554.
- Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. University of California Publications in Zoology 63:151-290.
- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of beaufort sea deltas by hatch-year semipalmated sandpipers. Estuaries and Coasts 41:280-292.
- Dau, C. P., and K. S. Bollinger. 2009. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 1-5 July 2009.
- Garner, G. W., and P. E. Reynolds. 1987. 1985 update report baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Garner, G. W., and P. F. Reynolds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment. Final report, baseline study of the fish, wildlife, and their habitats. U.S. Fish and Wildlife Service.
- Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*). in P. G. Rodewald, editor. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- IUCN. 2017. The IUCN Red List of Threatened Species; 2017-3; accessed June 01, 2017. in.
- Johnson, S., and D. Herter. 1989. The birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage, AK.
- Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, 2003-2004. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge.
- Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). in A. F. Poole, and F. B. Gil, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.
- Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002-17. U.S. Geological Survey. Report 2331-1258.



- Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. *The Condor* 57:3-18.
- Saalfeld, S. T., and R. B. Lanctot. 2015. Conservative and opportunistic settlement strategies in Arctic-breeding shorebirds. *The Auk* 132:212-234.
- Stehn, R. A., W. W. Larned, and R. M. Platte. 2013. Analysis of aerial survey indices monitoring waterbird populations of the Arctic Coastal Plain, Alaska, 1986-2012. USFWS, Migratory Bird Management, Anchorage and Soldotna.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, F. Huettmann, D. A. Nigro, and S. J. Kendall. 2010. Distribution and community characteristics of staging shorebirds on the northern coast of Alaska. *Arctic* 63:451-467.
- Taylor, A. R., R. B. Lanctot, A. N. Powell, S. J. Kendall, and D. A. Nigro. 2011. Residence time and movements of postbreeding shorebirds on the northern coast of Alaska. *The Condor* 113:779-794.
- U.S. Fish & Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. U.S. Fish and Wildlife Service.
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. US Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management.
- U.S. Shorebird Conservation Plan Partnership. 2016. Shorebirds of Conservation Concern in the United States of America — 2016. Pages 12 *in* B. Andres, editor. U.S. Shorebirds of Conservation Concern — 2016. U.S. Fish and Wildlife Service, Division of Migratory Bird Management.
- Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska.
- Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.



## Terrestrial Mammals

### Caribou

Caribou (*Rangifer tarandus*) are the most abundant large mammal in Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for brown bears and wolves. Caribou have been present in northeastern Alaska and the northern Yukon since the early Pleistocene. Human use of caribou in the region may date back thousands of years. Remnants of caribou fences and corral structures used by the Gwich'in people are found throughout the current southern range of the Porcupine caribou herd (Warbelow et al. 1975).

Large caribou herds tend to migrate over long distances using seasonally available forage resources that are often widely distributed. Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators. In the Arctic, caribou reproduction is highly synchronous and the majority of calving occurs in a two- to three-week period. Most adult females give birth to a single calf. Caribou calves are precocious, being able to stand and nurse within one hour after birth and follow their mothers within a few hours. The first 24 hours of life are critical, when a behavioral bond is formed between the calf and its mother. Disturbance of maternal groups on the calving grounds may interfere with bond formation and can increase calf mortality. After calving, small bands of cows with newborn calves gradually merge into larger groups and are joined by yearlings, barren females, and bulls arriving from wintering areas.

Summer weather conditions promote the emergence of mosquitoes, nose bots, warble flies, and other biting insects. Insect harassment drives caribou into densely packed groups. These post-calving aggregations often move toward the Arctic coast or to higher elevations in the mountains to find relief from insects. By August, large aggregations gradually disperse into widely interspersed smaller groups that move progressively toward winter ranges. Breeding takes place in late fall, and by mid-November, caribou arrive in areas where they will spend the winter.

Four caribou herds live in northern Alaska. Two of these, the Porcupine and Central Arctic herds, consistently use Arctic Refuge seasonally or throughout the year, including spring migration, calving and post-calving. In addition, some caribou from the Teshekpuk herd occasionally use the Arctic Refuge during winter.

### Porcupine Caribou Herd

The Porcupine caribou herd ranges over 130,000 square mi (337,000 square km) of wild lands in northeastern Alaska and northwestern Canada (Lenart 2007). Porcupine caribou are an important resource used by residents of Arctic Village, Venetie, Stevens Village, Fort Yukon, Chalkyitsik, and Kaktovik, Alaska, and several communities in the Yukon and Northwest Territories of Canada. Many visitors come to Arctic Refuge during early summer with hopes of seeing large numbers of caribou.

During the 1960s and 1970s, the Porcupine caribou herd was thought to be relatively stable at about 100,000 animals. Herd numbers increased after 1978, peaked at 178,000 in 1989, and then declined to 123,000 caribou in 2001 (Lenart 2007). Between 2002 and 2009, no estimates of abundance were available. During this period, caribou left the coastal plain and northern foothills of Arctic Refuge earlier



and did not form large post-calving aggregations, or weather conditions precluded flights to photograph groups. In 2010, 169,000 caribou were counted in a photo-census of the Porcupine caribou herd (Caikoski 2011). From 2013 to 2017 the population size was the largest observed for his herd since monitoring began in 1977, with an estimated population of 197,000 in 2013 and 218,000 in 2017 (Alaska Department of Fish and Game, 2017b).

The Porcupine herd migrates hundreds of miles from wintering grounds south of the Brooks Range to give birth on the coastal plain and northern foothills of Arctic Refuge and nearby Yukon Territory in Canada. The entire Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou (Griffith et al. 2002). Foothills and mountains of Arctic Refuge are also important summer, fall, and winter habitats, as well as spring and fall migration routes. As the summer progresses and willows (*Salix* sp.) emerge, caribou also use riparian habitats. The Porcupine caribou herd generally overwinters south of the Brooks Range in Arctic Refuge and in the Richardson and Ogilvie mountains of the Yukon Territory, Canada. Winter distribution varies by year but is primarily south of the Brooks Range (Caikoski 2011).

Spring migration to calving grounds begins in mid-April and continues through May. Pregnant caribou move northward from wintering areas toward calving grounds, where they give birth during the first week in June. Timing and routes of migration vary annually depending on where the caribou overwintered, snow conditions, and timing of the onset of spring weather. Caribou wintering in Alaska often follow a northeasterly route to the Arctic coast, crossing the southern flanks and valleys of the Brooks Range, eventually entering Canada near the Firth River and following it to the coast. Caribou wintering in Canada also converge in this region. In many years, migrating caribou then move westward along the coast to calving grounds within the Arctic Refuge, although some calving often occurs in the northern Yukon. Some caribou wintering in Alaska move in a more northerly direction, crossing the eastern Brooks Range and traveling more directly toward the Arctic coast.

Since intensive monitoring began in 1983, the Porcupine caribou herd has calved in a region extending from the northern foothills of the Brooks Range to the Arctic coast and from the Canning River in Arctic Refuge to the Babbage River in Canada, an area of nearly 8.9 million acres (Griffith et al. 2002). During the calving season in early June, Porcupine caribou selected areas of wet sedge, herbaceous tussock tundra and riparian vegetation types (Griffith et al. 2002). Emerging tussock cotton grass (*Eriophorum vaginatum*) flowers were an important source of high quality forage in areas used by calving caribou (Jorgenson et al. 2002). This plant species had greater biomass and forage quality in tussock tundra compared with other vegetation types. The distribution of tussock tundra and moist sedge-willow tundra was greater in calving areas in the Arctic Refuge coastal plain than in areas further south and east (Jorgenson et al. 2002).

### **Central Arctic Caribou Herd**

The annual range of the Central Arctic caribou herd overlaps that of the Porcupine caribou herd. Two main calving concentration areas have been identified for the Central Arctic caribou herd: a western area between the Kuparuk and Colville rivers, and an eastern area between the Sagavanirktok and Canning rivers. The eastern area includes the Canning River delta region in northwest Arctic Refuge.



During most winters, scattered groups of animals range throughout the coastal plain west of the Katakturuk River and adjacent uplands to the south. Between 2002 and 2009, the winter distribution of the Central Arctic caribou included areas both north and south of the Brooks Range in Arctic Refuge. In some years, this herd mixed with Porcupine caribou wintering in the same region. In 2010, almost all Central Arctic caribou wintered on the south side of the Brooks Range in Alaska, as did Porcupine caribou.

This herd was estimated at about 5,000 caribou in the mid-1970s when it was first identified as a distinct herd (Cameron and Whitten 1979). The herd grew to almost 13,000 by the early 1980s and over 25,000 by the late 1990s (Cameron et al. 2002). A photo-census in 2010 counted more than 70,000 caribou in the Central Arctic herd, but a late spring in 2013 resulted in high mortality and the population dropped to 50,000 animals (Alaska Department of Fish and Game 2017a). By 2016 the population estimate had decreased an additional 50 percent, to less than 23,000 caribou. The declines are attributed to high adult female mortality and loss of individuals to other herd units during mixing of the Central Arctic, Teshekpuk and Porcupine caribou herds.

### **Mammal Species other than Caribou**

As established by ANILCA, one purpose of the Arctic Refuge is to “conserve fish and wildlife populations and habitats in their natural diversity.” Among the wildlife species specifically mentioned under this purpose are Dall’s sheep, muskoxen, moose, brown bear, wolf, wolverine, and caribou.

Dall’s sheep do not occur on the Coastal Plain, but are found in the Brooks Range Mountains to the south, where the species reaches its northernmost geographic extent. The eastern Sadlerochit Mountains, near the southern border of the Arctic Refuge coastal plain, contains habitat suitable for sheep, and the species has occasionally been seen there. Sheep are sensitive to disturbance from noise and aircraft traffic, particularly during the lambing season (mid to late May). Dall’s sheep populations throughout the Brooks Range peaked during the 1980s, declined steeply during the early 1990s (most likely due to adverse weather), increased slowly through approximately 2011, then declined again during 2012-2014 in association with a series of severe winters. Surveys during 2015-2017 suggested that lamb production and survival were relatively high, and the population may once again be increasing.

Populations of both muskoxen (*Ovibos moschatus*) and moose (*Alces alces*) have experienced marked changes over the last several decades. Muskoxen were reintroduced to the coastal plain in the Arctic Refuge in 1969 and 1970. The population subsequently grew through about 1985, then remained relatively stable for the next decade. Beginning in 1998, however, muskox numbers within the refuge dropped dramatically and have remained very low ever since. The overall muskox population in northeast Alaska and northwest Canada peaked in 1993, declined through 2006, and has remained relatively stable since then. Most of that decline was due to population losses from the Arctic Refuge. Today, most of the muskoxen in the area are either west or east of the Arctic Refuge (U.S. Fish and Wildlife Service 2015a). Female muskoxen do not typically breed until they are 4 or 5 years old, most only breed every other year (or less frequently), and produce a single calf. Muskoxen subsist on generally low quality forage in winter, and to compensate, they conserve energy by reducing their winter activity. Calves are born between mid-April and mid-May, 4 to 6 weeks before snowmelt and the onset of growth



of nutritious forage. As a result, late winter is a time of high vulnerability (U.S. Fish and Wildlife Service 2015a).

Moose distribution on the Coastal Plain is largely confined to patches of woody vegetation along streams during winter, but some of these moose spread out across the Coastal Plain during summer. Moose populations in northeast Alaska, including the Arctic Refuge, increased rapidly during the 1980s. This was followed by a decline of at least 50% from 1989 to 1994, leading to harvest closures. By the early 2000s, moose populations west of the refuge had started to increase, and by 2015 there was some indication that moose were beginning to increase within drainages along the northwestern part of the Refuge. However moose continue to occur at low density east of the Canning River on the coastal plain and in the northern foothills of the Refuge. Because of concerns about the small population size, harvest restrictions have been maintained (U.S. Fish and Wildlife Service 2015a).

Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common in the foothills and mountains of the Brooks Range. Grizzly bear abundance on the coastal plain varies seasonally, with highest densities occurring during early summer, when caribou are present. Throughout the Arctic, grizzly bears have low rates of reproduction. They do not reproduce until they are approximately 9 years of age in the Arctic Refuge, average litter size is 2, bear cubs experience high first-year mortality, and the interval between successful litters is greater than 3 years. Bears emerge from their dens from early March through May (Rode et al 2018).

Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and appear to be increasing in abundance along the coast. Where both species occur, red foxes have been observed killing arctic foxes. Studies in Scandinavia suggest that red foxes may outcompete arctic foxes and may be the cause of declining arctic fox populations in some areas. The principal prey of both species during summer includes a variety of small mammals and ground nesting birds, but particularly brown and collared lemmings. Lemming populations in the Arctic cycle in abundance, with large peaks in abundance occurring approximately every 4 years, and arctic fox abundance generally cycles in response to changes in lemming abundance. There is evidence from Scandinavia and Utqiagvik, Alaska, that the magnitudes of these cycles have been reduced in recent years in association with a warming climate. Reduction or elimination of fox population cycles is predicted to have negative effects on alternate prey species, such as ground-nesting birds. In addition, provision of supplemental food, such as garbage, is likely to increase fox abundance near industrial infrastructure, and this may reduce survival of some ground nesting bird species. On the Alaskan North Slope, arctic foxes have a high incidence of rabies, but little is known about the relationship between disease and fox population dynamics or the potential for rabies to spread to other species.

Little is known about the abundance, distribution, and species composition of small mammal communities in northeastern Alaska. The limited small mammal surveys that have been carried out have identified at least one species, the holarctic least shrew, that until relatively recently was unknown in North America. Maintaining populations of rare, endemic species will require identifying their current distributions, habitat requirements, and sensitivity to disturbance. Of the more common species, arctic ground squirrels have a patchy distribution in the Arctic Refuge coastal plain because denning habitat is limited by a lack of well drained soils. In areas where ground squirrels occur, they are an important



source of food for foxes, bears, wolves, wolverines and weasels. Microtine rodents, particularly brown lemmings, are year-round residents of the Arctic Refuge coastal plain and are an important source of food for many species including bears, wolves, foxes, and wolverines in years when they are abundant. Extreme fluctuations in population abundance affect the abundance and distribution of lemming predators as well as predation on other species such as ground nesting birds.

## Terrestrial Mammal References

- Alaska Department of Fish and Game (ADF&G). 2017a. Central Arctic Caribou Herd news: Winter 2016-17. Juneau, AK: Alaska Department of Fish and Game.
- Alaska Department of Fish and Game (ADF&G). 2017b. Porcupine Caribou Herd News, Summer 2017. Juneau, AK: Alaska Department of Fish and Game.
- Caikoski, J.R. 2011. Units 25A, 25B, 25D and 26C caribou [Porcupine Herd]. Pp. 251-270 in P. Harper (ed.), Caribou management report of survey-inventory activities 1 July 2008-30 June 2010. Juneau, AK: Alaska Department of Fish and Game, Division of Wildlife Conservation.
- Cameron, R.D., and K.R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. *Journal of Wildlife Management* 43(3):626-33.
- Cameron, R.D., W.T. Smith, R.G. White and B. Griffith. 2002. The Central Arctic Caribou Herd. Pp. 38-45 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, T.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron and K.R. Whitten. 2002. The Porcupine Caribou Herd. Pages 8-37 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Jorgenson, J.C., M.S. Udevitz and N.A. Felix. 2002. Forage quantity and quality. Pages 6-50 in D.C. Douglas, P.E. Reynolds, and E.B. Rhodes (eds.), Arctic Refuge coastal plain terrestrial wildlife research summaries. Reston, VA: U.S. Department of the Interior, Geological Survey Biological Science Report USGS/BRD/BSR-2002-0001.
- Lenart, E.A. 2007. Units 25A, 15B, 15D and 26C caribou [Porcupine Herd]. Pages 232-248 in Harper, editor. Caribou management report of survey and inventory activities, 1 July 2004- 30 June 2006. Alaska Department of Fish and Game, Project 3.0 Juneau, Alaska, USA.
- Rode, K. D., J. W. Olson, D. L. Eggett, D. C. Douglas, G. M. Durner, T. C. Atwood, E. V. Regehr, R. R. Wilson, T. S. Smith, and M. St. Martin. 2018. Den phenology and reproductive success of polar bears in a changing climate. *Journal of Mammalogy* 99(1):16-26. doi:[10.1093/jmammal/gyx181](https://doi.org/10.1093/jmammal/gyx181)
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact statement, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



Warbelow, C., D. Roseneau, and P. Stern. 1975. The Kutchin caribou fences of northeastern Alaska and the Northern Yukon. In R.D. Jakimchuk, editor. Studies of large mammals along the proposed Mackenzie Valley Gas Pipeline Route from Alaska to British Columbia. Arctic Gas Biological Report Series. Volume 32. Renewable Resources Consulting Services, Canadian Arctic Gas Study, Limited, and Alaska Arctic Gas Company, Calgary, Alberta, Canada.

## Subsistence

Section 803 of ANILCA defines subsistence uses as: “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible by-products of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade” (16 U.S.C. § 3113).

Residents from Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes due to their close proximity within or adjacent to the Refuge boundaries (U.S. Fish and Wildlife Service 2015a, 2015b). Residents of Arctic Village, a Gwich'in community, and Kaktovik, an Inupiat community, use the Refuge most frequently. The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010).

Not only are subsistence opportunities critical to the cultural identities of these communities, the resources gained provide needed sustenance for residents. There are few year-round employment opportunities and food costs are high due to the cost of air transportation. Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl and fish return to the Refuge and coastal plain in abundance for another season.

Although both Arctic Village and Kaktovik rely heavily on the Refuge for subsistence resources, the resources used are significantly different. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys come primarily from the migrating Porcupine caribou herd. Because of their heavy reliance on this resource, the Gwich'in people consider the Porcupine caribou herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988).

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea. The Kaktovikmiut's way of life continues to be heavily dependent on subsistence harvest of marine and terrestrial animals and fish. Kaktovik bowhead whaling occurs only in the fall from late August to early October, when the whales migrate close to shore, because the spring migration passes too far offshore for hunts to occur. When the community successfully harvests whales, marine resources comprise 59 to 68



percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982:35-68).

In addition to whales, Kaktovik residents also harvest a considerable number of Dall sheep and caribou, which contribute 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the coastal plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resource. Inland coastal areas are also accessed by walking, or to a limited extent by ATV use on private Kaktovik Inupiat Corporation lands.

### **Subsistence References**

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom. <http://www.acia.uaf.edu/pages/scientific.html> (accessed July 27, 2012).
- Gwich'in Nation. 1988 Gwich'in Niintsyaa (Resolution). <http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html>.
- Jacobson, Michael J. and Cynthia Wentworth. 1982:35-68. *Kaktovik Subsistence: Land Use Values Through Time in the Arctic National Wildlife Refuge Area*. U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks.
- Minerals Management Service [MMS]. 2003. Beaufort Sea planning area: Oil and gas lease sales 186, 195, and 202. Final Environmental Impact Statement. Minerals Management Service 2003-001, Anchorage, Alaska.
- U.S. Fish and Wildlife Service. 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.



## Recreation

Management Guidance: Preserving unique recreational values currently found in the Coastal Plain is one of the original purposes of the Arctic National Wildlife Refuge, and an extensive body of sources provide the context for interpreting these recreational values (U.S. Fish and Wildlife Service 2015). This purpose encompasses a range of composite values allowing experiences unique on a national scale, including natural conditions (where plant and animal species and communities or biophysical processes had previously not been altered); and undeveloped setting characteristics (where immersion in an untrammelled landscape free from modern human manipulation remains). This, paired with the Refuge's extreme remoteness and wild character, provide a degree of physical and psychological separation from the reminders of modern civilization unsurpassed anywhere on American soil, and insure areas where enjoyment is earned through effort.

The Refuge's recreational management prioritizes maintaining opportunities to experience a sense of freedom, exploration, and discovery; and to encounter challenge, and experience true independence and self-reliance. According to the Arctic National Wildlife Refuge visitor study summary (Christensen 2009), the greatest positive influence on visits came from experiencing the components of "Wilderness" (92%), "A Sense of Vastness" (92%), "Remoteness and Isolation" (89%), "A Sense of Adventure" (84%), and "Natural Conditions" (84%). The Refuge purposes most frequently rated as "Very Important" were "Wildlife" (97%), "Wilderness" (96%), "A bequest to future generations" (89%), "Remoteness and isolation" (89%), and "A place where natural processes continue" (86%).

The Coastal Plain is located on lands within Alaska Department of Fish and Game (ADF&G) Game Management Unit (GMU) 26C. ADF&G regulates the hunting and fishing seasons, licenses, and bag limits. Nonresident brown bear and Dall sheep hunters must be accompanied in the field by a big game guide authorized to operate in the area. There are two registration brown bear hunting seasons in GMU 26C. Caribou hunting is open year round. Fishing season is open year-round, but limits have been set by species for lakes and flowing or salt waters.

Visitors from around the state, nation, and world recreate in the Coastal Plain, but so do subsistence users (Alaska Federation of Natives 2010), as well as do local residents that are not subsistence users as defined by Section 803 of ANILCA. While the latter groups are not considered visitors, they are mentioned in this section because they are also recreational users.

Activities: Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. More recently, shoulder season activities such as polar bear viewing, kite-skiing/boarding, and aurora viewing are also enjoyed. Occasionally, non-resident snow machine expeditions travel across the Coastal Plain, originating from the pack ice north of the Dalton Highway prohibition area, and anecdotal reports have been submitted of fat-tire biking expeditions.

The majority of visitors float rivers north from the Brooks Range Mountains or view polar bears from the Refuge's coastal lagoon waters immediately surrounding Kaktovik; while hiking/backpacking, and hunting/fishing comprise a smaller portion of the predominant visitor activities. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the



Marsh Fork-Canning, Main Stem Canning, and Hulahula Rivers, because of their reliable flows during all months when water is not frozen. The Kongakut River is the most-visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. More than half of the commercially-supported visitation is guided (U.S. Fish and Wildlife Service 2011).

Detailed commercial use reporting, visitor registration/field contacts, and regular visitor use monitoring have not been conducted. Information about current characteristics of visitor use (amount, type, timing, and distribution of visitor activities and behaviors); and visitor experiences (perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area), are very limited. Generally, what is understood comes from the required reports of commercial motorboat and air operators (including hunt guides), and reports show commercially-supported visitor use has been low in numbers and dispersed geographically.

Access: Most visitors engaged in recreation away from Kaktovik within the Coastal Plain use small, fixed-wing aircraft for access. Motorized and non-motorized boats, as well as foot-based access methods are also commonly used. Recreational snowmachine use is occasional but increasing. Adequate snow cover to prevent resource damage is required for allowable snow machine access. Very occasionally, visitors experience helicopters, but helicopters are not used for recreational access. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary. In 2017, 17 air operator businesses, eight motorboat operator businesses, and two hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated.

Visitor Use Numbers: Visitation to the Coastal Plain for traditional recreational activities has generally remained stable since the late 1980s, averaging around 1000 visitors annually (the calculated average of annual total known visitation between 2001 and 2009 was 1,126 people). Where locations are known, about 77% of overall commercially-supported visitation occurs north of the Brooks Range. The North Slope river drainages most commonly visited include the Kongakut River (21%), Canning River (Marsh Fork-Canning: just over 8%; Main Stem-Canning: over 4%), Hulahula River (just under 9%), and Jago River (5 %) (U.S. Fish and Service 2011).

While overall use for traditional activities has remained stable, the recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area. In 2010, the Refuge formalized a commercial recreational guide polar bear viewing program on Refuge waters in response to interest from local business to offer these services (see submerged lands section for more information about Refuge jurisdiction over surface activities on coastal lagoons).

In addition to the stable estimate of visitor use numbers for traditional activities, it is now estimated that in 2015 and 2016, the polar bears around Kaktovik experienced approximately 2,500 views by clients and guides taking part in commercially-operated water-based polar bear viewing (U.S. Fish and Wildlife Service 2017). These estimated views were made by an average of just over 42 viewers per day during an approximately 60-day viewing season in late August to early October (viewers includes clients and



guides). Visitor use from polar bear viewing tourism increased rapidly between 2011 and 2015, but may be reaching a stable level since 2015 because of the somewhat static availability of regularly-scheduled commercial flights, visitor housing and authorized boat guides. Still, the number of bear views per day has been increasing, indicating that operators are clustering their services around a core viewing season and taking an increasing number of trips each day. The increasing numbers of viewers (clients and guides) per day each season, with the average trip length remaining fairly constant, indicates the average number of hours spent daily on water by all guides combined has steadily increased. Since 2011, viewing has grown from 7 viewers per day during the 36 day viewing season to 42 viewers per day during 54 day viewing seasons from 2012 to 2016 (U.S. Fish and Wildlife Service 2017).

No visitor use numbers are known for the reported increases in numbers of spring caribou hunters, fat-tire bikers, snowmachiners, or aurora watchers.

Distribution: Multiple recreation areas/routes of known interest to visitors of the Coastal Plain include: caribou migration viewing June-July including the following unimproved landing areas: Jago Bitty, Lower Marsh Creek, Lower Canning River, Kaktatuiruk River, and Aichilik River; abundant and diverse bird sighting areas in June-July include the Lower Canning and Kaktatuiruk Rivers; routes from the Neruokpuk Lakes Complex through the Arctic Coastal Plain from March until September (includes spring ski touring); routes between the Sadlerochit Mountains and Brown Low Point along the Kaktatuiruk River (includes backpacking and packrafting); kayaking coastal lagoons June-October between the Hulahula and Kongakut River deltas, providing paddling within the Refuge's Marine Protected Area and access to Kaktovik during open water; and expedition-length packrafting routes with resupplies at major river crossings June-September, including Upper Marsh Fork to Kaktovik, Arctic Village to Kaktovik, Neruokpuk Lakes Complex to Kaktovik, and Turner River to Kaktovik.

Trends: There has been a steady increase in the number of commercial permits issued for air taxi operators providing access (as well as commercial filming permits in the Coastal Plain) and demand for recreational use of areas such as the Refuge's pristine night sky environment are expected to continue to increase. A planning effort is underway to ensure that the Refuge provides quality polar bear viewing opportunities that minimize threats to public safety, minimize potential disturbance to polar bears, and minimize conflicts with local residents.

## **Recreation References**

- Alaska Federation of Natives (AFN). 2010. The right to subsist. Federal protection of subsistence in Alaska. Alaska Federation of Natives, Anchorage. Arctic Climate Impact Assessment. 2005. Arctic climate assessment. Cambridge University Press. Cambridge, England. United Kingdom.
- Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.
- U.S. Fish and Wildlife Service. 2011. Arctic National Wildlife Refuge public use summary. Arctic Refuge, Fairbanks, Alaska, USA.
- <[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/pureportap2010.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/pureportap2010.pdf) (accessed May 29, 2018).

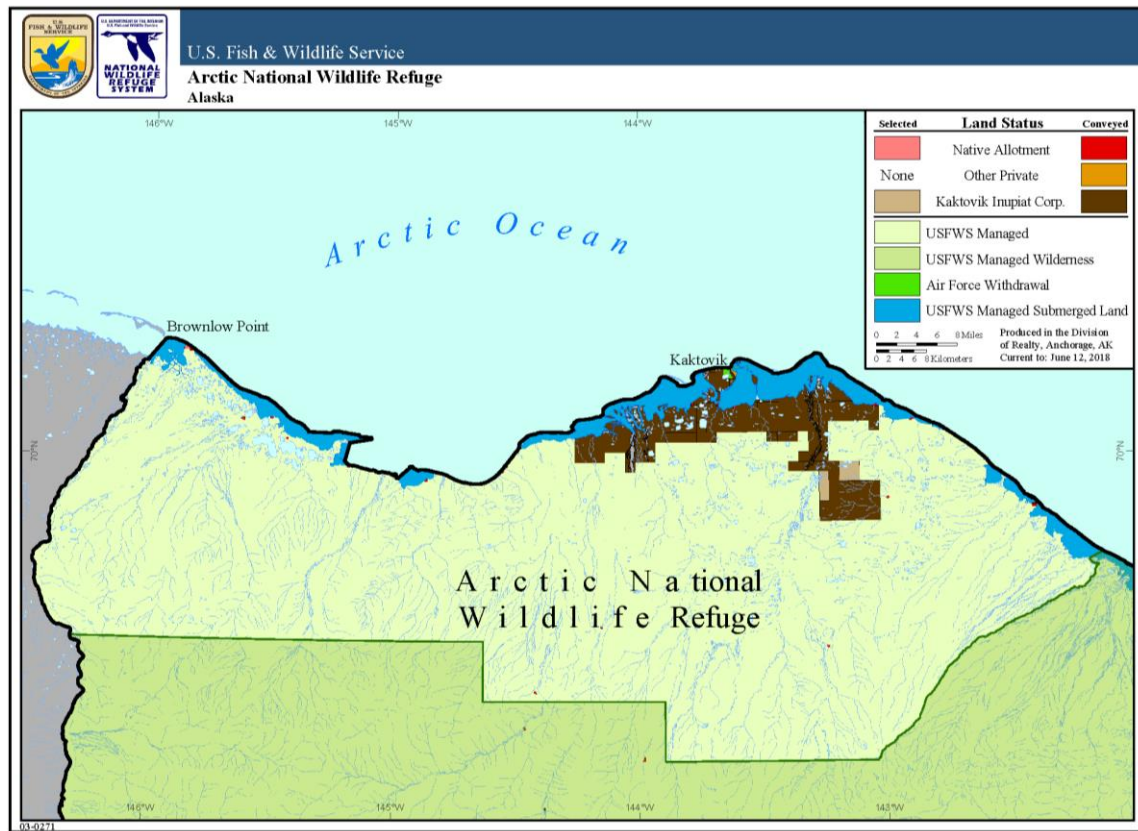


- U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.
- U.S. Fish and Wildlife Service. 2017. Arctic National Wildlife Refuge guided recreational polar bear viewing 2015-2016 summary report. Arctic Refuge, Fairbanks, Alaska, USA.  
<[https://www.fws.gov/uploadedFiles/Region\\_7/NWRS/Zone\\_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf](https://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Arctic/PDF/2015-16%20PBV%20Summary%20Report.pdf). (accessed May 29, 2018).



## Land Status Map

Map X.





**To:** Wendy Loya[wendy\_loya@fws.gov]  
**Cc:** Steve Berendzen[steve\_berendzen@fws.gov]  
**From:** Joanna Fox  
**Sent:** 2018-06-27T17:00:40-04:00  
**Importance:** Normal  
**Subject:** Draft Alternatives document  
**Received:** 2018-06-27T17:01:19-04:00  
[Executive Summary FWS Recs Alternatives Development 27June2018.docx](#)

Wendy,  
Here is the draft document as it currently stands. We are still missing text specific to polar bears, and the lagoon section needs a little more work.

Joanna

---

Joanna L. Fox  
Deputy Refuge Manager  
Arctic National Wildlife Refuge  
101 12th Avenue, Room 236  
Fairbanks, AK 99701  
(907) 456-0549

Follow us on Facebook!  
[www.facebook.com/arcticnationalwildliferefuge](http://www.facebook.com/arcticnationalwildliferefuge)

*"Do what you can, with what you have, where you are." -- Theodore Roosevelt*



## **Executive Summary USFWS Pre-meeting for BLM Lease Sale Alternative Workshop**

The Tax Cuts and Jobs Act of 2017 (PL 115-97) directed the FWS and BLM to create a program for oil and gas production from the Arctic Refuge in a manner similar to that used on the NPR-A. Many of the lease stipulations and Best Management Practices (BMPs) used on NPR-A are applicable to the Arctic Refuge. However, the Refuge has purposes and management mandates established by other Federal laws and authorities, including Public Land Order 2214 that established the original Refuge, ANILCA, the National Wildlife Refuge System Improvement Act, the Wilderness Act, and the Wild and Scenic Rivers Act. Many of these purposes and mandates are not addressed in the NPR-A lease stipulations and BMPs, as they are specific to wildlife refuges or the Arctic Refuge.

The USFWS held an internal meeting on June 19 and 20 to develop recommendations to meet the Arctic Refuge's new 2017 Tax Act development purpose while, to the greatest extent possible, continuing to meet the area's other purposes.

The USFWS delineated: A) *where* the most sensitive and important biological, recreational and cultural areas within the Arctic National Wildlife Refuge occur (*Attachment 1*), B) *how* Lease Stipulations and Best Management Strategies (BMPs) could be used to minimize impacts when avoidance of priority areas was not possible (*Attachment 2*), and C) recommended requirements for post-development reclamation (*Attachment 2*). We found many priority areas within Arctic Refuge overlapped such that protection of one resource area would also protect other priority resources (*Attachment 1*). For example, the coastal shoreline and lagoon areas were identified as a priority for polar bear survival, subsistence and recreational use, staging and molting areas for migratory birds, and were important for fish. Therefore, protection of this one area would have value for many of the Arctic Refuge's priority resources. To avoid impacts to the highest priority areas we generally are recommending no surface occupancy (NSO), either through non-leasing or NSO stipulations and directional drilling. Where development will occur, we seek to minimize disturbance through other stipulations and BMPs (*Attachment 2*).

Wilderness was an original (and continuing) purpose of the Arctic Refuge coastal plain, and provides the context within which the area's wildlife, ecological, scientific, recreational, aesthetic, and symbolic values are largely understood and appreciated. The coastal plain is now classified as Recommended for Wilderness designation. True, some of the Refuge coastal plain's natural and wild character will be lost with development. But we believe that with both adequate protection of the area's resources during development, and reclamation actions afterward, the area can be restored to a condition where it is once again eligible for Wilderness designation. That is our long-term goal.

Following are short summaries by priority areas.

**Polar Bears:** Coming Shortly from RO

**Caribou:** The Arctic Refuge provides important habitat for caribou during calving and post-calving seasons of most years. Disturbance of these areas could have significant impacts on caribou



reproduction and survival. Thus, we recommend complete protection of the area most commonly used for calving (no leasing and no surface occupancy), and limited development footprint for peripheral calving areas and major post-calving habitats. We further recommend that all infrastructure within the Coastal Plain be designed to ensure uninhibited passage of caribou from both the Porcupine and Central Arctic herds through stipulations and BMPs (See Attachment 2).

**Birds:** The Coastal Plain of the Arctic Refuge provides important habitat for millions of shorebirds, waterfowl, loons, gulls, and landbirds. Potential impacts from oil and gas development include habitat loss, disturbance, mortality due to collisions with wires and other structures, changes in abundance and distribution of predators, and exposure to spills. Important and highly-sensitive habitats include river deltas, lakes, and coastal lagoons. Buffers along these water bodies would provide protections for many birds as well as other wildlife. Many of the stipulations and BMPs established for birds and for predators of birds and their eggs in NPR-A are applicable and will provide some protections within the Arctic Refuge.

**Other Terrestrial Wildlife:** the ANILCA purposes of the Arctic Refuge include “to conserve fish and wildlife populations and habitats in their natural diversity.” However, little is currently known about distribution and abundance of many species of birds, mammals, and other taxa. Thus, we recommend a BMP with this objective. This will require that proposed development projects include necessary surveys and species assessments to establish baseline population levels, and that long term monitoring protocols be established and implemented to detect population changes.

**Traditional Use and Subsistence:** Arctic Refuge encompasses much of the traditional homelands of both the Inupiat and Gwich'in peoples in which contemporary subsistence use provides a vital connection to the land linking millennia-old archeological use between past and present. A purpose of ANILCA and Arctic Refuge is to provide the opportunity for local rural residents engaged in subsistence way of life to continue to do so. Recognizing this, identified areas of the coastal plain are of critical importance to subsistence users for access and use which are in need of protection from surface occupancy and protective stipulations and BMP's.

**Perennial Springs and Fish:** Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters, rivers without springs, have no fish. This spring water is ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic grayling and Dolly Varden are major subsistence resources in the Arctic Refuge and their survival depends on about twenty springs within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition.

**Coastal Lagoons and Fish:** The nearshore environment in the southern Beaufort Sea, adjacent to the 1002 Area, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie and other rivers along the eastern Arctic coastline. The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons become very productive environments during the brief summers and attract large numbers of



marine and anadromous fishes. During winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, some lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.

In particular, coastal lagoons and river deltas are important molting and feeding sites for waterfowl, shorebirds, and loons and will require special protections.

**Wild and Scenic Rivers and Recreation:** Internationally unique opportunities for challenge, self-reliance, and independence within a vast, and extremely remote setting should continue to offer visitors an unrivaled degree of physical and psychological separation from civilization for recreational pursuits earned through effort. Because of protective management mandates to maintain wilderness characteristics, wildlife-dependent recreation, and Wild and Scenic River Values of recommended rivers within the Coastal Plain, we request no surface occupancy of coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon, as well as buffers along the Hulahula and Canning Rivers within the coastal plain. In addition, we request a limited development footprint through use of best practices for soundscape and visual resource impact mitigation from new infrastructure located outside of, but audible or visible from within, these buffers through stipulations and BMPs (See Attachment 2).

**These recommendations represent our best effort to meet the new Tax Act purpose while meeting the area's conservation purposes.** We note that while NPR-A provides a useful framework for this project, there are some very significant differences between that area and the Refuge's coastal plain. Unlike NPR-A, the foothills of the Refuge are much closer to the coastline resulting in a narrower band of coastal plain and six to eight times steeper grades. Foothill soils are primarily composed of ice rich fine grain silts rather the sandy soils further to the west and are more sensitive to disturbance and susceptible to erosion. The increased surface grade also results in surface runoff that flows across the landscape and through the soils rather than ponding and saturating soils. The flowing water further contributes to erosional risks associated with surface disturbances and increases the impacts of linear surface development. These differences may mean that BMP's developed for current oil and gas activities in the NPR-A may not directly apply to future efforts on the coastal plain within the Arctic Refuge. Additional BMPs are being recommended to provide protection for these areas that are different than those in the NPR-A.

**Commented [1]:** Too detailed for this document, but possibly useful background:

Numerous laws, Departmental priorities, and originating Refuge purposes determine that recreation opportunities will be protectively managed:

- Section 5(d) of the Wild and Scenic Rivers Act (Public Law 90-542, as amended) establishes a method for providing Federal protection for certain free-flowing rivers and preserving them and their immediate environments for the use and enjoyment of present and future generations. The Wild and Scenic River considerations are a required element of comprehensive conservation plans and are conducted in accordance with the refuge planning process outlined in 602 FW 3.4C(1)(c) and (d), including public involvement and National Environmental Policy Act (NEPA) compliance.
- The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) gave guidance to the Secretary of the Interior for the overall management of the Refuge System. One of the Act's main components was identifying that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the priority general public uses of Refuges. In recent months the Secretary's priorities for hunting and fishing are emphasized throughout the Refuge System.
- The original Refuge purpose of preserving "unique...recreational values" drives recreation management and prioritizes internationally unique opportunities to experience challenge, self-reliance, and independence within a setting characterized by natural, undeveloped conditions and extreme remoteness; while providing a degree of physical and psychological separation from reminders of modern civilization, and recreational enjoyment earned through effort (CCP Section 1.4.1.3).



**To:** Bud Cribley[bud\_cribley@fws.gov]; Joanna Fox[joanna\_fox@fws.gov]; Joshua Rose[joshua\_rose@fws.gov]

**From:** Wendy Loya

**Sent:** 2018-06-29T12:09:37-04:00

**Importance:** Normal

**Subject:** meeting

**Received:** 2018-06-29T12:09:49-04:00

[Arctic Refuge DRAFT ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS.docx](#)

[DRAFT Executive Summary FWS Recs Alternatives Development 29June2018\\_R2.docx](#)

Docs for today's meeting that we won't share on screen.. live GIS maps should be via webex

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



## ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS

### ***K-1a Lease Stipulation/Best Management Practice – Rivers***

**Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-1 would be a best management practice.

**Objective:** Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; impacts to wilderness hunting and recreation activities; and impacts to scenic and other resource values.

**Requirement/Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within 0.5 miles of the active flood plain from the southern boundary of the 1002 Area to the stream mouth. For streams located entirely within the 1002 Area, the setback extends to the head of the stream as identified in the National Hydrography Dataset. Floodplain gravel mines designed to become water reservoirs will be considered on a case-by-case basis consistent with Best Management Practice E-8. On a case-by case basis, and in consultation with USFWS, other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event.

- a. Canning River setback will extend from the western boundary of the 1002 Area to 3 miles east of the eastern edge of the active flood plain. Additional protective measures for the Canning River Delta and Lakes are detailed in Stipulation K-1b.
- b. Hulahula River setback will be 5 miles in all directions from the active flood plain. Additional protective measures around the perennial spring at Fish Hole 1 and aufeis are detailed in Stipulation K-1c.
- c. Aichilak River setback will extend 3 miles from the eastern edge of the coastal plain boundary along the Aichilak River.
- d. Sadlerochit River setback will have a 1.0 mile setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- e. Tamayariak River will have a 0.5 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- f. Katakturuk River will have a 0.5 mi setback from the banks' ordinary high water mark.
- g. Nularvik River will have a 0.5 mi setback from the banks' ordinary high water mark.
- h. **Okpilak River will have a 0.5 /4.0 mi setback from the banks' ordinary high water mark. (Subsistence)**
- i. Jago River will have a 1.0 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- j. Okerokovik River will have a 0.5 mi setback from the banks' ordinary high water mark.,
- k. Niguanak River will have a 0.5 mi setback from the banks' ordinary high water mark.,
- l. Sikrelurak River will have a 0.5 mi setback from the banks' ordinary high water mark.
- m. Angunwill river have a 0.5 mi setback from the banks' ordinary high water mark.
- n. Kogotpak river will have a 0.5 mi setback from the banks' ordinary high water mark.
- o. Marsh Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- p. Carter Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- q. Itkilyariak Creek will have a 0.5 mi setback from the banks' ordinary high water mark.

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



***K-1b Stipulation – Canning River Delta and Lakes***

Objective: Protect and minimize adverse effects to the water quality, quantity and diversity of fish and wildlife habitats and populations, subsistence resources, cultural resources and protect and minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; and the loss of migratory bird habitat.

Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.5 mile of the ordinary high watermark of the ordinary high watermark of any waterbody within Townships 8 and 9 north of the Canning and Tamyariak watersheds. On a case-by-case basis in consultation with the USFWS and other federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



***K-1c Lease Stipulation/Best Management Practice – Springs/Aufeis***

Note: On lands unavailable for leasing in the respective alternatives, K-1b would be a best management practice. Under Alternative B, no leasing should be permitted within 3 miles of Sadlerochit Spring or the Fish Hole 1 spring on the Hulahula River to protect the subsurface flow paths to perennial springs from disturbance by drilling or fracking activity,

Objective: Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the coastal plain. River systems with springs provide year round habitat and host the most diverse and largest populations of fish, invertebrates, and wildlife and are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs and helps sustain river flow during summer and provides insect relief for caribou.

Requirement/Standard:

a. Prior to drilling activities subsurface flow paths within the watershed must be mapped and subsequent drilling activities will be conducted in a manner that does not disrupt flow of the perennial springs.

a. No surface occupancy of new non-subsistence infrastructure will be permitted within three miles of Sadlerochit Spring nor within 1 mi of the Sadlerochit river where aufeis forms (need to identify by township). Spring is a habitat of special significance on the refuge. It supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.

b. No surface occupancy of new non-subsistence infrastructure will be permitted within three miles of the perennial spring at Fish Hole 1 on the Hulahula River nor within 1 mile of the aufeis field (need to identify by township). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.

d. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of the perennial Tamayariak Spring and associated aufeis field.

e. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of Okerokavik Spring and associated aufeis field in the Jago River drainage



***K-2 Lease Stipulation/Best Management Practice – Nearshore marine, lagoon and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic Refuge***

**Objective:** Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, marine mammals, and polar bear summer and winter coastal habitat), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies.

**Requirement/Standard**

**(Exploration):** Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and until the later of November 1 or sea ice is within 10 miles of the coast of each season, whichever is later. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized officer and the US FWS that the actions or activities meet all of the following criteria:

- a. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.
- b. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts or pipeline leaks during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and “top-setting” of hydrocarbon-bearing zones.
- c. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of “direct spill” related impacts on area resources and subsistence uses.
- d. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.

**(Development):** With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 1 mile seaward of the shoreline (as measured from mean high tide) of the major coastal lagoons or the natural barrier islands, or 1 mile inland from the mainland shoreline, unless they can meet all the following criteria:

- a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.
- b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
- c. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays as identified by the community of Kaktovik and the North Slope Borough.
- d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



and/or changes in operational procedures, and “top-setting” of hydrocarbon-bearing zones.

e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound “direct spill” related impacts on area resources and subsistence uses.

f. Before conducting open water activities, the lessee shall consult with the community of Kaktovik, the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.

***K-1c Lease Stipulation – Coastal Polar Bear Denning Critical Habitat***

Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.

Standard:

a. From the coastline to 5 miles inland, no permanent oil and gas infrastructure shall be located within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.

b. From the coastline to 5 miles inland, between October 30 and April 15 of any year, operators shall not conduct oil and gas activities within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.

***K-2 Best Management Practice – Migratory waterfowl nesting and molting habitat***

Objective: Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing for large congregations of migratory waterfowl.

Requirement/Standard:

a. Aerial surveys for nesting colonies and brood-rearing areas for migratory waterfowl shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding 0.5-mile area. These surveys shall be conducted following accepted BLM and USFWS protocols.

b. Development may be prohibited or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.



***K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat***

Note: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-5a would be a best management practice. All lands within the Arctic Refuge Coastal Plain are recognized as habitat of the the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area.

**Objective:** Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration.

**Requirement/Standard:** The following standards will be applied to permitted activities:

- a. Within the Arctic Refuge Coastal Plain, lessees shall orient linear corridors when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects created by loops of road and/or pipeline that connect facilities.
- b. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required by the authorized officer, after consultation with the USFWS an other appropriate federal, State, and North Slope Borough regulatory and resource agencies, where pipelines potentially impede caribou movement.
- c. Major construction activities using heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from no later than May 20 through no earlier than July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20 or if they remain in the area in significant numbers past July 20, major construction activities will be suspended. The lessee shall submit with the development proposal a “stop work” plan that considers this and any other mitigation related to caribou early arrival and/or late departure. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.
- d. The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads:
  1. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
  2. The lessee or a contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped:
    - a. temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation.
    - b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
  3. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period.
  4. Aircraft use (including fixed wing and helicopter) shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



Twin Otter, and limited to an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through July 20 in areas where caribou are present, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

***K-5b Best Management Practice – K-10 Best Management Practice – Porcupine Caribou Herd Calving Area***

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.

Requirement/Standard: Within the Porcupine Caribou Calving Area, no areas will be offered for lease and no permanent oil and gas facilities will be allowed on the approximately 650,000 acres comprising the following townships:

Township 3N, Ranges 34E-37E

Township 4N, Ranges 31E-38E

Township 5N, Ranges 31E-39E

Township 6N, Ranges 32E-39E,  
and bounded on the south and east by the Mollie Beattie Wilderness Area.



***K-c Lease Stipulation – Porcupine Caribou Post Calving Habitat Area***

**Objective:** To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods .

**Requirement Standard:** Permanent surface disturbance resulting from oil and gas activities is limited to 150 acres (approximately 0.65% of the area) within each of the following townships (Map ---K):

Township 5N, Ranges 27E-30E

Township 6N, Ranges 37E-31E

This does not include surface disturbance activities from pipeline construction. A pipeline will be considered for development of one or more of these tracts after a workshop is convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but need not be limited to BLM, USFWS, other Federal, state, and North Slope Borough representatives. (No alternative procedures will be approved).

***K-W Lease Stipulation – Wilderness Boundary***

**Objective:** Protect wilderness values within the Mollie Beattie Wilderness Area

**Requirement/Standard:**

- a. Surface occupancy, including exploratory and production well drill pads, structures and facilities, gravel and ice roads would not be allowed within 3 miles of the southern and eastern boundaries of the 1002 area where they are adjacent to designated Wilderness.
- b. To the extent practicable, aircraft operations will be planned to minimize flights below 2,000 feet above ground level when flying within 3 miles of the Wilderness boundary.

***K-S Lease Stipulation – Subsistence***

**Objective:** Ensure a continued opportunity for traditional subsistence access and use of critical habitats and resources along coastal marine areas and designated high use river corridors.

- a. Traditional access and use of the coastal marine waters and near inland areas are most significant during the open water periods from June through October for travel and harvest of marine mammals, migratory birds, fish, and caribou.
- b. Traditional access and use of the Hulahula and Okpilak drainages are most significant during the late fall October through May for access to the uplands of the coastal plain the Brooks Range for hunting caribou, sheep and furbearers, and to accessed fishery resources in the Hulahula River and the upper Sadlerochit River-Schrader-Peters Lake region.

**Requirement/Standard:** To ensure a continued opportunity for important high use subsistence areas along the 1002 coastal shoreline and the Hulahula and Okpilak river corridors:

- a. No surface occupancy of non-subsistence infrastructure will be allowed inland **4 miles** from the coast and extend from the Canning River to the Aichilik River on Arctic National Wildlife Refuge Lands;
- b. No surface occupancy of non-subsistence infrastructure will be allowed **4 miles on either side of the Hulahula River and Okpilak Rivers.**



## **DRAFT Executive Summary USFWS Pre-meeting for BLM Lease Sale Alternative Workshop**

The Tax Cuts and Jobs Act of 2017 (PL 115-97) directed the FWS and BLM to create a program for oil and gas production from the Arctic Refuge in a manner similar to that used on the NPR-A. Many of the lease stipulations and Best Management Practices (BMPs) used on NPR-A are applicable to the Arctic Refuge. However, the Refuge has purposes and management mandates established by other Federal laws and authorities, including Public Land Order 2214 that established the original Refuge, ANILCA, the National Wildlife Refuge System Improvement Act, the Wilderness Act, and the Wild and Scenic Rivers Act. Many of these purposes and mandates are not addressed in the NPR-A lease stipulations and BMPs, as they are specific to wildlife refuges or the Arctic Refuge.

The USFWS held an internal meeting on June 19 and 20 to develop recommendations to meet the Arctic Refuge's new 2017 Tax Act development purpose while, to the greatest extent possible, continuing to meet the area's other purposes.

The USFWS delineated: A) *where* the most sensitive and important biological, recreational and cultural areas within the Arctic National Wildlife Refuge occur (*Attachment 1*), B) *how* Lease Stipulations and Best Management Practices (BMPs) could be used to minimize impacts when avoidance of priority areas was not possible (*Attachment 2*), and C) recommended requirements for post-development reclamation (*Attachment 2*). We found many priority areas within Arctic Refuge overlapped such that protection of one resource area would also protect other priority resources (*Attachment 1*). For example, the coastal shoreline and lagoon areas were identified as a priority for polar bear survival, subsistence and recreational use, staging and molting areas for migratory birds, and were important for fish. Therefore, protection of this one area would have value for many of the Arctic Refuge's priority resources. To avoid impacts to the highest priority areas we generally are recommending no surface occupancy (NSO), either through non-leasing or NSO stipulations and directional drilling. Where development will occur, we seek to minimize disturbance through other stipulations and BMPs (*Attachment 2*).

Wilderness was an original (and continuing) purpose of the Arctic Refuge coastal plain, and provides the context within which the area's wildlife, ecological, scientific, recreational, aesthetic, and symbolic values are largely understood and appreciated. The coastal plain is now classified as Recommended for Wilderness designation. True, some of the Refuge coastal plain's natural and wild character will be lost with development. But we believe that with both adequate protection of the area's resources during development, and reclamation actions afterward, the area can be restored to a condition where it is once again eligible for Wilderness designation. That is our long-term goal.

There are significant physical differences between the NPRA and the Arctic Refuge coastal plain that result in differences in habitat. Finer grained soils on the foothill slopes of the Arctic Refuge coastal plain are more susceptible to erosion and thermokarst when sensitive vegetation and underlying permafrost are damaged. More deeply incised rivers create abundant polar bear denning habitat further inland and carry surface waters to the coast, while groundwater springs



provide valuable overwintering fish habitat and aufeis that persists as a summer water source and caribou insect relief habitat. Over 20% of the surface area of the NPRA is water, while less than 2% of the coastal plain is classified as water. These differences mean that stipulations and best management practices developed for current oil and gas activities in the NPR-A need to be adapted to protect the natural resources of the Arctic Refuge coastal plain.

These recommendations meet the requirements of the Tax Act while retaining the original conservation purposes of the Arctic National Wildlife Refuge. Following are short summaries by priority areas.

**Polar Bears:** The Coastal Plain provides important winter denning and summer onshore habitat not found in the NPRA for polar bears of the Southern Beaufort Sea population. Summer land use and land-based denning is increasing due to sea ice loss. Areas have been identified along the coast and specific river drainages within the Coastal Plain that have concentrated denning, so stipulations are proposed to ensure that these core denning areas receive adequate protection. Protections have also been proposed for coastal areas including an inland buffer along lagoons and shoreline to ensure bears have the ability to move unimpeded for access to ephemeral resources (e.g., whale carcasses).

**Caribou:** The Arctic Refuge provides important habitat for caribou during calving and post-calving seasons of most years. Disturbance of these areas could have significant impacts on caribou reproduction and survival. Thus, we recommend complete protection of the area most commonly used for calving (no leasing and no surface occupancy), and limited development footprint for peripheral calving areas and major post-calving habitats. We further recommend that all infrastructure within the Coastal Plain be designed to ensure uninhibited passage of caribou from both the Porcupine and Central Arctic herds through stipulations and BMPs (See Attachment 2).

**Birds:** The Coastal Plain of the Arctic Refuge provides important habitat for millions of shorebirds, waterfowl, loons, gulls, and landbirds. Potential impacts from oil and gas development include habitat loss, disturbance, mortality due to collisions with wires and other structures, changes in abundance and distribution of predators, and exposure to spills. Important and highly-sensitive habitats include river deltas, lakes, and coastal lagoons. Buffers along these water bodies would provide protections for many birds as well as other wildlife. Many of the stipulations and BMPs established for birds and for predators of birds and their eggs in NPR-A are applicable and will provide some protections within the Arctic Refuge.

**Other Terrestrial Wildlife:** the ANILCA purposes of the Arctic Refuge include “to conserve fish and wildlife populations and habitats in their natural diversity.” However, little is currently known about distribution and abundance of many species of birds, mammals, and other taxa. Thus, we recommend a BMP with this objective. This will require that proposed development projects include necessary surveys and species assessments to establish baseline inventories, and that long term monitoring protocols be established and implemented to detect population changes.

**Traditional Use and Subsistence:** Arctic Refuge encompasses much of the traditional homelands of both the Inupiat and Gwich'in peoples in which contemporary subsistence use provides a vital



connection to the land linking millennia-old archeological use between past and present. A purpose of ANILCA and Arctic Refuge is to provide the opportunity for local rural residents engaged in subsistence way of life to continue to do so. Recognizing this, identified areas of the coastal plain are of critical importance to subsistence users for access and use which are in need of protection from surface occupancy and protective stipulations and BMP's.

**Perennial Springs and Fish:** Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters; rivers without springs, have no overwintering fish. This spring water is ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic grayling and Dolly Varden are major subsistence resources in the Arctic Refuge and their survival depends on about twenty springs within the coastal plain and adjacent foothills, thus they are high value habitats. Four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition.

**Coastal Lagoons and Fish:** The nearshore environment in the southern Beaufort Sea, adjacent to the 1002 Area, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm. The lagoons are relatively shallow and the environment becomes less salty and warmer than sea water outside the barrier islands. The lagoons become productive environments during the summer and attract large numbers of marine and anadromous fishes. These waters also provide abundant food and staging habitat for waterfowl, shorebirds, and loons during summer and fall, as they acquire energy reserves needed for fall migration. During winter some lagoons become hypersaline environments that get colder than normal sea water under ice, forcing fish to return to rivers and marine fishes retreat to offshore environments.

**Wild and Scenic Rivers and Recreation:** Internationally unique opportunities for challenge, self-reliance, and independence within a vast, and extremely remote setting should continue to offer visitors an unrivaled degree of physical and psychological separation from civilization for recreational pursuits earned through effort. Because of protective management mandates to maintain wilderness characteristics, wildlife-dependent recreation, and Wild and Scenic River Values of recommended rivers within the Coastal Plain, we request no surface occupancy of coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon, as well as buffers along the Hulahula and Canning Rivers within the coastal plain. In addition, we request a limited development footprint through use of best practices for soundscape and visual resource impact mitigation from new infrastructure located outside of, but audible or visible from within, these buffers through stipulations and BMPs (See Attachment 2).

**Commented [1]:** Too detailed for this document, but possibly useful background:

Numerous laws, Departmental priorities, and originating Refuge purposes determine that recreation opportunities will be protectively managed:

- Section 5(d) of the Wild and Scenic Rivers Act (Public Law 90-542, as amended) establishes a method for providing Federal protection for certain free-flowing rivers and preserving them and their immediate environments for the use and enjoyment of present and future generations. The Wild and Scenic River considerations are a required element of comprehensive conservation plans and are conducted in accordance with the refuge planning process outlined in 602 FW 3.4C(1)(c) and (d), including public involvement and National Environmental Policy Act (NEPA) compliance.
- The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) gave guidance to the Secretary of the Interior for the overall management of the Refuge System. One of the Act's main components was identifying that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the priority general public uses of Refuges. In recent months the Secretary's priorities for hunting and fishing are emphasized throughout the Refuge System.
- The original Refuge purpose of preserving "unique...recreational values" drives recreation management and prioritizes internationally unique opportunities to experience challenge, self-reliance, and independence within a setting characterized by natural, undeveloped conditions and extreme remoteness; while providing a degree of physical and psychological separation from reminders of modern civilization, and recreational enjoyment earned through effort (CCP Section 1.4.1.3).



**To:** Paul Leonard[paul\_leonard@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-06-29T19:20:50-04:00  
**Importance:** Normal  
**Subject:** Arctic Refuge DRAFT ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS.docx  
**Received:** 2018-06-29T19:20:57-04:00  
[Arctic Refuge DRAFT ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS.docx](#)

This is not entirely correct, but useful for springs



## ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS

### ***K-1a Lease Stipulation/Best Management Practice – Rivers***

**Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-1 would be a best management practice.

**Objective:** Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; impacts to wilderness hunting and recreation activities; and impacts to scenic and other resource values.

**Requirement/Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within 0.5 miles of the active flood plain from the southern boundary of the 1002 Area to the stream mouth. For streams located entirely within the 1002 Area, the setback extends to the head of the stream as identified in the National Hydrography Dataset. Floodplain gravel mines designed to become water reservoirs will be considered on a case-by-case basis consistent with Best Management Practice E-8. On a case-by case basis, and in consultation with USFWS, other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event.

- a. Canning River setback will extend from the western boundary of the 1002 Area to 3 miles east of the eastern edge of the active flood plain. Additional protective measures for the Canning River Delta and Lakes are detailed in Stipulation K-1b.
- b. Hulahula River setback will be 5 miles in all directions from the active flood plain. Additional protective measures around the perennial spring at Fish Hole 1 and aufeis are detailed in Stipulation K-1c.
- c. Aichilak River setback will extend 3 miles from the eastern edge of the coastal plain boundary along the Aichilak River.
- d. Sadlerochit River setback will have a 1.0 mile setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- e. Tamayariak River will have a 0.5 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- f. Katakturuk River will have a 0.5 mi setback from the banks' ordinary high water mark.
- g. Nularvik River will have a 0.5 mi setback from the banks' ordinary high water mark.
- h. **Okpilak River will have a 0.5 /4.0 mi setback from the banks' ordinary high water mark. (Subsistence)**
- i. Jago River will have a 1.0 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- j. Okerokovik River will have a 0.5 mi setback from the banks' ordinary high water mark.,
- k. Niguanak River will have a 0.5 mi setback from the banks' ordinary high water mark.,
- l. Sikrelurak River will have a 0.5 mi setback from the banks' ordinary high water mark.
- m. Angunwill river have a 0.5 mi setback from the banks' ordinary high water mark.
- n. Kogotpak river will have a 0.5 mi setback from the banks' ordinary high water mark.
- o. Marsh Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- p. Carter Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- q. Itkilyariak Creek will have a 0.5 mi setback from the banks' ordinary high water mark.

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



***K-1b Stipulation – Canning River Delta and Lakes***

Objective: Protect and minimize adverse effects to the water quality, quantity and diversity of fish and wildlife habitats and populations, subsistence resources, cultural resources and protect and minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; and the loss of migratory bird habitat.

Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.5 mile of the ordinary high watermark of the ordinary high watermark of any waterbody within Townships 8 and 9 north of the Canning and Tamyariak watersheds. On a case-by-case basis in consultation with the USFWS and other federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



***K-1c Lease Stipulation/Best Management Practice – Springs/Aufeis***

Note: On lands unavailable for leasing in the respective alternatives, K-1b would be a best management practice. Under Alternative B, no leasing should be permitted within 3 miles of Sadlerochit Spring or the Fish Hole 1 spring on the Hulahula River to protect the subsurface flow paths to perennial springs from disturbance by drilling or fracking activity,

Objective: Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the coastal plain. River systems with springs provide year round habitat and host the most diverse and largest populations of fish, invertebrates, and wildlife and are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs and helps sustain river flow during summer and provides insect relief for caribou.

Requirement/Standard:

a. Prior to drilling activities subsurface flow paths within the watershed must be mapped and subsequent drilling activities will be conducted in a manner that does not disrupt flow of the perennial springs.

a. No surface occupancy of new non-subsistence infrastructure will be permitted within three miles of Sadlerochit Spring nor within 1 mi of the Sadlerochit river where aufeis forms (need to identify by township). Spring is a habitat of special significance on the refuge. It supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.

b. No surface occupancy of new non-subsistence infrastructure will be permitted within three miles of the perennial spring at Fish Hole 1 on the Hulahula River nor within 1 mile of the aufeis field (need to identify by township). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.

d. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of the perennial Tamayariak Spring and associated aufeis field.

e. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of Okerokavik Spring and associated aufeis field in the Jago River drainage



***K-2 Lease Stipulation/Best Management Practice – Nearshore marine, lagoon and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic Refuge***

**Objective:** Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, marine mammals, and polar bear summer and winter coastal habitat), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies.

**Requirement/Standard**

**(Exploration):** Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and until the later of November 1 or sea ice is within 10 miles of the coast of each season, whichever is later. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized officer and the US FWS that the actions or activities meet all of the following criteria:

- a. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.
- b. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts or pipeline leaks during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and “top-setting” of hydrocarbon-bearing zones.
- c. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of “direct spill” related impacts on area resources and subsistence uses.
- d. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.

**(Development):** With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 1 mile seaward of the shoreline (as measured from mean high tide) of the major coastal lagoons or the natural barrier islands, or 1 mile inland from the mainland shoreline, unless they can meet all the following criteria:

- a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.
- b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
- c. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays as identified by the community of Kaktovik and the North Slope Borough.
- d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



and/or changes in operational procedures, and “top-setting” of hydrocarbon-bearing zones.

e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound “direct spill” related impacts on area resources and subsistence uses.

f. Before conducting open water activities, the lessee shall consult with the community of Kaktovik, the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.

***K-1c Lease Stipulation – Coastal Polar Bear Denning Critical Habitat***

Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.

Standard:

a. From the coastline to 5 miles inland, no permanent oil and gas infrastructure shall be located within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.

b. From the coastline to 5 miles inland, between October 30 and April 15 of any year, operators shall not conduct oil and gas activities within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.

***K-2 Best Management Practice – Migratory waterfowl nesting and molting habitat***

Objective: Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing for large congregations of migratory waterfowl.

Requirement/Standard:

a. Aerial surveys for nesting colonies and brood-rearing areas for migratory waterfowl shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding 0.5-mile area. These surveys shall be conducted following accepted BLM and USFWS protocols.

b. Development may be prohibited or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.



***K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat***

Note: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-5a would be a best management practice. All lands within the Arctic Refuge Coastal Plain are recognized as habitat of the the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area.

**Objective:** Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration.

**Requirement/Standard:** The following standards will be applied to permitted activities:

- a. Within the Arctic Refuge Coastal Plain, lessees shall orient linear corridors when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects created by loops of road and/or pipeline that connect facilities.
- b. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required by the authorized officer, after consultation with the USFWS and other appropriate federal, State, and North Slope Borough regulatory and resource agencies, where pipelines potentially impede caribou movement.
- c. Major construction activities using heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from no later than May 20 through no earlier than July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20 or if they remain in the area in significant numbers past July 20, major construction activities will be suspended. The lessee shall submit with the development proposal a “stop work” plan that considers this and any other mitigation related to caribou early arrival and/or late departure. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.
- d. The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads:
  1. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
  2. The lessee or a contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped:
    - a. temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation.
    - b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
  3. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period.
  4. Aircraft use (including fixed wing and helicopter) shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a

DRAFT FOR INTERNAL USE ONLY-PRE-DECISIONAL



Twin Otter, and limited to an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through July 20 in areas where caribou are present, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

***K-5b Best Management Practice – K-10 Best Management Practice – Porcupine Caribou Herd Calving Area***

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.

Requirement/Standard: Within the Porcupine Caribou Calving Area, no areas will be offered for lease and no permanent oil and gas facilities will be allowed on the approximately 650,000 acres comprising the following townships:

Township 3N, Ranges 34E-37E

Township 4N, Ranges 31E-38E

Township 5N, Ranges 31E-39E

Township 6N, Ranges 32E-39E,  
and bounded on the south and east by the Mollie Beattie Wilderness Area.



***K-c Lease Stipulation – Porcupine Caribou Post Calving Habitat Area***

**Objective:** To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods .

**Requirement Standard:** Permanent surface disturbance resulting from oil and gas activities is limited to 150 acres (approximately 0.65% of the area) within each of the following townships (Map ---K):

Township 5N, Ranges 27E-30E

Township 6N, Ranges 37E-31E

This does not include surface disturbance activities from pipeline construction. A pipeline will be considered for development of one or more of these tracts after a workshop is convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but need not be limited to BLM, USFWS, other Federal, state, and North Slope Borough representatives. (No alternative procedures will be approved).

***K-W Lease Stipulation – Wilderness Boundary***

**Objective:** Protect wilderness values within the Mollie Beattie Wilderness Area

**Requirement/Standard:**

- a. Surface occupancy, including exploratory and production well drill pads, structures and facilities, gravel and ice roads would not be allowed within 3 miles of the southern and eastern boundaries of the 1002 area where they are adjacent to designated Wilderness.
- b. To the extent practicable, aircraft operations will be planned to minimize flights below 2,000 feet above ground level when flying within 3 miles of the Wilderness boundary.

***K-S Lease Stipulation – Subsistence***

**Objective:** Ensure a continued opportunity for traditional subsistence access and use of critical habitats and resources along coastal marine areas and designated high use river corridors.

- a. Traditional access and use of the coastal marine waters and near inland areas are most significant during the open water periods from June through October for travel and harvest of marine mammals, migratory birds, fish, and caribou.
- b. Traditional access and use of the Hulahula and Okpilak drainages are most significant during the late fall October through May for access to the uplands of the coastal plain the Brooks Range for hunting caribou, sheep and furbearers, and to accessed fishery resources in the Hulahula River and the upper Sadlerochit River-Schrader-Peters Lake region.

**Requirement/Standard:** To ensure a continued opportunity for important high use subsistence areas along the 1002 coastal shoreline and the Hulahula and Okpilak river corridors:

- a. No surface occupancy of non-subsistence infrastructure will be allowed inland **4 miles** from the coast and extend from the Canning River to the Aichilik River on Arctic National Wildlife Refuge Lands;
- b. No surface occupancy of non-subsistence infrastructure will be allowed **4 miles on either side of the Hulahula River and Okpilak Rivers.**



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Leonard, Paul  
**Sent:** 2018-07-05T23:28:51-04:00  
**Importance:** Normal  
**Subject:** Viewshed  
**Received:** 2018-07-05T23:29:38-04:00  
[Viewshed.pdf](#)

Can discuss as many details as you'd like.

Finest resolution I could practicably do (24m spatial grain) given immediate constraints. Vertical accuracy is probably less than 1m.

Apologies for the ugly map, I am quite limited with this video card (e.g., see the phantom lines in the map?) I can easily stylize differently though if you'd like.

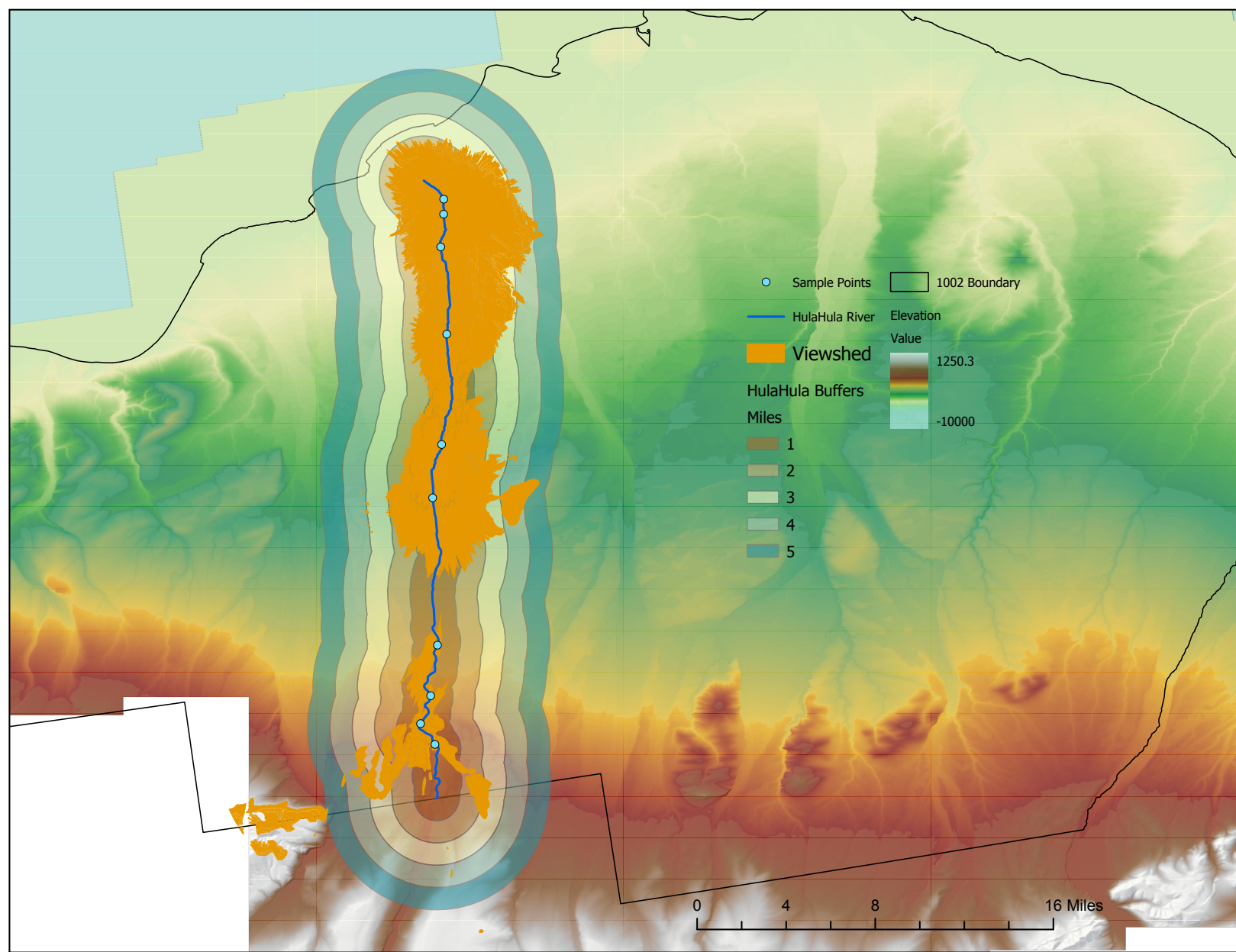
FYI: this is a high-res map so you can print larger or zoom electronically if you'd like.

Cheers,  
Paul

--

Paul Leonard, PhD  
Science Coordinator  
[Arctic LCC](#)  
101 12th Ave. Room 216  
Fairbanks, AK 99701  
(907) 456-0445







**To:** Mary Colligan[mary\_colligan@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]; Jennifer Reed[jennifer\_reed@fws.gov]  
**Cc:** Paul Leonard[paul\_leonard@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-07-06T12:22:42-04:00  
**Importance:** Normal  
**Subject:** Example Viewshed model for hulahula river  
**Received:** 2018-07-06T12:22:00-04:00  
[hulahula Viewshed. v1 070618.pdf](#)

Dear Mary, Steve and Jen,

Attached is a first draft at a viewshed model by Paul for the Hulahula. Big kudos to him for working through this with a crappy computer and a holiday. It models how visible a 40 ft structure (approx. 3 story building (30ft) with 5 ft airspace over 5 ft gravel pad) would be visible from select points along the river (blue dots). The orange area is the approximate distance to which the building could occur and still be visible. Beyond the orange, the building would not be visible from the blue points (could be visible from points along river not sampled). Clearly Paul was not able to model for every point along the river given time constraints. I am hoping we can take this *as an example* of the type of analysis that should be done in the EIS to evaluate river buffers.

Send thoughts, questions, feedback to Paul and I.

Thank you,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

**From:** Leonard, Paul <paul\_leonard@fws.gov>  
**Sent:** Thursday, July 5, 2018 7:29 PM  
**To:** Wendy Loya <wendy\_loya@fws.gov>  
**Subject:** Viewshed

Can discuss as many details as you'd like.

Finest resolution I could practicably do (24m spatial grain) given immediate constraints.  
Vertical accuracy is probably less than 1m.

Apologies for the ugly map, I am quite limited with this video card (e.g., see the phantom lines in the map?) I can easily stylize differently though if you'd like.

FYI: this is a high-res map so you can print larger or zoom electronically if you'd like.



Cheers,  
Paul

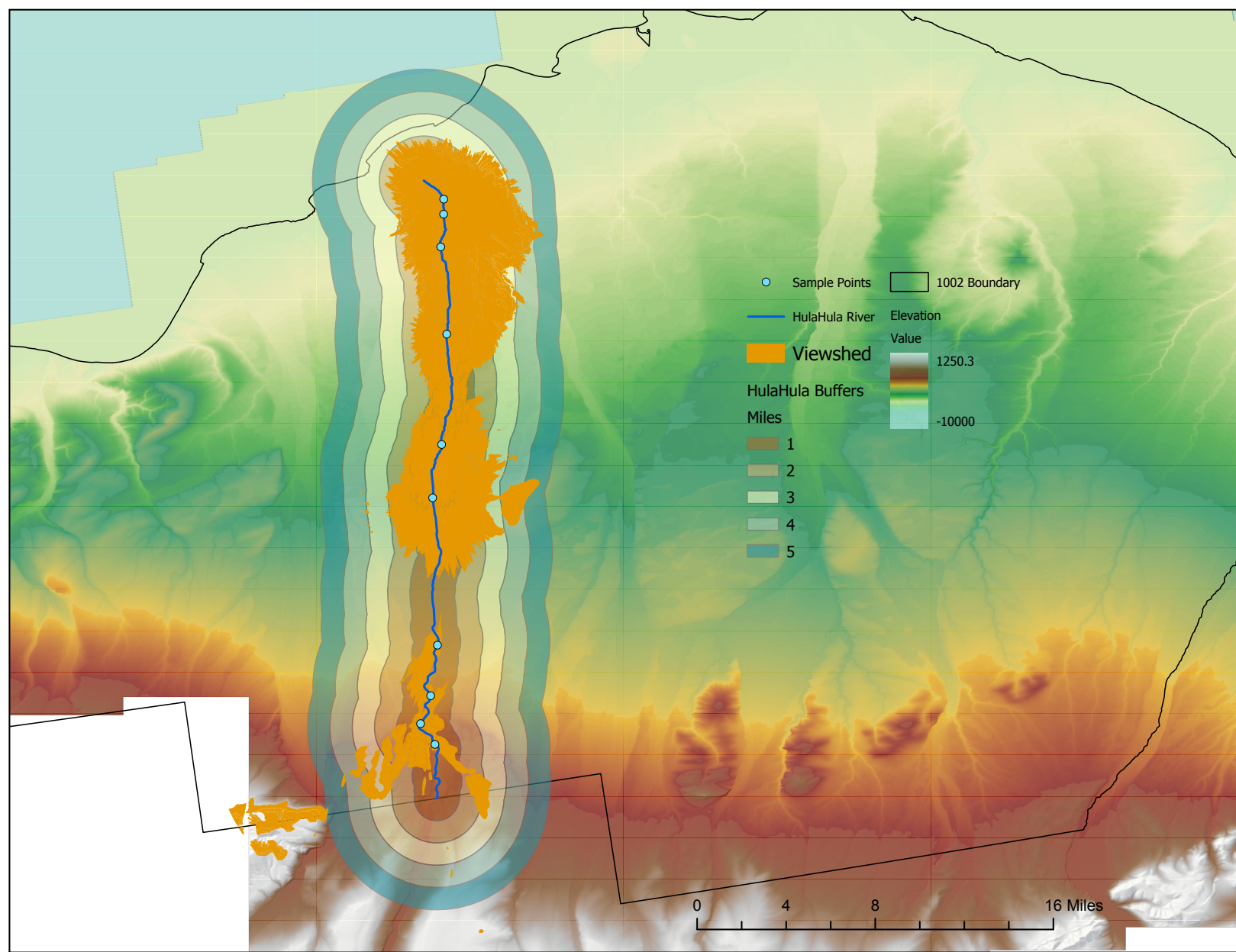
--

Paul Leonard, PhD  
Science Coordinator

[Arctic LCC](#)

101 12th Ave. Room 216  
Fairbanks, AK 99701  
(907) 456-0445







**To:** Wendy Loya[[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)]; Leonard, Paul[[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)]  
**From:** Arthur, Stephen  
**Sent:** 2018-07-06T17:01:05-04:00  
**Importance:** Normal  
**Subject:** Re: Revised caribou management areas  
**Received:** 2018-07-06T17:01:53-04:00  
[Special restrictions for Porcupine Caribou management areas.docx](#)

Here it is. Paul, do you want a map of this, and if so what format?

Stephen M. Arthur, Ph.D.

*Supervisory Wildlife Biologist  
Arctic National Wildlife Refuge  
101 12th Ave., Room 236  
Fairbanks, AK 99701  
(907)455-1830*

On Fri, Jul 6, 2018 at 11:58 AM, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Steve A,

Can you send me the attachment, and also Paul Leonard if you haven't already shared with him?

Thank you!!!

Dr. Wendy M. Loya,

Arctic Program Coordinator

Office of Science Applications, US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

**From:** Berendzen, Steve <[steve\\_berendzen@fws.gov](mailto:steve_berendzen@fws.gov)>  
**Sent:** Friday, July 6, 2018 11:51 AM  
**To:** Arthur, Stephen <[stephen\\_arthur@fws.gov](mailto:stephen_arthur@fws.gov)>  
**Cc:** Loya, Wendy <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>  
**Subject:** Re: Revised caribou management areas



Thanks, Steve - my understanding is that we'll need this description (or a finalized one) at a later time to delineate whatever boundary is decided

Steve Berendzen

Refuge Manager, Arctic National Wildlife Refuge

907-456-0253

On Thu, Jul 5, 2018 at 4:52 PM, Arthur, Stephen <[stephen\\_arthur@fws.gov](mailto:stephen_arthur@fws.gov)> wrote:

Attached is a written description of special management areas for caribou in the coastal plain of the Arctic Refuge, based on my discussions with Brian Lawhead and Alex Pritchard (ABR) and Erin Julianus (BLM) this morning. Let me know if you have any questions.

Stephen M. Arthur, Ph.D.

*Supervisory Wildlife Biologist*

*Arctic National Wildlife Refuge*

[101 12th Ave., Room 236](#)

[Fairbanks, AK 99701](#)

[\(907\)455-1830](#)



Special restrictions for Porcupine Caribou management areas:

The Porcupine Caribou primary calving area is defined as the area with higher-than-average density of parturient caribou cows during more than 40% of years. This area is not available for leasing and no surface occupancy is permitted. This area includes approximately 653,000 acres, consisting of the entire area of the following townships, excluding areas that are within the Mollie Beattie Wilderness Area:

T03N, Ranges 34E-38E

T04N, Ranges 31E-39E

T05N, Ranges 32E-40E

T06N, Ranges 32E-40E

Peripheral calving areas include townships that partly overlap the calving area defined above. Portions of these townships may be offered for lease but no surface occupancy will be permitted. This area encompasses approximately 95,500 acres and includes the following areas:

T06N Range 31E

Southern one-half of T07N, Ranges 3E-35E and Ranges 37E-38E

The Porcupine Caribou post-calving habitat area includes areas used for group formation and insect relief during late June and early July. In this area, leasing and limited development may occur but type and density of infrastructure will be limited to maintain the ability of caribou to move freely throughout the area to form aggregations of many thousands of caribou. Density of infrastructure will be limited to 0.6% of the land area per township and human activity will be limited during periods when caribou are present (generally June 15-July 15). This area encompasses approximately 245,000 acres and includes the following townships:

T05N, Ranges 27E-30E

T06N, Ranges 27E-30E

The southern one-half of T07, Ranges 27E-30E



**To:** Mary Colligan[mary\_colligan@fws.gov]; Mitch Ellis[mitch\_ellis@fws.gov]; Eric Taylor[eric\_taylor@fws.gov]; Sara Boario[sara\_boario@fws.gov]  
**Cc:** Greg Siekaniec[greg\_siekaniec@fws.gov]; Karen Clark[karen\_clark@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-07-09T10:10:56-04:00  
**Importance:** Normal  
**Subject:** Draft documents for 1002 Alternatives workshop  
**Received:** 2018-07-09T10:11:14-04:00  
[DRAFT FWS Comments on Arctic Refuge Coastal Plain Leasing EIS Alternatives 070618.docx](#)  
[Arctic Refuge Coastal Plain DRAFT Table of Stips and BMPs 070918.docx](#)  
[DRAFT 1002 Map for Alternatives workshop 070918.docx](#)

Dear 1002 RDT,

Attached are draft documents we have prepared as background materials for the BLM hosted workshop July 9-12<sup>th</sup>. These are similar to the materials we shared in the meeting on Friday July 29<sup>th</sup>. They include:

1. DRAFT FWS comments on BLM Alternatives
2. DRAFT FWS Map of recommended protections (referred to in #1 as Attachment 1)
3. DRAFT FWS suggested Leasing Stipulations and BMPs ((referred to in #1 as Attachment 2)

**This Friday July 13<sup>th</sup>, we will need to turn these into our Final Comments on the Draft Alternatives and submit to BLM.**

Given that workshop that will lead us to our final recommendations runs the 9th-12<sup>th</sup>, I am sending these now so that you can pre-review and we can quickly address questions or concerns on Friday the 13<sup>th</sup> when we prepare the final versions. I will provide a narrative of any major deviations after the workshop. The details most likely to change are highlighted in blue. **In the Leasing Stipulations table, Section K (starting page 23) identifies the primary means for ensuring an alternative meets all 5 purposes of the Refuge.**

Mary Colligan, Steve Berendzen and I will represent the FWS at the meeting and be at BLM Mon - Thurs.

Thank you,  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



**DRAFT FWS Comments on  
BLM Coastal Plain Leasing EIS Alternative**

The Tax Cuts and Jobs Act of 2017 (PL 115-97) directed the U. S. Fish and Wildlife Service (FWS) and the Bureau of Land Management (BLM) to create a program for oil and gas production from the Arctic National Wildlife Refuge (Refuge) in a manner similar to that used on the National Petroleum Reserve-Alaska (NPR-A). Many of the lease stipulations and Best Management Practices (BMPs) used on NPR-A are applicable to the Refuge. However, the Refuge has purposes and management mandates established by other Federal laws and authorities, including Public Land Order 2214 that established the Refuge, Alaska National Interest Lands Conservation Act (ANILCA), the National Wildlife Refuge System Improvement Act, the Wilderness Act, and the Wild and Scenic Rivers Act. Many of the purposes and mandates in these Federal laws and authorities are not addressed in the NPR-A lease stipulations and BMPs, as they are specific either to National Wildlife Refuges, or the Arctic Refuge.

Our goal is to provide adequate protection of the area's resources during exploration, development, and reclamation so that the area can be restored to a condition where it is once again eligible for Wilderness designation. The FWS has delineated: A) *where* the most sensitive and important biological, recreational and cultural areas occur within the Refuge (*Attachment 1*); B) *how* Lease Stipulations and BMPs can be used to minimize impacts when avoidance of priority areas is not possible (*Attachment 2*); and C) recommended requirements for post-development reclamation (*Attachment 2*). Many priority areas within the Refuge overlapped, such that protection of one resource area would also protect other priority resources (*Attachment 1*). For example, the coastal shoreline and lagoons are a priority for polar bear survival, subsistence and recreational use, staging and molting areas for migratory birds, and were important for fish. Thus, protection of this area would have value for many of the Refuge's priority resources. To avoid impacts to the highest priority areas we recommend no surface occupancy (NSO), either through non-leasing, or NSO stipulations and directional drilling. Where development will occur, we seek to minimize disturbance through other stipulations and BMPs (*Attachment 2*).

Wilderness is an original, and continuing, purpose of the Refuge coastal plain, and provides the context within which the area's wildlife, ecological, scientific, recreational, aesthetic, and symbolic values are understood and appreciated. The Refuge coastal plain is currently classified as Recommended for Wilderness designation. Some of the coastal plain's natural and wild character will be lost with development. Our goal is to have adequate protection of the area's resources during development, and reclamation actions afterward, so the area can be restored to a condition where it is once again eligible for Wilderness designation.

There are significant physical differences between the NPR-A and the Arctic Refuge coastal plain. The finer grained soils on the foothill slopes of the Refuge coastal plain are more susceptible to erosion and thermokarst when sensitive vegetation and underlying permafrost are damaged. More deeply incised rivers create abundant polar bear denning habitat further inland and carry surface waters to the coast, while groundwater springs provide valuable overwintering fish habitat, and a tundra that persists as a summer water source and caribou insect relief habitat. Over 20% of the surface area of the NPR-A is water, while less than 2% of the coastal plain is classified as water. These differences mean that stipulations and best management practices developed for current oil and gas activities in the NPR-A need to be adapted to protect the natural resources of the Arctic Refuge coastal plain.



These recommendations meet the requirements of the Tax Act while retaining the original conservation purposes of the Arctic National Wildlife Refuge. Following are short summaries by priority areas.

**Polar Bears:** The refuge coastal plain provides important winter denning and summer onshore habitat not found in the NPR-A for polar bears of the Southern Beaufort Sea population. Summer land use, and land-based denning is increasing due to sea ice loss. Areas have been identified along the coast and along specific river drainages within the coastal plain that have concentrated denning, so stipulations are proposed to ensure that these core denning areas receive adequate protection. Protections are also proposed for coastal areas including an inland buffer along lagoons and shoreline to ensure bears have the ability to move unimpeded for access to ephemeral resources such as whale carcasses.

**Caribou:** The Arctic Refuge provides vital habitat for caribou during calving and post-calving seasons of most years. Disturbance of these areas could have significant impacts on caribou reproduction and survival. We recommend complete protection of the area most commonly used for calving (no leasing and NSO), and a limited development footprint for peripheral calving areas and major post-calving habitats. We further recommend that all infrastructure within the coastal plain be designed to ensure uninhibited passage of caribou from both the Porcupine and Central Arctic herds through stipulations and BMPs (See Attachment 2).

**Birds:** The coastal plain of the Arctic Refuge provides habitat for millions of shorebirds, waterfowl, loons, gulls, and landbirds. Potential impacts from oil and gas development include habitat loss, disturbance, mortality due to collisions with wires and other structures, changes in abundance and distribution of predators, and exposure to spills. Important and highly-sensitive habitats include river deltas, lakes, and coastal lagoons. Buffers along these water bodies would provide protections for many birds as well as other wildlife. Many of the stipulations and BMPs established for birds and for predators of birds and their eggs in NPR-A are applicable and will provide some protections within the Refuge.

**Other Terrestrial Wildlife:** The ANILCA purposes of the Arctic Refuge include “to conserve fish and wildlife populations and habitats in their natural diversity.” However, little is currently known about distribution and abundance of many species of birds, mammals, and other taxa. Thus, we recommend a BMP with this objective. This will require that proposed development projects include surveys and species assessments to establish baselines that long term monitoring protocols be established and implemented to detect population changes.

**Traditional Use and Subsistence:** Arctic Refuge encompasses much of the traditional homelands of both the Inupiat and Gwich'in peoples in which contemporary subsistence use provides a vital connection to the land linking millennia-old archeological use between past and present. A purpose of ANILCA and Arctic Refuge is to provide the opportunity for local rural residents engaged in subsistence way of life to continue to do so. Recognizing this, we have identified areas of the coastal plain which are of critical importance to subsistence users for access and use which are in need of protection from surface occupancy and protective stipulations and BMP's.

**Perennial Springs and Fish:** Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters while rivers without springs have no overwintering fish. This spring water is ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic grayling and Dolly Varden are major subsistence resources in the Refuge and their survival



depends on about twenty springs within the coastal plain and adjacent foothills, thus they are high value habitats. Four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition.

**Coastal Lagoons and Fish:** The nearshore environment in the southern Beaufort Sea, adjacent to the 1002 Area, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm. The lagoons become productive environments during the summer and attract large numbers of marine and anadromous fishes. These waters also provide abundant food and staging habitat for waterfowl, shorebirds, and loons during summer and fall, as they acquire energy reserves needed for fall migration. During winter some lagoons become hypersaline and get colder than normal seawater under ice, forcing some fish to return to rivers and marine fishes retreat to offshore environments.

**Wild and Scenic Rivers and Recreation:** The Refuge provides internationally unique opportunities for challenge, self-reliance, and independence within a vast and extremely remote setting for local residents as well as sport hunters and fishers and wilderness recreationalists. In order to maintain wilderness characteristics, wildlife-dependent recreation, and Wild and Scenic River values within the coastal plain, we recommend infrastructure be situated outside of coastal lagoons, as well as establishing buffers along the Hulahula, Canning Rivers and other rivers within the coastal plain. Limiting the development footprint through the use of best practices for soundscape and visual resource impact mitigation will minimize impacts to residents and visitors from infrastructure audible or visible within river-based travel corridors.

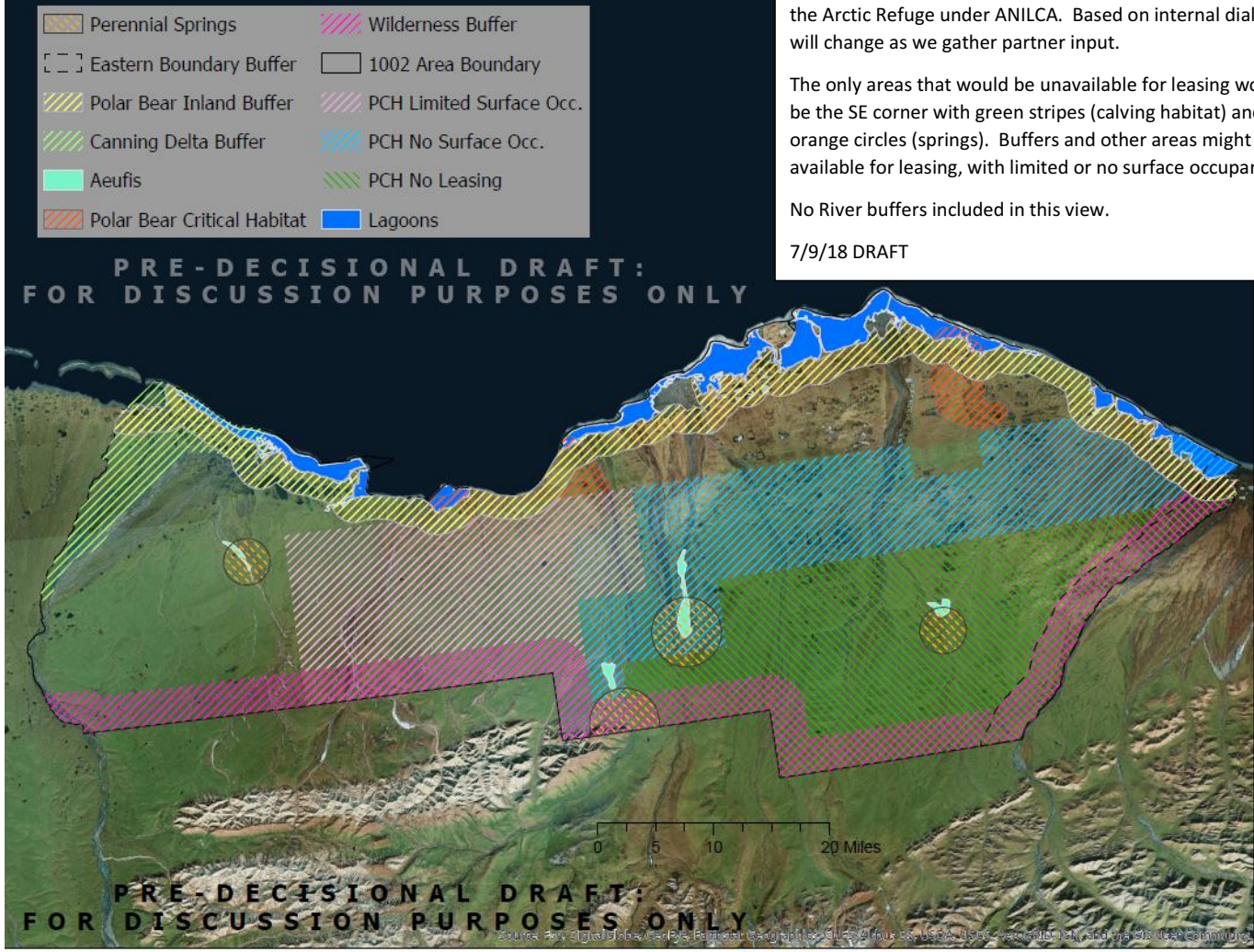


Draft of ideas for managing Arctic Refuge Coastal Plain in a manner similar to NPRA and managing for all 5 purposes of the Arctic Refuge under ANILCA. Based on internal dialogue, will change as we gather partner input.

The only areas that would be unavailable for leasing would be the SE corner with green stripes (calving habitat) and the orange circles (springs). Buffers and other areas might be available for leasing, with limited or no surface occupancy.

No River buffers included in this view.

7/9/18 DRAFT





**To:** Mary Colligan[mary\_colligan@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-07-09T10:23:16-04:00  
**Importance:** Normal  
**Subject:** Current draft of Stips table 070918  
**Received:** 2018-07-09T10:23:27-04:00  
[Arctic Refuge Coastal Plain DRAFT Table of Stips and BMPs 070918.docx](#)

A few updates over the weekend. I don't have printed copies, but can bring some on Tuesday for us.

DRAFT date 070918.

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



## WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND

## PUBLIC SAFETY

**A-3 Best Management Practice**

**Objective:** Minimize pollution through effective hazardous-materials contingency planning.

**Requirement/Standard:** For oil- and gas-related activities, a hazardous materials emergency contingency plan shall be prepared and implemented before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Procedures in the plan applicable to fuel and hazardous substances handling (associated with transportation vehicles) shall consist of best management practices if approved by the authorized officer. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of federal, State, and North Slope Borough contacts. Other federal and State regulations may apply and require additional planning requirements. All appropriate staff shall be instructed regarding these procedures.

In addition contingency plans related to facilities developed for oil production shall include requirements to:

- a. Provide refresher spill-response training to North Slope Borough and local community spill-response teams on a yearly basis.
- b. Plan and conduct a major spill-response field-deployment drill annually.
- c. Prior to production and as required by law, develop spill prevention and response contingency plans and participate in development and maintenance of the North Slope Subarea Contingency Plan for Oil and Hazardous Substances Discharges/Releases for the National Petroleum Reserve-Alaska operating area. Planning shall include development and funding of detailed (e.g., 1:26,000 scale) environmental sensitivity index maps for the lessee's/permittee's operating area and areas outside the lessee's/permittee's operating area that could be affected by their activities. The specific area to be mapped shall be defined in the lease agreement and approved by the authorized officer in consultation with the US Fish and Wildlife Service and appropriate resource agencies. Maps shall be completed in paper copy and geographic information system format in conformance with the latest version of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration's Environmental Sensitivity Index Guidelines. Draft and final products shall be peer reviewed and approved by the authorized officer, the US Fish and Wildlife Service and in consultation with other federal, State, and North Slope Borough resource and regulatory agencies.

**A-4 Best Management Practice**

**Objective:** Minimize the impact of contaminants on fish, wildlife, and the environment; including wetlands, marshes and marine waters; as a result of fuel, crude oil, and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety.

**Requirement/Standard:** Before initiating any oil and gas or related activity or operation, including field research/surveys and/or seismic operations, lessees/permittees shall develop a comprehensive spill prevention and response contingency plan per 40 CFR § 112 (Oil Pollution Act). The plan shall consider and take into account the following requirements: a. On-site Clean-up Materials. Sufficient oil-spill-cleanup materials (absorbents, containment devices, etc.) shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment. b. Storage Containers. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed 1,320 gallons shall be stored within an impermeable lined and diked area or within approved alternate storage containers, such as over packs, capable of containing 110% of the stored volume. In areas within 500 feet of waterbodies, fuel containers are to be stored within appropriate containment. c. Liner Materials. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. d. Permanent Fueling Stations. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. e. Proper Identification of Containers. All fuel containers,



including barrels and propane tanks, shall be marked with the responsible party's name, product type, and year filled or purchased. f. Notice of Reportable Spills. Notice of any reportable spill (as required by 40 CFR § 300.125 and 18 AAC § 75.300) shall be given to the authorized officer as soon as possible, but no later than 24 hours after occurrence.g. Identification of Oil Pans ("duck ponds"). All oil pans shall be marked with the responsible party's name.

#### ***A-5 Best Management Practice***

Objective: Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.

Requirement/Standard: Refueling of equipment within 500 feet of the active floodplain of any water body is prohibited. Fuel storage stations shall be located at least 500 feet from any water body with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes, and small equipment, e.g., portable generators and water pumps, will be permitted. The authorized officer may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.

#### ***A-6 Best Management Practice***

Objective: Minimize the impact on fish, wildlife, and the environment from contaminants associated with the exploratory drilling process.

Requirement/Standard: Surface discharge of reserve-pit fluids is prohibited.

#### ***A-7 Best Management Practice***

Objective: Minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment.

Requirement/Standard: Discharge of produced water **in upland areas onshore on land in in freshwaters, in coastal lagoons** and in marine waters is prohibited.

#### ***A-8 Best Management Practice***

Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities.

Requirement/Standard: Oil and gas lessees, their contractors and subcontractors, **and all other personnel associated with authorized oil and gas activities** will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. **These bear-interaction plans shall be developed in consultation with and approved by the U.S Fish & Wildlife Service and the Alaska Department of Fish and Game.** The plans shall include specific measures to Identify and establish:

- a. **Methods and procedures to minimize attraction of bears to the work sites, e.g., bear resistant containers for all waste categories, waste handling, waste removal and disposal.**
- b. **The organization and layout of buildings and work sites to minimize human/bear interactions.**
- c. **Communication methods and procedures to warn personnel of bears near or on work sites.**
- d. **Identify and establish personnel, methods, procedures, and training, if authorized, to discourage bears from approaching the work site using passive and active, non-injurious, less-lethal methods.**
- e. **Identify and establish contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel.**
- f. **Identify and establish methods and procedures for the proper storage and disposal of materials that may be attractive, or toxic, or both to bears,**



- e.g., bear resistant waste containers.
- g. A systematic record of bears on the work site and in the immediate area.
- h. Methods, procedures, and training to identify and avoid known or observed polar bear dens by at least 1-mile, and grizzly bear dens by at least 0.5-mile, unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service, or the Alaska Department of Fish and Game, or both as appropriate.
- i. Methods and procedures to minimize disturbance to polar bear dens from oil and gas activities.

Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to:

- a. Minimize attraction of bears to the work sites.
- b. Organize layout of buildings and work sites to minimize human/bear interactions.
- c. Warn personnel of bears near or on work sites and identify proper procedures to be followed.
- d. Establish procedures, if authorized, to discourage bears from approaching the work site.
- e. Provide contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel.
- f. Discuss proper storage and disposal of materials that may be toxic to bears.
- g. Provide a systematic record of bears on the work site and in the immediate area

#### ***A-9 Best Management Practice***

Objective: Reduce air quality impacts.

Requirement/Standard: All oil and gas operations (vehicles and equipment) that burn diesel fuels must use “ultra-low sulfur” diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality.

#### ***A-10 Best Management Practice***

Objective: Prevent unnecessary or undue degradation of the lands and protect health.

Requirement/Standard: This measure includes the following elements:

- a. Prior to initiation of a NEPA analysis for an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source (hereafter project), the authorizing officer (BLM) may require the project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutant(s) of concern as determined by BLM if no representative air monitoring data are available for the project area, or existing representative ambient air monitoring data are insufficient, incomplete, or do not meet minimum air monitoring standards set by the Alaska DEC or the EPA. If BLM determines that baseline monitoring is required, this pre-analysis data must meet Alaska DEC and EPA air monitoring standards, and cover the year immediately prior to the submittal. Pre-project monitoring may not be appropriate where the life of the project is less than one year.
- b. The BLM may require monitoring for the life of the project depending on the magnitude of potential air emissions from the project, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within or proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project.



- c. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the project proponent shall prepare (and submit for BLM approval) an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project, including reasonably foreseeable air pollutant emissions of criteria air pollutants, volatile organic compounds, hazardous air pollutants, and greenhouse gases estimated for each year for the life of the project. The BLM will use this estimated emissions inventory to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the proposed project.
- d. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM may require the proponent to provide an emissions reduction plan that includes a detailed description of operator committed measures to reduce project related air pollutant emissions including, but not limited to greenhouse gases, **mercury and other heavy metals**, and fugitive dust.
- e. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the authorized officer may require air quality modeling for purposes of analyzing project direct, indirect or cumulative impacts to air quality. The BLM may require air quality modeling depending on the magnitude of potential air emissions from the project or activity, duration of the proposed action, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. The BLM will determine the information required for a project specific modeling analysis through the development of a modeling protocol for each analysis. The authorized officer will consult with the **US Fish and Wildlife Service** and other appropriate federal, State, and/or local agencies regarding modeling to inform his/her modeling decision and avoid duplication of effort. The modeling shall compare predicted impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds (such as impacts to air quality related values, incremental cancer risks, etc.).
- f. The BLM may require air quality mitigation measures and strategies within its authority (and in consultation with local, state, federal, and tribal agencies with responsibility for managing air resources) in addition to regulatory requirements and proponent committed emission reduction measures, and for emission sources not otherwise regulated by Alaska DEC or EPA, if the air quality analysis shows potential future impacts to NAAQS or AAAQS or impacts above specific levels of concern for air quality related values (AQRVs).
- g. If ambient air monitoring indicates that project-related emissions are causing or contributing to impacts that would cause unnecessary or undue degradation of the lands, cause exceedances of NAAQS, or fail to protect health (either directly or through use of subsistence resources), the authorized officer may require changes in activities at any time to reduce these emissions to comply with the NAAQS and/or minimize impacts to AQRVs. Within the scope of BLM's authority, the BLM may require additional emission control strategies to minimize or reduce impacts to air quality.
- h. ~~(Alternative B-2 only)~~ Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results developed in conformance with this best management procedure shall be provided by the project proponent to the North Slope Borough and to local communities and tribes in a timely manner.



***A-11 Best Management Practice***

Objective: Ensure that permitted activities do not create human health risks through contamination of subsistence foods.

Requirement/Standard: A lessee proposing a permanent oil and gas development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The monitoring study shall examine subsistence foods for all contaminants that could be associated with the proposed development. The study shall identify the level of contaminants in subsistence foods prior to the proposed permanent oil and gas development and monitor the level of these contaminants throughout the operation and abandonment phases of the development. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the lessee shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the lessee's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the lessee's activities, the authorized officer may require changes in the lessee's processes to reduce or eliminate emissions of the contaminant. The design of the study/studies must meet the approval of the authorized officer and the US Fish and Wildlife Service. The authorized officer in consultation with US Fish and Wildlife Service and other appropriate federal, State, and North Slope Borough agencies and the Native Village of Kaktovik and Venetie Tribal Government prior to approving the study/studies design. The authorized officer, in consultation with or at the recommendation of the US Fish and Wildlife Service, may require/authorize changes in the design of the studies throughout the operations and abandonment period, or terminate or suspend studies if results warrant.

***A-12 Best Management Practice***

Objective: To minimize negative health impacts associated with oil spills.

Requirement/Standard: If an oil spill with potential impacts to public health occurs, the BLM, in undertaking its oil spill responsibilities, will consider:

- a. Immediate health impacts and responses for affected communities and individuals.
- b. Long-term monitoring for contamination of subsistence food sources.
- c. Long-term monitoring of potential human health impacts.
- d. Perceptions of contamination and subsequent changes in consumption patterns.
- e. Health promotion activities and communication strategies to maintain the consumption of traditional food.

**WATER USE FOR PERMITTED ACTIVITIES*****B-1 Best Management Practice***

Objective: Maintain populations of, and adequate habitat for, fish and invertebrates.

Requirement/Standard: Withdrawal of unfrozen water from rivers and streams during winter is prohibited. The removal of ice aggregate from grounded areas ≤4-feet deep may be authorized from rivers on a site- specific basis.



**B-2 Best Management Practice**

**Objective:** Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, invertebrates, and waterfowl.

**Requirement/Standard:** Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are:

- a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.
- b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are ≤5.
- c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume.
- d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations.
- e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern.
- f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. Note: All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat.
- g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.
- h. Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds is maintained.

**WINTER OPERATIONS (OVERLAND MOVES, SEISMIC EXPLORATION, EXPLORATORY DRILLING, ETC)**

The following required operating procedures/best management practices apply to overland and over-ice moves, seismic work, and any similar cross-country vehicle use of vehicles and heavy equipment on non-roaded surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.

**C-1 Best Management Practice**

**Objective:** Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.

**Requirement/Standard:**

- a. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 0.5 mile of known or observed grizzly bear dens unless alternative protective measures are approved by the authorized officer in consultation with US Fish and Wildlife Service and Alaska Department of Fish and Game.
- b. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed polar bear dens unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.
- c. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed seal birthing lairs unless alternative protective measures are approved by the authorized officer in consultation with the National Oceanographic and Atmospheric Administration.



d. Between October 30 and April 15 of any year, operators working within polar bear denning, and seal birthing habitat, shall conduct a survey for polar bear dens and seal birthing lairs in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate, throughout the planned area of activities and before initiating activities.

a. Cross-country use of heavy equipment and seismic activity is prohibited within 0.5 mile of occupied grizzly bear dens identified by the Alaska Department of Fish and Game unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game.

b. Cross-country use of heavy equipment and seismic activity is prohibited within 1 mile of known or observed polar bear dens or seal birthing lairs. Operators near coastal areas shall conduct a survey for potential polar bear dens and seal birthing lairs and consult with the USFWS and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.

*(Text is same as in Northeast NPR-A 2008 Record of Decision)*

#### **C-2 Best Management Practice**

**Objective:** Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.

**Requirement/Standard:**

- a. Ground operations shall be allowed only when frost depth are at sufficient depths and snow cover is at sufficient depths and density to protect the tundra, as determined by the authorized officer and the US Fish and Wildlife Service. Soils should be frozen at least 12 inches below the lowest surface height (e.g. intertussock space). Snow depth and snow density should amount to no less than a Snow Water Equivalent of 3" over the highest vegetated surface (e.g. top of tussock). Ground operations shall cease when the spring snowmelt begins when snow depth and density no longer meet criteria.

Table for Snow Depth x Density to achieve SWE of 3"

Snow Specific Gravity	Needed Snow Depth (inches)
0.05	60
0.1	30
0.15	20
0.2	15



0.25	12
0.3	10
0.35	9
0.4	8
0.45	7
0.5	6

b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. **Note:** This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction.

c. Bulldozing of tundra mat and vegetation to create trails or seismic lines is prohibited. ~~in~~ Clearing of drifted snow is allowed on existing snow trails, snow pads for camps, ice roads, or ice pads seismic to the extent that the tundra mat is not disturbed.

d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons.

e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.

~~f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River, and 2 miles on either side of the Kogosukruk and Kikiakrorak rivers and tributaries of the Kogosukruk River from April 15 through August 5, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use will remain 0.5 mile away from known raptor nesting sites, unless authorized by the authorized officer.~~

#### **C-3 Best Management Practice**

**Objective:** Maintain natural spring (break-up) runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality and protect stream banks.

**Requirement/Standard:** Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice ("bridges") shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.

#### **C-4 Best Management Practice**

**Objective:** Avoid additional freeze-down of aquatic habitat~~deep-water pools~~ harboring over-wintering fish and invertebrates used by fish.

**Requirement/Standard:** Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the invertebrates and water quality they rely on. Rivers, streams, and lakes shall be crossed at areas of grounded ice or with the approval of the authorizing officer and US Fish and Wildlife Service, and it has been demonstrated no addition impacts



**will occur to fish or invertebrates.** Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the invertebrates they rely on. Rivers, streams, and lakes shall be crossed at areas of grounded ice whenever possible.

#### **C-5 Best Management Practice**

**Objective:** Minimize the effects of high-intensity acoustic energy from seismic surveys on fish.

**Requirement/Standard:**

**a. Seismic surveys will not be conducted over unfrozen water with fish overwintering potential.**

- a. When conducting vibroseis-based surveys above potential fish overwintering areas (water 6 feet deep or greater, ice plus liquid depth), operators shall follow recommendations by Morris and Winters (2005): only a single set of vibroseis shots should be conducted if possible; if multiple shot locations are required, these should be conducted with minimal delay; multiple days of vibroseis activity above the same overwintering area should be avoided if possible.
- b. When conducting air gun-based surveys in freshwater, operators shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): operators will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained).

**c. Explosive-based surveys are prohibited.**

- e. When conducting explosive-based surveys, operators shall follow setback distances from fish-bearing waterbodies based on requirements outlined by Alaska Department of Fish and Game (1991).

#### **OIL AND GAS EXPLORATORY DRILLING**

##### **D-1 Lease Stipulation**

**Objectives:** Protect **water quality** in fish-bearing rivers, streams, and lakes from blowouts and minimize alteration of riparian habitat.

**Requirement/Standard:** Exploratory drilling is prohibited in rivers and streams, as determined by the active floodplain, and fish-bearing lakes.

##### **D-2 Lease Stipulation**

**Objective:** Minimize surface impacts from exploratory drilling.

**Requirement/Standard:** Construction of permanent or gravel oil and gas facilities shall be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.

#### **FACILITY DESIGN AND CONSTRUCTION**



***E-1 Best Management Practice***

**Objective:** Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources.

**Requirement/Standard:** All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with the US Fish and Wildlife Service and other appropriate federal, State, and North Slope Borough regulatory and resources agencies, and the **Native Village of Kaktovik and the Venetie Tribal Government** prior to approving construction of roads. Subject to approval by the authorized officer and the US Fish and Wildlife Service, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.

***E-2 Lease Stipulation***

**Objective:** **Protect water quality and the diversity of fish, invertebrates and wildlife populations and habitats.** Protect fish-bearing waterbodies, water quality, and aquatic habitats.

**Requirement/Standard:**

- a. Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 feet as measured from the ordinary high watermark of fish-bearing waterbodies unless further setbacks are stipulated under Lease Stipulation K-2. Essential pipeline and road crossings will be permitted on a case-by-case basis by the authorized officer following consultation with the US Fish and Wildlife Service and other appropriate federal, State, and North Slope Borough regulatory and resources agencies, and the **Native Village of Kaktovik and the Venetie Tribal Government**.
- b. Exploration and Construction camps are prohibited on frozen lakes and river ice.
- c. Siting of camps on river sand and gravel bars is allowed and encouraged. Where leveling of trailers or modules is required and the surface has a vegetative mat, leveling shall be accomplished through blocking **in a way that preserves the vegetative mat,** rather than use of a bulldozer.



**E-3 Lease Stipulation**

Objective: Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing.

Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies **and the Native Village of Kaktovik**, shall be required to address the objectives of water quality and free passage of fish.

**E-4 Best Management Practice**

Objective: Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents.

Requirement/Standard: All pipelines shall be designed, constructed, and operated under an authorized officer-approved quality assurance/quality control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.

**E-5 Best Management Practice**

Objective: Minimize impacts of the development footprint.

Requirement/Standard: Facilities shall be designed and located to minimize the development footprint **and impacts to other purposes of the Arctic National Wildlife Refuge**. Issues and methods that are to be considered include: (a) use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads; (b) sharing facilities with existing development; (c) collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads; (d) integration of airstrips with roads; (e) use of gravel- reduction technologies, e.g., insulated or pile-supported pads, (f) coordination of facilities with infrastructure in support of offshore development; (g) **location of facilities and other infrastructure outside of areas identified as important for wildlife habitat, subsistence uses, recreational uses;** and (h) where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.



**E-6 Best Management Practice**

**Objective:** Reduce the potential for ice-jam flooding, damage from aufeis, impacts to wetlands and floodplains, erosion, alteration of natural drainage patterns, and restriction of fish passage.

**Requirement/Standard:**

- a) To allow for sheet flow and flood plain dynamics and to ensure fish passage and passage of other organisms, bridges are preferred over culverts if technically feasible. When necessary, culverts can be constructed on smaller streams, if they are large enough to avoid restricting fish passage or adversely affecting natural stream flow.
- b) To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in "Fish Passage Design Guidelines" developed by the US Fish and Wildlife Service Alaska Fish Passage Program (June 29, 2018), the basis of these guidelines, "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" (U.S. Forest Service 2008), and other generally accepted best management procedures prescribed by the authorized officer and the US Fish and Wildlife Service.
- c) In addition to the best management practices outlined in the aforementioned documents for stream simulation design, the design engineer should ensure that crossing structures are designed for aufeis, permafrost, sheet flow, additional freeboard during breakup, and other unique conditions of the arctic environment.

**E-7 Best Management Practice**

**Objective:** Minimize disruption of caribou movement and subsistence use.

**Requirement/Standard:** Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence and recreational activities. Listed below are the accepted design practices:

- a. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members.
- b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer after consultation with the US Fish and Wildlife Service, other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), and the Native Village of Kaktovik and the Venetie Tribal Government.
- c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road will be considered by the authorized officer.
- d. Above-ground pipelines shall have a non-reflective finish.

**E-8 Best Management Practice**

**Objective:** Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.

**Requirement/Standard:** Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with the US Fish and Wildlife Service and other appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider:

- a. Design and construction of gravel mine sites to serve as water reservoirs for future use may not be considered within active floodplains of the four rivers that support populations of freshwater, anadromous, or endemic fish (Canning, Sadlerochit, Hulahula, and Aichilik rivers).
- b. Locations outside the active floodplain for all other rivers.



- c. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use.
- d. Potential use of the site for enhancing fish and wildlife habitat **while preventing entrapment of native fishes.**
- d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.
- e. All constructed water storage reservoirs shall be a sufficient distance from drill sites, fueling stations, or other temporary or permanent site that generates or maintains more than 220 gallons of fuel, drilling fluids, or other hazardous materials to avoid contamination via surface or groundwater of the storage reservoir. The lessee shall implement a water quality and contaminants monitoring program for any constructed water storage facility.

#### ***E-9 Best Management Practice***

**Objective:** Avoidance of human-caused increases in populations of predators of ground-nesting birds.

**Requirement/Standard:**

- a. Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites.
- b. Feeding of wildlife **and allowing wildlife to access human food or putrescible waste,** is prohibited and will be subject to non-compliance regulations.

#### ***E-10 Best Management Practice***

**Objective:** **Reduction of risk of collisions between migrating birds and oil and gas and related facilities during low light conditions.** Prevention of migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions.

**Requirement/Standard:** Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.

#### ***E-11 Best Management Practice: Arctic Refuge does not contain significant numbers of TES bird species at this time, revise to reflect more general protections for future listings or abundance?***

**Objective:** Minimize the take of bird species, particularly those listed under the Endangered Species Act and BLM Special Status Species from direct or indirect interaction with oil and gas facilities.

**Requirement/Standard:** In accordance with the guidance below, before the approval of facility construction, aerial surveys of the following species shall be conducted within any area proposed for development.

#### ***Special Conditions in Spectacled and/or Steller's Eiders Habitats:***

- a. Surveys shall be conducted by the lessee for at least 3 years before authorization of construction, if such construction is within the USFWS North Slope eider survey area and at least 1 year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below.
- b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with the USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and



their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels.

c. To reduce the possibility of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to the USFWS when exceptions are authorized:

1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad; 2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or 3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods. d. To reduce the likelihood of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below. b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with the USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels. c. To reduce the possibility of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to the USFWS when exceptions are authorized: 1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad; 2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or 3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods. d. To reduce the likelihood of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS.

*Special Conditions in Yellow-billed Loon Habitats:* a. Aerial surveys shall be conducted by the lessee for at least 3 years before authorization of construction of facilities proposed for development which are within 1 mile of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August. b. Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. The default standard mitigation is



a 1-mile buffer around all recorded nest sites and a minimum 1,625-foot (500-meter) buffer around the remainder of the shoreline. Development will generally be prohibited within buffers unless no other option exists.

#### *Protections for Birds*

a. To reduce the possibility of birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases, which are to be few in number and limited in extent. Exceptions are limited to the following situations:

1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad;
2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or
3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.

b. To reduce the likelihood of birds colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the US Fish and Wildlife Service.

#### *E-12 Best Management Practice*

**Objective:** Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development.

**Requirement/Standard:** An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the authorized officer **after consultation with the US Fish and Wildlife Service**, before approval of the exact facility location and facility construction.

#### *E-13 Best Management Practice*

**Objective:** Protect cultural and paleontological resources.

**Requirement/Standard:** Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity, **based on a study design approved by the authorized officer after consultation with the US Fish and Wildlife Service and other appropriate federal, State, North Slope Borough agencies, and the Native Village of Kaktovik.** Upon finding any potential cultural or paleontological resource, the lessee or their designated representative shall notify the authorized officer **and the US Fish and Wildlife Service**, and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer.



*See E-6 which includes fish passage*

***E-14 Best Management Practice*** Objective: Ensure the passage of fish at stream crossings. Requirement/Standard: To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in “Stream Crossing Design Procedure for Fish Streams on the North Slope Coastal Plain” by McDonald et al. (1994), “Fundamentals of Culvert Design for Passage of Weak-Swimming Fish” by Behlke et al. (1991), and other generally accepted best management procedures prescribed by the authorized officer. To adhere to these best management practices, at least 3 years of hydrologic and fish data shall be collected by the lessee for any proposed crossing of a stream whose structure is designed to occur, wholly or partially, below the stream’s ordinary high watermark. These data shall include, but are not limited to, the range of water levels (highest and lowest) at the location of the planned crossing, and the seasonal distribution and composition of fish populations using the stream. *(Text is same as in Northeast NPR-A 2008 Record of Decision)*

***E-15 Best Management Practice***

Objective: Prevent or minimize the loss of nesting habitat for cliff nesting raptors.

Requirement/Standard:

- a. Removal of greater than 100 cubic yards of bedrock outcrops, sand, and/or gravel from cliffs shall be prohibited.
- b. Any extraction of sand and/or gravel from an active river or stream channel shall be prohibited unless preceded by a hydrological study that indicates no potential impact by the action to the integrity of the river bluffs.

***E-16 Best Management Practice***

Objective: Prevent or minimize the loss of raptors due to electrocution by powerlines.

Requirement/Standard: Comply with the most up-to-date industry-accepted suggested practices for raptor protection on powerlines. Current accepted standards were published in “Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006” in 2006 by the Avian Power Line Interaction Committee and are updated as needed.

***E-18 Best Management Practice***

Objective: Avoid and reduce temporary impacts to productivity from disturbance near Steller’s and/or spectacled eider nests.

Requirement/Standard: Ground-level activity (by vehicle or on foot) within 200 meters of occupied Steller’s and/or spectacled eider nests, from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 meters of occupied Steller’s and/or spectacled eider nests will be prohibited. In instances where summer (June 1 through August 15) support/construction activity must occur off existing thoroughfares, USFWS-approved nest surveys must be conducted during mid-June prior to the approval of the activity. Collected data will be used to evaluate whether the action could occur based on employment of a 200-meter buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. The BLM will also work with the USFWS to schedule oil spill response training in riverine, marine, and inter-tidal areas that occurs within 200 meters of shore outside sensitive nesting/brood-rearing periods or conduct nest surveys. The protocol and timing of nest surveys for Steller’s and/or spectacled eiders will be determined in cooperation with the USFWS, and must be



approved by the USFWS. Surveys should be supervised by biologists who have previous experience with Steller's and/or spectacled eider nest surveys.

#### ***E-19 Best Management Practice***

**Objective:** Provide information to be used in monitoring and assessing wildlife movements during and after construction.

**Requirement/Standard:** A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer and the US Fish and Wildlife Service. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features.

Ancillary data shall include construction beginning and ending dates.

#### ***E-20 Best Management Practice***

**Objective:** Maintain visual component of wilderness characteristics within river/recreation buffers in their current condition by preserving scenic diversity of view and special features in a setting characterized by natural, undeveloped scenery and conditions.

**Manage permitted activities to meet Visual Resource Management class objectives described below.**

**Requirement/Standard:** Buffers for no surface occupancy for coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon (Stipulation K-X); for no surface occupancy along the Hulahula River and Canning Rivers within the coastal plain (Stipulation K-X); and limit development of new infrastructure located outside of, but visible from within, these buffers. For limited development of new infrastructure located outside of, but visible from within, these buffers, use best practices for designing and maintaining necessary infrastructure possibly visible from within buffers by adopting existing best practices in visual resource impact mitigation and innovating new methods to strive for no visual impact from within the buffers, including but not limited to: modeling visibility of infrastructure as seen from within the buffer during planning and development to locate and cap the height of temporary and permanent structures; identifying and locating the minimum number of roads, drill pads, pipelines, production facilities, etc.; and timing gas flare events to coincide with lower visitation times. Additionally, for limited development of new infrastructure located outside of, but visible from within, these buffers, manage permitted activities to meet Visual Resource Management class objectives described below. At the time of application for construction of permanent facilities, the lessee/permittee shall, after consultation with the authorized officer and the US Fish and Wildlife Service, submit a plan to best minimize visual impacts, consistent with the Visual Resource Management class for the lands on which facilities would be located. A photo simulation of the proposed facilities is a necessary element of the plan. Would need to include VRM map in EIS.

**Class I:** Natural ecological changes and very limited management activity are allowed. The level of change to the characteristic landscape should be very low and must not attract attention.

**Class II:** The level of change to the characteristic landscape should be low. Management activities may be seen, but should not dominate the view of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.



**Class III:** The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

**Class IV:** The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize impacts through location and design by repeating form, line, color, and texture.

---

***E-21 Best Management Practices***

**Objective:** Maintain surface water hydrology across the landscape to ensure vegetative communities are protected.

**Requirement/Standard:** Permanent infrastructure, including roads, airstrips, pads, etc. should be designed and built to minimize the disturbance to surface water hydrology (i.e. sheetflow), minimize ponding and drying, protect the landscape from erosion and decreasing slope stability, and infrastructure washout.

---

***E-22 Best Management Practice***

**Objective:** Maintain soundscape component of wilderness characteristics within river/recreation buffers in their current condition by preserving a setting characterized by natural quiet and natural sounds.

**Requirement/Standard:** No surface occupancy allowed for coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon; and along the Hulahula River and Canning Rivers; and limit occupation/infrastructure located outside of, but audible from within, these buffers to reduce noise potential. Use best practices for noise impact mitigation and innovate new methods to prevent to the extent practicable noise impacts within the buffers, including but not limited to: placing production facilities and aircraft landing areas outside sound range of the recreation buffer; and adopting/innovating construction methods that dampen sound transmission at any sites where sound is generated (such as at landing areas, production facilities, etc.).

At the time of application for activities located outside of but audible from within said buffers, the lessee/permittee shall, after consultation with the authorized officer and the US Fish and Wildlife Service, submit a plan to best minimize noise impacts to recreation by attempting to maintain natural quiet and natural sounds. Development and implementation of baseline data collection protocols about current soundscape conditions and monitoring of noise impacts during activity will be a necessary element of the plan.

---

**USE OF AIRCRAFT FOR PERMITTED ACTIVITIES**



**F-1 Best Management Practice**

**Objective:** Minimize the effects of low-flying aircraft on wildlife, subsistence activities, local communities and recreational users of the area, including sport hunters and fishers.

**Requirement/Standard:** The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.):

a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests.

b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer, in consultation with the US Fish and Wildlife Service, Alaska Department of Fish and Game, and other relevant agencies and observers.

c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, local communities and recreational users, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by the US Fish and Wildlife Service and other appropriate federal, State, and borough agencies as well as the Native Village of Kaktovik and the Venetie Tribal Government. Consultations with these same agencies and governments will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility.

d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods as identified by the residents of Kaktovik (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.

e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Porcupine Caribou Calving Area and Post-Calving Area from May 20 through July 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas lessees over any identified Goose Molting Areas should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices.

f. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. (Note: The boundary of the Utukok River Uplands Special Area differs among Alternatives B-1 through D. See Maps 2-2, 2-3, and 2-4.)

g. Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away.

h.) Fixed-wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM-



authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices.

i. Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.

j. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of polar bears observed on land, ice, or in the water, unless doing so would endanger human life or violate safe flying practices. At all times, aircraft shall maintain the maximum distance and altitude possible from concentrations of polar bears, particularly at the whale “bone pile” on Barter Island, and should take precautions to avoid flying lower than 1,500 feet above ground level directly over or within 0.5 mile of these areas, unless doing so would endanger human life or violate safe flying practices.

## OIL AND GAS FIELD ABANDONMENT

### Alternative B-1

Alternat  
ive B-2  
Preferred  
Alternative

Alternat  
ive C

#### *G-1 Lease Stipulation*

**Objective:** Ensure ongoing and long-term reclamation of land to its previous condition and use.

**Requirement/Standard:**

a. Oil and gas infrastructure, including gravel pads, roads, airstrips, wells and production facilities, will be removed and the land reclaimed on an ongoing basis, as extraction is complete.

b. Prior to final abandonment, land used for oil and gas infrastructure—including but not limited to well pads, production facilities, access roads, and airstrips—shall be reclaimed to ensure eventual restoration of ecosystem function and meet minimal standards for eligibility of Wilderness designation. The leaseholder shall develop and implement an abandonment and reclamation plan approved by the BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land’s previous hydrological, vegetative, and habitat condition, and Wilderness eligibility. The BLM may grant exceptions to satisfy stated environmental or public purposes.

## SUBSISTENCE CONSULTATION FOR PERMITTED ACTIVITIES



***H-1 Best Management Practice***

**Objective:** Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities.

**Requirement/Standard:** Lessee/permittee shall consult directly with affected communities using the following guidelines:

- a. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, including the Native Village of Kaktovik and Venetie Tribal Government, the North Slope Borough, and the Arctic National Wildlife Refuge Subsistence Advisory Panel to discuss the siting, timing and methods of their proposed operations to help discover local traditional and scientific knowledge, resulting in measures that minimize impacts to subsistence uses. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the authorized officer shall consult with the directly involved parties and determine which activities will occur, including the timeframes.
- b. The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to the Arctic National Wildlife Refuge Subsistence Advisory Panel, the Native Village of Kaktovik and the Venetie Tribal Government, and the North Slope Subsistence Regional Advisory Council for review and comment. The applicant must allow time for the BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it.
- c. A plan shall be developed that shows how the activity, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan will also describe the methods used to monitor the effects of the activity on subsistence use. The plan shall be submitted to the BLM and US Fish and Wildlife Service as part of the plan of operations. The plan should address the following items:
  1. A detailed description of the activity(ies) to take place (including the use of aircraft).
  2. A description of how the lessee/permittee will minimize and/or deal with any potential impacts identified by the authorized officer during the consultation process.
  3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community.
  4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc.
  5. Procedures necessary to facilitate access by subsistence users to conduct their activities.
  6. Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters.
  - 7.) All vessels over 50 ft. in length engaged in operations requiring a BLM permit must have an Automatic Identification System (AIS) transponder system on the vessel.
- d. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the authorized officer, the US Fish and Wildlife Service and Arctic National Wildlife Refuge Subsistence Advisory Panel.
- e. Permittees that propose barging facilities, equipment, supplies, or other materials to the Arctic National Wildlife Refuge in support of oil and



gas activities in the shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and the North Slope Borough to minimize impacts from the proposed barging on subsistence whaling activities.

## ***H-2 Best Management Practice***

**Objective:** Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration.

**Requirement/Standard:** The authorized officer will consult with appropriate federal, State, North Slope Borough agencies, Native Village of Kaktovik and the Venetie Tribal Government prior to approving the study/studies design. In addition to the consultation process described in Best Management Practice H-1 for permitted activities, before activity to conduct geophysical (seismic) exploration commences, applicants shall notify the local search and rescue organizations of proposed seismic survey locations for that operational season. For the purpose of this standard, a potentially affected cabin/campsite is defined as any camp or campsite used for subsistence purposes and located within the boundary of the area subject to proposed geophysical exploration and/or within 1 mile of actual or planned travel routes used to supply the seismic operations while it is in operation.

- a. Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify all potentially affected subsistence-use cabin and campsite users.
- b. The official recognized list of subsistence-use cabin and campsite users is the North Slope Borough's most current inventory of cabins and campsites, which have been identified by the subsistence users' names.
- c. A copy of the notification letter, a map of the proposed exploration area, and the list of potentially affected users shall also be provided to the office of the appropriate Native Tribal government.
- d. The authorized officer will prohibit seismic work within 1 mile of any known subsistence-use cabin or campsite unless an alternate agreement between the cabin/campsite owner/user is reached through the consultation process and presented to the authorized officer. (Regardless of the consultation outcome, the authorized officer will prohibit seismic work within 300 feet of a known subsistence-use cabin or campsite.)
- e. The permittee shall notify the appropriate local search and rescue (e.g., Nuiqsut Search and Rescue, Atkasuk Search and Rescue) of their current operational location within the Arctic National Wildlife Refuge on a weekly basis. This notification should include a map indicating the current extent of surface use and occupation, as well as areas previously used/occupied during the course of the operation in progress. The purpose of this notification is to allow hunters up-to-date information regarding where seismic exploration is occurring, and has occurred, so that they can plan their hunting trips and access routes accordingly. Identification of the appropriate search and rescue offices to be contacted can be obtained from the coordinator of the Arctic National Wildlife Refuge Subsistence Advisory Panel in the BLM's Arctic Field Office.



***H-3 Best Management Practice***

Objective: Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals.

Requirement/Standard: Hunting and trapping by lessee's/permittee's employees, agents, and contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Kaktovik, Utqiagvik, Deadhorse). Use of lessee/permittee facilities, equipment, or transport for personnel access or aid in hunting and trapping is prohibited.

***I-1 Best Management Practice***

Objective: Minimize cultural and resource conflicts.

Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, best management practices, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer and the Native Village of Kaktovik for review and approval and should:

- a. provide sufficient detail to notify personnel of applicable stipulations and best management practices as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region.
- b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, migratory birds and marine mammals, and provide guidance on how to avoid disturbance.
- c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species.
- d. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating.
- e. Include information concerning avoidance of conflicts with subsistence hunting and fishing, commercial fishing activities, and pertinent mitigation.
- f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft such as caribou calving and hunting and fishing along the coastal shorelines and lagoon waters. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near Kaktovik's barrier islands and coastal lagoon waters.
- g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site.
- h. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee.
- i. Include a module discussing bear interaction plans to minimize conflicts between polar bears, grizzly bears and humans.
- j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel.
- k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment.
- l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment.



**ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS**

---

**J.**

The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The authorized officer, in consultation with the US Fish and Wildlife Service, BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The authorized officer, in consultation with the US Fish and Wildlife Service, may require modifications to or disapprove a proposed activity that is likely to adversely affect a proposed or listed endangered species, threatened species, or critical habitat. The authorized officer will not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.

---



**ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS*****K-1a Lease Stipulation/Best Management Practice – Rivers***

**Objective:** Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; impacts to wilderness hunting and recreation activities; and impacts to scenic and other resource values.

**Requirement/Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within the described setback distances outlined below from the southern boundary of the 1002 Area to the stream mouth. For streams located entirely within the 1002 Area, the setback extends to the head of the stream as identified in the National Hydrography Dataset. Floodplain gravel mines designed to become water reservoirs will be considered on a case-by-case basis consistent with Best Management Practice E-8. On a case-by-case basis, and in consultation with the US Fish and Wildlife Service, other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event.

- a. Canning River setback will extend from the western boundary of the 1002 Area to 3 miles east of the eastern edge of the active flood plain. Additional protective measures for the Canning River Delta and Lakes are detailed in Stipulation K-1b.
- b. Hulahula River setback will be 5 miles in all directions from the active flood plain. Additional protective measures around the perennial spring at Fish Hole 1 and aufeis are detailed in Stipulation K-1c.
- c. Aichilak River setback will extend 3 miles from the eastern edge of the coastal plain boundary along the Aichilak River.
- d. Sadlerochit River setback will have a 1.0 mile setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- e. Tamayariak River will have a 0.5 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- f. Katakturuk River will have a 0.5 mi setback from the banks' ordinary high water mark.
- g. Nularvik River will have a 0.5 mi setback from the banks' ordinary high water mark.
- h. Okpilak River will have a 1.0 /4.0 mi setback from the banks' ordinary high water mark.
- i. Jago River will have a 1.0 mi setback from the banks' ordinary high water mark. Additional protective measures around the perennial spring and aufeis are detailed in Stipulation K-1c.
- j. Okerokovik River will have a 0.5 mi setback from the banks' ordinary high water mark..
- k. Niguanak River will have a 0.5 mi setback from the banks' ordinary high water mark..
- l. Sikrelurak River will have a 0.5 mi setback from the banks' ordinary high water mark.
- m. Angunwill river have a 0.5 mi setback from the banks' ordinary high water mark
- n. Kogotpak river will have a 0.5 mi setback from the banks' ordinary high water mark.
- o. Marsh Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- p. Carter Creek will have a 0.5 mi setback from the banks' ordinary high water mark.
- q. Itkilyariak Creek will have a 0.5 mi setback from the banks' ordinary high water mark.



***K-1b Stipulation – Canning River Delta and Lakes***

**Objective:** Protect and minimize adverse effects to the water quality, quantity and diversity of fish and wildlife habitats and populations, subsistence resources, cultural resources and protect and minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of migratory bird habitat;

**Requirement/Standard:** Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.5 mile of the ordinary high watermark of the ordinary high watermark of any waterbody within Townships 8 and 9 north of the Canning and Tamyariak watersheds. On a case-by-case basis in consultation with the USFWS and other federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.



***K-1c Lease Stipulation/Best Management Practice – Springs/Aufeis***

Note: On lands unavailable for leasing in the respective alternatives, K-1b would be a best management practice. No leasing should be permitted within 3 miles of Sadlerochit Spring, the Fish Hole 1 spring on the Hulahula River and infrastructure setbacks apply to all identified springs.

**Objective:** Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the coastal plain. River systems with springs provide year round habitat and host the most diverse and largest populations of fish, invertebrates, and wildlife and are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs and helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could potentially be disturbed by drilling or fracking activity, we recommend buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.

**Requirement/Standard:**

- a. Prior to drilling activities subsurface flow paths within watersheds containing springs must be mapped and subsequent drilling activities will conduct in a manner that does not disrupt flow of the perennial springs.
- b. No surface occupancy of new non-subsistence infrastructure will be permitted within 3 miles of Sadlerochit Spring (04N031E) nor within 1 mi of the Sadlerochit river where aufeis forms (04N031E & 05N031E). It supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.
- c. No surface occupancy of new non-subsistence infrastructure will be permitted within 3 miles of the perennial spring at Fish Hole 1 on the Hulahula River (05N032E) nor within 1 mile of the aufeis field (05N032E & 06N032E). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.
- d. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of the perennial Tamayariak Spring and associated aufeis field (07N026E).
- e. No surface occupancy of new non-subsistence infrastructure will be permitted within 2 miles of Okerokavik Spring (04N036E) and associated aufeis field in the Jago River drainage (05N035E & 05N036E)



***K-2 Lease Stipulation/Best Management Practice – Nearshore marine, lagoon and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic Refuge***

**Objective:** Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, marine mammals, and polar bear summer and winter coastal habitat), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies.

**Requirement/Standard**

**(Exploration):** Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and until the later of November 1 or sea ice is within 10 miles of the coast of each season, whichever is later.

Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized officer and the US Fish and Wildlife Service that the actions or activities meet all of the following criteria:

- a. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.
- b. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts or pipeline leaks during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and “top-setting” of hydrocarbon-bearing zones.
- c. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of “direct spill” related impacts on area resources and subsistence uses.
- d. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.

**(Development):** With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 1 mile seaward of the shoreline (as measured from mean high tide) of the major coastal lagoons or the natural barrier islands, or 1 mile inland from the mainland shoreline, unless they can meet all the following criteria:

- a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.
- b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
- c. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays as identified by the community of Kaktovik and the North Slope Borough.
- d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and “top-setting” of hydrocarbon-bearing zones.



e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound “direct spill” related impacts on area resources and subsistence uses. f. Before conducting open water activities, the lessee shall consult with the community of Kaktovik, the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.



***K-1c Lease Stipulation – Coastal Polar Bear Denning Critical Habitat***

Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.

Standard:

- a. From the coastline to 5 miles inland, no permanent oil and gas infrastructure shall be located within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.
- b. From the coastline to 5 miles inland, between October 30 and April 15 of any year, operators shall not conduct oil and gas activities within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.

***K-2 Best Management Practice – Migratory waterfowl nesting and molting habitat***

Objective: Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing for large congregations of migratory waterfowl.

Requirement/Standard:

- a. Aerial surveys for nesting colonies and brood-rearing areas for migratory waterfowl shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding 0.5-mile area. These surveys shall be conducted following accepted BLM and US Fish and Wildlife Service protocols.
- b. Development may be prohibited or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.

***K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat***

Note: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-5a would be a best management practice. All lands within the Arctic Refuge Coastal Plain are recognized as habitat of the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area.

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration.

Requirement/Standard: The following standards will be applied to permitted activities:

- a. Within the Arctic Refuge Coastal Plain, lessees shall orient linear corridors when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects created by loops of road and/or pipeline that connect facilities.
- b. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required by the authorized officer, after consultation with the US Fish and Wildlife Service, and other appropriate federal, State, and North Slope Borough regulatory and resource agencies, where pipelines potentially impede caribou movement.
- c. Major construction activities using heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from no later than May 20 through no earlier than July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20 or if they remain in the area in significant numbers past July 20, major construction activities will be suspended. The lessee shall submit with the development proposal a “stop work” plan that considers this and any other mitigation related to caribou early arrival and/or late departure. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.



d. The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads:

1. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
2. The lessee or a contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped: a. temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.
3. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period.
4. Aircraft use (including fixed wing and helicopter) shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a Twin Otter, and limited to an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through July 20 in areas where caribou are present, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.
5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.



***K-5b Best Management Practice – Porcupine Caribou Herd Calving Area***

**Objective:** Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.

**Requirement/Standard:** Within the Porcupine Caribou Calving Area, no areas will be offered for lease and no permanent oil and gas facilities will be allowed on the approximately 650,000 acres comprising the following townships:

Township 3N, Ranges 34E-37E

Township 4N, Ranges 31E-38E

Township 5N, Ranges 31E-39E

Township 6N, Ranges 32E-39E,

and bounded on the south and east by the Mollie Beattie Wilderness Area.

***K-5c Lease Stipulation – Porcupine Caribou Post Calving Habitat Area***

**Objective:** To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods.

**Requirement Standard:** Permanent surface disturbance resulting from oil and gas activities is limited to 150 acres (approximately 0.65% of the area) within each of the following townships (Map ---K): Township 5N, Ranges 27E-30E Township 6N, Ranges 37E-31E This does not include surface disturbance activities from pipeline construction. A pipeline will be considered for development of one or more of these tracts after a workshop is convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but need not be limited to BLM, USFWS, other Federal, state, and North Slope Borough representatives. (No alternative procedures will be approved).

***K-6 Lease Stipulation – Coastal Area***

**Objective:** Protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear utilization and movement in Coastal Area habitats; protect and minimize disturbance from oil and gas activities to Coastal Area habitats for polar bears and seals; prevent loss and alteration of important Coastal Area bird habitat; and prevent impacts to Coastal Area subsistence resources and activities.

**Requirement/Standard:**

a. Permanent infrastructure for oil or gas activities is not allowed in the Coastal Area between the northern boundary of the Arctic National Wildlife Refuge and the mainland, and inland areas within 2-miles of the coast. Infrastructure that may be necessary for authorized oil and gas activities within these critical and sensitive Coastal Area habitats (e.g., barge landing, docks, spill response staging and storage areas, or pipelines) may be approved by the authorized officer on a case-by-case basis in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate. All lessees/permittees involved in authorized activities in the Coastal Area must coordinate construction and use infrastructure with all other prospective Refuge users or user groups. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains' associations to minimize impacts to subsistence whaling, and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil



and gas infrastructure within the Coastal Area, the lessee/permittee shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these Coastal Area habitats and their use by wildlife and people.

b. Vessels used as part of a BLM-authorized activity shall be operated in a manner that minimizes disturbance to wildlife in the Coastal Area. Vessels shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Vessels shall maintain a 0.5 mile buffer from polar bears observed on land or ice, and shall avoid polar bears in the water by at least 100 yards unless doing so would endanger human life or violate safe boating practices. Vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.

---

***K-W Lease Stipulation – Wilderness Boundary***

Objective: Protect wilderness values within the Mollie Beattie Wilderness Area

Requirement/Standard:

- a. Surface occupancy, including exploratory and production well drill pads, structures and facilities, gravel and ice roads would not be allowed within 3 miles of the southern and eastern boundaries of the 1002 area where they are adjacent to designated Wilderness.
- b. To the extent practicable, aircraft operations will be planned to minimize flights below 2,000 feet above ground level when flying within 3 miles of the Wilderness boundary.

---

***K-S Lease Stipulation – Subsistence***

Objective: Ensure a continued opportunity for traditional subsistence access and use of critical habitats and resources along coastal marine areas and designated high use river corridors.

- a. Traditional access and use of the coastal marine waters and near inland areas are most significant during the open water periods from June through October for travel and harvest of marine mammals, migratory birds, fish, and caribou.
- b. Traditional access and use of the Hulahula and Okpilak drainages are most significant during the late fall October through May for access to the uplands of the coastal plain the Brooks Range for hunting caribou, sheep and furbearers, and to accessed fishery resources in the Hulahula River and the upper Sadlerochit River-Schrader-Peters Lake region.

Requirement/Standard: To ensure a continued opportunity for important high use subsistence areas along the 1002 coastal shoreline and the Hulahula and Okpilak river corridors:

- a. No surface occupancy of non-subsistence infrastructure will be allowed inland 4 miles from the coast and extend from the Canning River to the Aichilik River on Arctic National Wildlife Refuge Lands;
- b. No surface occupancy of non-subsistence infrastructure will be allowed 4 miles on either side of the Hulahula River and Okpilak Rivers.



## SUMMER VEHICLE TUNDRA ACCESS

### ***L-1 Best Management Practice***

**Objective:** Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities.

**Requirement/Standard:** On a case-by-case basis, the authorized officer **in consultation with US Fish and Wildlife Service** BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best Management Practice C-2a.

Permission for such use would only be granted after an applicant has:

- a. Submitted studies satisfactory to the authorized officer and **US Fish and Wildlife Service** of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.
- b. Submitted surveys satisfactory to the authorized officer and **US Fish and Wildlife Service** of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer.
- c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's and **US Fish and Wildlife Service's** satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer and **US Fish and Wildlife Service**, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.
- d. Designed and/or modified the use proposal to minimize impacts to the authorized officer's and **US Fish and Wildlife Service's** satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.

## GENERAL WILDLIFE AND HABITAT PROTECTION

### ***M-A Best Management Practice***

Ensure that the Refuge meets the ANILCA mandate "to conserve fish and wildlife populations and habitats in their natural diversity"

**Requirement/Standard:** Activities associated with exploration, production, and transportation of oil and gas resources will be conducted in such a way as to not substantially alter the natural abundance and diversity of wildlife species. Development proponents will work with managing agencies to establish appropriate assessment and monitoring protocols to ensure that populations are maintained. Where data on species occurrence and abundance are lacking, appropriate surveys will be conducted prior to development to determine baseline population levels. Study designs will be



approved by the authorized officer and US Fish and Wildlife Service after consultation with other federal, state, North Slope Borough agencies and the Native Village of Kaktovik and Venetie Tribal Council, as appropriate.

---

***M-1 Best Management Practice***

Objective: Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the coastal plain of the Arctic National Wildlife Refuge.

Requirement/Standard: Chasing wildlife with ground vehicles and aircraft is prohibited. Particular attention will be given to avoid disturbing caribou and polar bears.

---

***M-2 Best Management Practice***

Objective: Prevent the introduction, or spread, of non-native, invasive plant species in the coastal plain of the Arctic National Wildlife Refuge.

Requirement/Standard: Certify that all equipment and vehicles (intended for use either off or on roads) are weed-free prior to transporting them into the coastal plain of the Arctic National Wildlife Refuge.

- a. Prior to operations in the Coastal Plain, submit a plan for approval by the authorized officer and US Fish and Wildlife Service, detailing methods for staging, operating, and cleaning equipment and vehicles, including boats, that avoids and minimizes the introduction and spread of invasive species. The plan should address both aquatic and terrestrial plants and animals. The plan should also provide details related to the monitoring and controls of non-native species.
- b. Monitor annually along roads for non-native invasive species, and initiate effective weed control measures upon evidence of their introduction.

Certify that all equipment and vehicles (intended for use either off or on roads) are weed-free prior to transporting them into the NPR-A. Monitor annually along roads for non-native invasive species, and initiate effective weed control measures upon evidence of their introduction. Prior to operations in the NPR-A, submit a plan for the BLM's approval, detailing the methods for cleaning equipment and vehicles, monitoring for weeds and weed control.

---

***M-3 Best Management Practice***

Objective: Minimize loss of populations of, and habitat for, plant and animal species that are rare or endemic to the Arctic.

Requirement/Standard: If a development is proposed in an area that provides potential habitat for an identified rare or endemic plant or animal species in Alaska, the development proponent would conduct surveys at appropriate times of the summer season and in appropriate habitats for the Sensitive Plant Species that might occur there. The results of these surveys will be submitted to the BLM with the application for development.

---



---

***M-4 Best Management Practice***

Objective: Minimize loss of individuals of, and habitat for, mammalian species designated as Sensitive by the BLM in Alaska.

Requirement/Standard: If a development is proposed in an area that provides potential habitat for the Alaska tiny shrew, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats in an effort to detect the presence of the shrew. The results of these surveys will be submitted to BLM with the application for development.

---



**To:** Kate Krebs[kate.krebs@empsi.com]  
**Cc:** Miriam (Nicole) Hayes[mnhayes@blm.gov]; Chad Ricklefs[chad.ricklefs@empsi.com]; Amy Lewis[amy.lewis@empsi.com]  
**From:** Wendy Loya  
**Sent:** 2018-07-12T21:09:40-04:00  
**Importance:** Normal  
**Subject:** Response: USFWS Action Items  
**Received:** 2018-07-12T21:09:48-04:00  
[K1C Springs revised 071218.docx](#)  
[C-2 Snow depth fence monitor revised 071218.docx](#)  
[CAH productivity.pdf](#)  
[PCH summary.pdf](#)  
[K5a and c caribou revised 071218.docx](#)

Hi Kate,

Attached are our edits to K-1C. We have removed the no-leasing stipulation and have asked for only No surface occupancy at 3,4 and 1 mi around respective springs, and 1 mi around aufeis.  
Updated K1C for springs with revised study language and NSO buffers.

C-2 is revised for snowfences and to allow for agency personnel or their representative(s) to go out with seismic operators as monitors

K5a: attempt to clarify numbers. Original BLM language was vague, and that may have allowed authorized officer some flexibility. We are comfortable with either the original or our revision for the DEIS.

K5c: still draft, attempt to reduce density in a meaningful way while allowing development in each township area. Need to work with Rob at BLM once RFDS is available.

Have requested Casey Burns follow up on USGS ACP bird survey data as he is aware of it and that is his section.

Attaching calving success data. The attached tables show estimates of productivity (based on calf:cow ratios in late June) for both herds.

May be other small edits as we continue to go over partner suggested revisions with our experts.

Thanks you guys!!!  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)

---

**From:** Kate Krebs <[kate.krebs@empsi.com](mailto:kate.krebs@empsi.com)>  
**Sent:** Thursday, July 12, 2018 7:15 AM  
**To:** Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>



---

Cc: Hayes, Miriam (Nicole) <[mnhayes@blm.gov](mailto:mnhayes@blm.gov)>; Chad Ricklefs <[chad.ricklefs@emp.si.com](mailto:chad.ricklefs@emp.si.com)>; Amy Lewis <[amy.lewis@emp.si.com](mailto:amy.lewis@emp.si.com)>

Subject: [EXTERNAL] USFWS Action Items

Wendy:

Thank you so much for your participation this week. I think I speak for the BLM when I say that this week would not have gone as well if USFWS had not put such thought into the alternatives in advance of the meeting.

I have the following action items for you/USFWS:

- Update part a of Stip K-1c (springs/aufeis) because it would require drilling.
- Springs/Aufeis (K1c): FWS doesn't have a good understanding of groundwater and how to protect. Where is ice chip harvesting dealt with? Tamayarik and Okerokavik are both located in high potential area. FWS will think more about this with their hydrology specialists.
- Stip K-5a (caribou summer habitat):
  - Part b: Define significant
  - Part 2: one part uses 10 or more caribou, then goes on to say "a large number of caribou". Can there be consistency in using numbers versus more generic language
- Stip K-5c (post-calving): Update 0.6% if there is something more appropriate
- Birds: FWS asked to look to new USGS breeding bird maps to update this data shown on current map; suggests there are four species that use the Refuge more than others (jaegers, etc) (FWS TO PROVIDE?)
- Caribou: FWS might have data on calving success rates to share
- FWS: Wendy is drafting BMP re. snow fences

**Kate Krebs**

EMPSi Environmental Management and Planning Solutions, Inc.

Please note our new street address:

3005 Center Green Drive, Suite 205

Boulder, CO 80301

tel: 303-495-3506    main: 303-447-7160    fax: 866-625-0707

[www.EMPSi.com](http://www.EMPSi.com)    Twitter: EMPSInc    Facebook: EMPSi

*Bringing clarity to the complex*™

GSA Contract GS10F-04125

Albuquerque    Denver    Portland    Reno    San Francisco    Santa Fe    Washington, DC

PLEASE NOTE: This message, including any attachments, may include privileged, confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.



---

***K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat***

Note: All lands within the Arctic Refuge Coastal Plain are recognized as habitat of the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area.

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration.

Requirement/Standard: The following standards will be applied to permitted activities:

a. Lessees shall orient infrastructure when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects.  
b. Before authorization of construction of permanent facilities (limited as they may be by restricted surface occupancy areas established in other lease stipulations), the lessee shall design and implement and report a study of caribou movement unless an acceptable study(s) specific to the Porcupine and Central Arctic Caribou herds has been completed within the last 10 years.

c. Heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from no later than May 20 through no earlier than July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20 or if they remain in the area in significant numbers (greater than approximately 10% of the estimated calving cow population or 1,000 during insect-relief periods) past July 20, major construction activities will be suspended. The lessee shall submit with the development proposal a “stop work” plan that considers this and any other mitigation related to caribou early arrival and/or late departure. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.

d. The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads:

1. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.

2. The lessee or a contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped:

a. Temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou (group of approximately 100 or more) appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation.

b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.

3. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period.

4. Aircraft use shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of

---



all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.

---

***K-5b Best Management Practice – Porcupine Caribou Herd Calving Area***

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.

Requirement/Standard: The Porcupine Caribou primary calving area is defined as the area with higher-than-average density of parturient caribou cows during more than 40% of years. This area is not available for leasing and no surface occupancy is permitted. This area includes approximately 653,000 acres, consisting of the entire area of the following townships, excluding areas that are within the Mollie Beattie Wilderness Area:

T03N, Ranges 34E-38E

T04N, Ranges 31E-39E

T05N, Ranges 32E-40E

T06N, Ranges 32E-40E

Peripheral calving areas include townships that partly overlap the calving area defined above. Portions of these townships may be offered for lease but no surface occupancy will be permitted. This area encompasses approximately 95,500 acres and includes the following areas:

T06N Range 31E

Southern one-half of T07N, Ranges 3E-35E and Ranges 37E-38E

---

***K-5c Lease Stipulation – Porcupine Caribou Post-Calving Habitat Area (and Central Arctic Caribou Calving)***

Objective: To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods .

Requirement Standard: No Central Processing Facilities shall be allowed in the Porcupine Caribou Post-Calving Habitat area. Well pads, roads, airstrips and pipelines will be permitted in accordance with the Caribou **K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat.**

Infrastructure will be limited to 55 acres of the land area per township and oil and gas activity will be limited during periods when caribou are present (generally June 15-July 20).

This area encompasses approximately 245,000 acres and includes the following townships:

T05N, Ranges 27E-30E

T06N, Ranges 27E-30E

The southern one-half of T07, Ranges 27E-30E

**Commented [LWM1]:** FWS will continue to refine this to reflect reasonable, low density development once the RFDS is available. At this time, this would reflect approximately one pad and one 6 mi road.



**To:** Nichelle (Shelly) Jones[njones@blm.gov]; Donna Wixon[dwixon@blm.gov]; Sarah LaMarr[slamarr@blm.gov]  
**Cc:** Joshua Rose[joshua\_rose@fws.gov]; Joanna Fox[joanna\_fox@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-07-17T19:28:58-04:00  
**Importance:** Normal  
**Subject:** Suggested ROPs for Seismic EA  
**Received:** 2018-07-17T19:29:10-04:00  
[Suggested ROPS\\_WINTER OPERATIONS\\_Coastal Plain 071718.docx](#)

Hi Shelly, Donna and Sarah,

Attached are the draft ROPs (formerly BMPs in NPRA IAP) that the FWS suggested as part of the Leasing EIS Alternatives workshop. It would be worth checking with Nicole about what the different alternatives will consider with regards to winter travel and seismic activity, or if they will adopt these across alternatives. These should remain for internal consideration while we work towards the alternatives in the EA.

Thank you,  
Wendy

Dr. Wendy M. Loya  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



## WINTER OPERATIONS (OVERLAND MOVES, SEISMIC EXPLORATION, EXPLORATORY DRILLING, ETC)

The following required operating procedures/Required Operating Procedures apply to overland and over-ice moves, seismic work, and any similar cross-country vehicle use and heavy equipment on non-road surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.

### ***C-1 Required Operating Procedure***

**Objective:** Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.

**Requirement/Standard:**

- a. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 0.5 mile of known or observed grizzly bear dens unless alternative protective measures are approved by the authorized officer in consultation with US Fish and Wildlife Service and Alaska Department of Fish and Game.
- b. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed polar bear dens unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.
- c. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed seal birthing lairs unless alternative protective measures are approved by the authorized officer in consultation with the National Oceanographic and Atmospheric Administration.
- d. Between October 30 and April 15 of any year, operators working within polar bear denning, and seal birthing habitat, shall conduct a survey for polar bear dens and seal birthing lairs in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate, throughout the planned area of activities and before initiating activities.

### ***C-2 Required Operating Procedure***

**Objective:** Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.

**Requirement/Standard:**

- a. Ground operations shall be allowed only when frost depth are at sufficient depths and snow cover is at sufficient depths and density to protect the tundra, as determined by the authorized officer and the US Fish and Wildlife Service. Soils should be frozen to at least -5C at least 30 cm below the lowest surface height (e.g. intertussock space). Snow depth and snow density should amount to no less than a Snow Water Equivalent of 3" over the highest vegetated surface (e.g. top of tussock). Ground operations shall cease when the spring snowmelt begins when snow depth and density no longer meet criteria.
- b. Snow depth and density measurements should reflect conditions at the time of planned operations.

Table for Snow Depth x Density to achieve SWE of 3"

Snow Specific Gravity	Needed Snow Depth (inches)
0.1	30
0.2	15
0.3	10
0.35	9
0.4	8
0.45	7
0.5	6



	<p>b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. <b>Note:</b> This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction.</p> <p>c. Bulldozing of tundra mat and vegetation to create trails or seismic lines is prohibited. Clearing of drifted snow is allowed on existing snow trails, snow pads for camps, ice roads, or ice pads to the extent that the tundra mat is not disturbed.</p> <p>d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern, as approved by the authorizing officer. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons.</p> <p>e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.</p> <p>f. To minimizes changes in snow distribution resulting from oil and gas activities that could impact bear denning habitat and water quality and quantity, the use of snowfences will require approval by the authorized officer in consultation with the US Fish and Wildlife Service.</p> <p>g. Seismic operations and winter overland travel may be monitored by agency representative(s) and operator may be required to accommodate the agency representative(s) during operations.</p>
<p><b><i>C-3 Required Operating Procedure</i></b>  <u>Objective:</u> Maintain natural spring (break-up) runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality and protect stream banks.  <u>Requirement/Standard:</u> Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice (“bridges”) shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.</p>	
<p><b><i>C-4 Required Operating Procedure</i></b>  <u>Objective:</u> Avoid additional freeze-down of aquatic habitat harboring over-wintering fish and invertebrates used by fish.  <u>Requirement/Standard:</u> Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the invertebrates they rely on or water quality. Rivers, streams, and lakes shall be crossed at areas of grounded ice or with the approval of the authorizing officer and US Fish and Wildlife Service, and it has been demonstrated no additional impacts will occur to fish or aquatic invertebrates.</p>	
<p><b><i>C-5 Required Operating Procedure</i></b>  <u>Objective:</u> Minimize the effects of high-intensity acoustic energy from seismic surveys on fish.  <u>Requirement/Standard:</u>  a. Seismic surveys will not be conducted over unfrozen water with fish overwintering potential.  b. When conducting air gun-based surveys in freshwater, operators shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): operators will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained).  c. Explosive-based surveys are prohibited.</p>	



[20180723\\_Coastal\\_Alts\\_MASTER.pdf](#)

Casey Burns  
Wildlife and Threatened & Endangered Species Lead  
Bureau of Land Management - Alaska  
(907) 271-3128

[illegible]



Alternative B	Alternative C	Alternative D
<p><b>Note:</b> While language below refers only to the BLM or Authorized Officer, it is understood that all activities, including development of plans and consideration of exceptions, modifications, or waivers would include coordination with the US Fish and Wildlife Service as the surface management agency. In addition, the BLM will coordinate with other appropriate federal, State, and North Slope Borough agencies and the Native Village of Kaktovik, Native Village of Venetie Tribal Government, the Arctic Village Council, and the Venetie Village Council as appropriate.</p>		
<p><b>PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS</b></p>		
<p><b>Lease Stipulation 1 – Rivers and Streams</b></p> <p><b>Objective:</b> Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts on subsistence cabin and campsites; the disruption of subsistence activities and other resource values. Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and auefs across the Coastal Plain.</p> <p><b>Requirement/Standard:</b> Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within the described setback distances outlined below from the southern boundary of the Coastal Plain to the stream mouth. For streams located entirely within the Coastal Plain, the setback extends to the head of the stream as identified in the National Hydrography Dataset. On a case-by case basis, essential pipeline and road crossings to the main channel will be permitted through setback areas. The setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event.</p> <p>a. Canning River: from the western boundary of the Coastal Plain to 1 mile east of the eastern edge of the active flood plain</p> <p>b. Hulahula River: 1 mile in all directions from the active flood plain</p> <p>c. Aichilik River: 1 miles from the eastern edge of the Coastal Plain boundary</p> <p>d. Okpilak River: 1 mile from the banks' ordinary high-water mark</p> <p>e. Jago River: 1 mile from the banks' ordinary high-water mark</p> <p>f. The following rivers will have a 0.5 mile setback from the banks' ordinary high-water mark:</p> <ul style="list-style-type: none"><li>• Sadlerochit River</li><li>• Tamayariak River</li><li>• Okerokovik River</li></ul>	<p><b>Lease Stipulation 1 – Rivers and Streams</b></p> <p><b>Objective:</b> Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts on subsistence cabin and campsites; the disruption of subsistence activities; impacts on wilderness hunting and recreation activities; and impacts on scenic and other resource values. Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and auefs across the Coastal Plain.</p> <p><b>Requirement/Standard:</b> Same as Alternative B with the following rivers and setbacks:</p> <p>a. Canning River: from the western boundary of the Coastal Plain to 3 miles east of the eastern edge of the active flood plain</p> <p>b. Hulahula River: 4 miles in all directions from the active flood plain</p> <p>c. Aichilik River: 3 miles from the eastern edge of the Coastal Plain boundary</p> <p>d. Okpilak River: 3 miles from the banks' ordinary high water mark</p> <p>e. The following rivers will have a 1 mile setback from the banks' ordinary high water mark:</p> <ul style="list-style-type: none"><li>• Sadlerochit River</li><li>• Jago River</li></ul> <p>f. The following rivers will have a 0.5 mi setback from the banks' ordinary high-water mark:</p> <ul style="list-style-type: none"><li>• Tamayariak River</li><li>• Katakturuk River</li><li>• Nularvik River</li><li>• Okerokovik River</li><li>• Nigunak River</li><li>• Sikrelurak River</li><li>• Angunwill River</li><li>• Kogotpak River</li><li>• Marsh Creek</li><li>• Carter Creek</li><li>• Itkilyariak Creek</li></ul>	
<p><b>Lease Stipulation 2 – Canning River Delta and Lakes</b></p> <p>No similar objective and requirement.</p>	<p><b>Lease Stipulation 2 – Canning River Delta and Lakes</b></p> <p><b>Objective:</b> Protect and minimize adverse effects to the water quality, quantity and diversity of fish and wildlife habitats and populations, subsistence resources, cultural resources and protect and minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; and the loss of migratory bird habitat.</p> <p><b>Requirement/Standard:</b> (NSO) Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.5 mile of the ordinary high watermark of any waterbody within Townships 8 and 9 north of the Canning and Tamayariak watersheds. On a case-by-case basis, essential pipeline(s), road crossings,</p>	



Alternative B	Alternative C	Alternative D
<p><b>Lease Stipulation 3 – Springs/Aufeis</b></p> <p>No similar objective or requirement; see Lease Stipulation 1.</p>		<p>and other permanent facilities may be considered through the permitting process in these areas where the lessee/operator/contractor can demonstrate on a site-specific basis that impacts will be minimal.</p> <p><b>Lease Stipulation 3 – Springs/Aufeis</b></p> <p><b>Objective:</b> Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the coastal plain. River systems with springs provide year-round habitat and host the most diverse and largest populations of fish, aquatic invertebrates, and wildlife and are associated with major subsistence activity and cultural resources.</p> <p><b>Requirement/Standard:</b></p> <ol style="list-style-type: none"> <li>Prior to drilling activities, lessee shall conduct studies in watersheds containing springs necessary to ensure subsequent drilling activities will not disrupt flow of the perennial springs. Study plans will be developed in consultation with the BLM and US Fish and Wildlife Service and other agencies as appropriate.</li> <li>No surface occupancy will be permitted within 3 miles of Sadlerochit Spring (04N031E) nor within 1 mi of the Sadlerochit river where aufeis forms (04N031E &amp; 05N031E). It supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.</li> <li>No surface occupancy will be permitted within 4 miles of the perennial spring at Fish Hole 1 on the Hulahula River (05N032E) nor within 1 mile of the aufeis field (05N032E &amp; 06N032E). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.</li> <li>No surface occupancy will be permitted within 1 mile of the perennial Tamayariak Spring and associated aufeis field (07N026E).</li> <li>No surface occupancy will be permitted within 1 mile of Okerokavik Spring (04N036E) and associated aufeis field in the Jago River drainage (05N035E &amp; 05N036E).</li> </ol>
<p><b>Lease Stipulation 4 – Nearshore marine, lagoon and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic National Wildlife Refuge</b></p> <p>No similar objective or requirement.</p>		<p><b>Lease Stipulation 4 – Nearshore marine, lagoon and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic National Wildlife Refuge</b></p> <p><b>Objective:</b> Protect fish and wildlife habitat including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, marine mammals, and polar bear summer and winter coastal habitat, preserve air and water quality, and minimize impacts to subsistence activities, recreational use and historic travel routes and cultural resources on the major coastal waterbodies.</p> <p><b>Requirement/Standard</b></p> <p><b>Exploration:</b> (TL) Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and until the later of November 1 or sea ice is within 10 miles of the coast of each season, whichever is later. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized officer and the US Fish and Wildlife Service that the actions or activities meet all of the following criteria:</p> <ol style="list-style-type: none"> <li>Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources. The</li> </ol>



Alternative B	Alternative C	Alternative D
		<p>location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough and the Native Village of Kaktovik, recognizing that marine and nearshore travel routes change over time, and are subject to shifting environmental conditions.</p> <p>b. Avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses.</p>
<p><b>Lease Stipulation 5-Coastal Polar Bear Denning Critical Habitat</b></p> <p>No similar objective or requirement.</p>		<p><b>Lease Stipulation 5-Coastal Polar Bear Denning Critical Habitat</b></p> <p><u>Objective:</u> Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.</p> <p><u>Standard:</u></p> <p>a. <b>NSO:</b> From the coastline to 5 miles inland, no permanent oil and gas infrastructure shall be located within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakuruk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the US Fish and Wildlife Service.</p> <p>b. <b>TL:</b> From the coastline to 5 miles inland, between October 30 and April 15 of any year, the lessee/operator/contractor shall not conduct oil and gas activities within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakuruk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the US Fish and Wildlife Service.</p>
<p><b>Lease Stipulation 6 – Caribou Summer Habitat</b></p> <p>No similar objective or requirement.</p>		<p><b>Lease Stipulation 6 – Caribou Summer Habitat</b></p> <p><i>Note: All lands within the Arctic Refuge Coastal Plain are recognized as habitat of the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area.</i></p> <p><u>Objective:</u> Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration.</p> <p><u>Required Operating Procedure:</u> The following standards will be applied to permitted activities:</p> <p>a. Lessees shall orient infrastructure when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects.</p> <p>b. Before authorization of construction of permanent facilities (limited as they may be by restricted surface occupancy areas established in other lease stipulations), the lessee shall design and implement and report a study of caribou movement unless an acceptable study(s) specific to the Porcupine and Central Arctic Caribou herds has been completed within the last 10 years.</p> <p><u>Stipulation:</u> (TL) Heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from no later than May 20 through no earlier than July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement and allowance for deviation is to restrict activities that will disturb caribou during calving and insect-relief periods, but allow for activity if caribou are unlikely to be disturbed in significant numbers. If caribou arrive on the calving</p>



Alternative B	Alternative C	Alternative D
		<p>grounds prior to May 20 or if they remain in the area in significant numbers (greater than approximately 10% of the estimated calving cow population or 1,000 during insect-relief periods) past July 20, major construction activities will be suspended. The lessee shall submit with the development proposal a "stop work" plan that considers this and any other mitigation related to caribou early arrival and/or late departure. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.</p> <p>The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads:</p> <ul style="list-style-type: none"> <li>a. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.</li> <li>b. The lessee/operator/contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped:             <ul style="list-style-type: none"> <li>i. Temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou (group of approximately 100 or more) appears to be imminent. The lessee/operator/contractor shall submit with the development proposal a vehicle use plan that considers these and any other mitigation.</li> <li>ii. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.</li> </ul> </li> <li>c. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period.</li> <li>d. Aircraft use shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. The lessee/operator/contractor shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.</li> <li>e. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.</li> </ul>
Lease Stipulation 7 – Porcupine Caribou Calving Habitat Area	Lease Stipulation 7 – Porcupine Caribou Calving Habitat Area	Lease Stipulation 7 – Porcupine Caribou Calving Habitat Area



Alternative B	Alternative C	Alternative D
<p><b>Objective:</b> Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.</p> <p><b>Requirement/Standard:</b> The Porcupine Caribou primary calving area is defined as the area with higher-than-average density of parturient caribou cows during more than 40% of year. Human activity will be limited during periods when caribou are present (generally May 15 – June 15). These areas encompass approximately 733,100 acres.</p>	<p><b>Objective:</b> Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.</p> <p><b>Requirement/Standard:</b> The Porcupine Caribou primary calving area is defined as the area with higher-than-average density of parturient caribou cows during more than 40% of years.</p> <p>a. Approximately 476,600 acres would not be offered for lease and not available for surface occupancy.</p> <p>b. Approximately 129,600 acres may be offered for lease but subject to no surface occupancy.</p>	<p><b>Objective:</b> Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods.</p> <p><b>Requirement/Standard:</b> The Porcupine Caribou primary calving area is defined as the area with higher-than-average density of parturient caribou cows during more than 40% of years.</p> <p>c. Approximately 476,600 acres would not be offered for lease and not available for surface occupancy.</p> <p>d. Approximately 256,400 acres may be offered for lease but subject to no surface occupancy.</p>
<p><b>Lease Stipulation 8 – Porcupine Caribou Post Calving Habitat Area</b></p> <p><b>Objective:</b> To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods.</p> <p><b>Requirement/Standard:</b> The Porcupine Caribou post-calving habitat area includes areas used for group formation and insect relief during late June and early July. <b>Human activity will be limited during periods when caribou are present (generally June 15 – July 30).</b> This area encompasses approximately 245,000 acres.</p>	<p><b>Lease Stipulation 8 – Porcupine Caribou Post Calving Habitat Area</b></p> <p><b>Objective:</b> To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods.</p> <p><b>Requirement/Standard:</b> The Porcupine Caribou post-calving habitat area includes areas used for group formation and insect relief during late June and early July. In this area, leasing and limited development may occur but type and density of infrastructure will be limited to maintain the ability of caribou to move freely throughout the area to form aggregations of many thousands of caribou. <b>Human activity will be limited during periods when caribou are present (generally May 15 – July 30).</b> This area encompasses approximately 245,000 acres.</p>	<p><b>Lease Stipulation 8 – Porcupine Caribou Post Calving Habitat Area</b></p> <p><b>No similar TL Needed due to Lease Stipulation 6</b></p> <p><b>Development CSU:</b> No central processing facilities shall be allowed in the Porcupine Caribou Post-Calving Habitat area. Well pads, roads, airstrips and pipelines will be permitted in accordance with the Stipulation 6, Caribou Summer Habitat. Infrastructure will be limited across the area to 10% of the entire area.</p>
<p><b>Lease Stipulation 9 – Coastal Area</b></p> <p><b>Objective:</b> Protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear utilization and movement in Coastal Area habitats; protect and minimize disturbance from oil and gas activities to Coastal Area habitats for polar bears and seals; prevent loss and alteration of important Coastal Area bird habitat; and prevent impacts to Coastal Area subsistence resources and activities.</p> <p><b>Required Operating Procedure:</b> Prior to exploration or development, lessees/operators/contractors will be required to conduct a coastline survey in the Coastal Area between the northern boundary of the Arctic National Wildlife Refuge and the mainland, and inland areas within 2-miles of the coast. Based on the survey, the lessee/operator/contractor shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these Coastal Area habitats and their use by wildlife and people.</p>	<p><b>Lease Stipulation 9 – Coastal Area</b></p> <p><b>Objective:</b> Protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear utilization and movement in Coastal Area habitats; protect and minimize disturbance from oil and gas activities to Coastal Area habitats for polar bears and seals; prevent loss and alteration of important Coastal Area bird habitat; and prevent impacts to Coastal Area subsistence resources and activities.</p> <p><b>Requirement/Standard:</b></p> <p>a. NSO: Exploratory well drill pads, production well drill pads, or central processing facilities for oil and gas are not allowed in the Coastal Area between the northern boundary of the Arctic National Wildlife Refuge and the mainland, and inland areas within 1-mile of the coast. Infrastructure that may be necessary for authorized oil and gas activities within these critical and sensitive Coastal Area habitats (e.g., barge landing, docks, spill response staging and storage areas, or pipelines) may be approved by the authorized officer on a case-by-case basis in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate. All lessees/operators/contractors involved in authorized activities in the Coastal Area must coordinate construction and use infrastructure with all other prospective Refuge users or user groups. Before conducting open water activities, the lessee/operator/contractor shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains' associations to minimize impacts to subsistence whaling, and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil and gas infrastructure within the Coastal Area, the lessee/operator/contractor shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the</p>	<p><b>Lease Stipulation 9 – Coastal Area</b></p> <p><b>Objective:</b> Protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear utilization and movement in Coastal Area habitats; protect and minimize disturbance from oil and gas activities to Coastal Area habitats for polar bears and seals; prevent loss and alteration of important Coastal Area bird habitat; and prevent impacts to Coastal Area subsistence resources and activities.</p> <p><b>Requirement/Standard:</b></p> <p>a. NSO: Exploratory well drill pads, production well drill pads, or a central processing facility for oil or gas would not be within 2 miles of the coast inland or on coastal waters, lagoons or barrier islands within the boundaries of the Arctic Refuge Coastal Plain area. Other facilities necessary for oil and gas production that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Nor would this stipulation preclude infrastructure associated with offshore oil and gas exploration and production or construction and renovation.</p> <p>b. Oil and gas operations are not allowed on the major coastal waterbodies and coastal islands between May 15 and until the later of November 1 or sea ice is within 10 miles of the coast of each season, whichever is later. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized officer and the US Fish and Wildlife Service that the actions or activities meet all of the following criteria:</p> <p>i. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources.</p>



Alternative B	Alternative C	Alternative D
	infrastructure and its use on these Coastal Area habitats and their use by wildlife and people.	<p>ii. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts or pipeline leaks during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and "top-setting" of hydrocarbon-bearing zones.</p> <p>iii. Avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses.</p> <p>iv. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough and the Native Village of Kaktovik, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.</p> <p>c. Infrastructure that may be necessary for authorized oil and gas activities within these critical and sensitive Coastal Area habitats (e.g., barge landing, docks, spill response staging and storage areas, or pipelines) may be approved by the authorized officer on a case-by-case basis in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate. All lessee/operator/contractor involved in authorized activities in the Coastal Area must coordinate construction and use infrastructure with all other prospective Refuge users or user groups. Before conducting open water activities, the lessee/operator/contractor shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains' associations to minimize impacts to subsistence whaling, and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil and gas infrastructure within the Coastal Area, the lessee/operator/contractor shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these Coastal Area habitats and their use by wildlife and people, including:</p> <p>v. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.</p> <p>vi. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.</p> <p>vii. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays as identified by the community of Kaktovik and the North Slope Borough.</p> <p>viii. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and "top-setting" of hydrocarbon-bearing zones.</p>



Alternative B	Alternative C	Alternative D
		<p>d. Avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound "direct spill" related impacts on area resources and subsistence uses.f. Before conducting open water activities, the lessee/operator/contractor shall consult with the community of Kaktovik, the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.</p> <p>e. Vessels used as part of a BLM-authorized activity shall be operated in a manner that minimizes disturbance to wildlife in the Coastal Area. Vessels shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Vessels shall maintain a 0.5 mile buffer from polar bears observed on land or ice, and shall avoid polar bears in the water by at least 100 yards unless doing so would endanger human life or violate safe boating practices. Vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.</p>
<p><b>Lease Stipulation 10 – Wilderness Boundary</b></p> <p>No Similar Requirement</p>		<p><b>Lease Stipulation 10 – Wilderness Boundary</b></p> <p><u>Objective:</u> Protect wilderness values within the Mollie Beattie Wilderness Area.</p> <p><u>Requirement/Standard:</u></p> <p>a. Surface occupancy, including exploratory and production well drill pads, structures and facilities, gravel and ice roads would not be allowed within 3 miles of the southern and eastern boundaries of the Coastal Plain where they are adjacent to designated Wilderness.</p> <p>b. To the extent practicable, aircraft operations will be planned to minimize flights below 2,000 feet above ground level when flying within 3 miles of the Wilderness boundary.</p>
<p><b>Lease Stipulation 11 – Traditional/Subsistence Access Routes</b></p> <p><u>Objective:</u> Prevent disruption of subsistence use and access.</p>		
<p><u>Requirement/Standard:</u> Prior to exploration or development, lessees/operators/contractors are required to develop a subsistence access plan in coordination with the Native Village of Kaktovik and the City of Kaktovik to be approved by the authorized officer.</p>		
<p><b>WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY</b></p>		
<p><b>Required Operating Procedure 1</b></p>		
<p><u>Objective:</u> Protect the health and safety of oil and gas field workers and the general public by disposing of solid waste and garbage in accordance with applicable federal, State, and local law and regulations.</p>		
<p><u>Requirement/Standard:</u> Areas of operation shall be left clean of all debris.</p>		
<p>Same as Alternative C.</p>		
<p><b>Required Operating Procedure 2</b></p> <p><u>Objective:</u> Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil and gas field workers and the general public. Minimize human-caused changes in predator populations.</p> <p><u>Requirement/Standard:</u> The lessee/operator/contractor shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the authorized officer for approval, in consultation with federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application.</p>		<p><b>Required Operating Procedure 2</b></p> <p><u>Objective:</u> Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil and gas field workers, local communities, Refuge subsistence users, Refuge recreational users, and the general public. Minimize human-caused changes in predator populations. Minimize attracting predators, particularly bears, to human use areas.</p> <p><u>Requirement/Standard:</u> Lessees/operators/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration, development and production, including seismic activities. The plan shall include methods and</p>



Alternative B	Alternative C	Alternative D
		<p>procedures to use bear resistant containers for all waste materials and classes. The plan shall be submitted to the authorized officer and the US Fish and Wildlife Service for approval, in consultation with other federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements:</p> <p>a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. The use of bear resistant containers for all waste shall be specified.</p> <p>b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. The use of bear resistant containers for all waste shall be specified. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer and the US Fish and Wildlife Service. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer.</p> <p>c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations.</p> <p>d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.</p>
<p><b>Required Operating Procedure 3</b></p> <p>Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements:</p> <p>a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage.</p> <p>b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. The lessee/operator/contractor shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer.</p> <p>c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations.</p> <p>d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.</p>		<p><b>Required Operating Procedure 3</b></p> <p>For oil- and gas-related activities, a hazardous materials emergency contingency plan shall be prepared and implemented before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Procedures in the plan applicable to fuel and hazardous substances handling (associated with transportation vehicles) shall consist of best management practices if approved by the authorized officer. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of federal, State, and North Slope Borough contacts. Other federal and State regulations may apply and require additional planning requirements. All appropriate staff shall be instructed regarding these procedures.</p> <p>In addition contingency plans related to facilities developed for oil production shall include requirements to:</p> <p>a. Provide refresher spill-response training to North Slope Borough and local community spill-response teams on a yearly basis.</p> <p>b. Plan and conduct a major spill-response field-deployment drill annually.</p> <p>c. Prior to production and as required by law, develop spill prevention and response contingency plans and participate in development and maintenance of the North</p>



Alternative B	Alternative C	Alternative D
		<p>Slope Subarea Contingency Plan for Oil and Hazardous Substances Discharges/Releases for the Arctic National Wildlife Refuge. Planning shall include development and funding of detailed (e.g., 1:26,000 scale) environmental sensitivity index maps for the lessee's/permittee's operating area and areas outside the lessee's/permittee's operating area that could be affected by their activities. The specific area to be mapped shall be defined in the lease agreement and approved by the authorized officer in consultation with the US Fish and Wildlife Service and appropriate resource agencies. Maps shall be completed in paper copy and geographic information system format in conformance with the latest version of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration's Environmental Sensitivity Index Guidelines. Draft and final products shall be peer reviewed and approved by the authorized officer, the US Fish and Wildlife Service and in consultation with other federal, State, and North Slope Borough resource and regulatory agencies.</p>
<p><b>A-5 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.</p> <p><u>Requirement/Standard:</u> Refueling of equipment within 100 feet of the active floodplain of any water body is prohibited. Fuel storage stations shall be located at least 100 feet from any water body with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes, and small equipment, e.g., portable generators and water pumps, will be permitted. The authorized officer may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.</p>		<p><b>A-5 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.</p> <p><u>Requirement/Standard:</u> Refueling of equipment within 500 feet of the active floodplain of any water body is prohibited. Fuel storage stations shall be located at least 500 feet from any water body with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes, and small equipment, e.g., portable generators and water pumps, will be permitted. The authorized officer may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.</p>
<p><b>A-8 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize conflicts resulting from interaction between humans and bears during oil and gas activities.</p> <p><u>Requirement/Standard:</u> The lessee/operator/contractor will, as a part of preparation of lease operation planning, prepare and/or implement bear-interaction plans to minimize conflicts between bears and humans. These bear interaction plans shall be developed in consultation with and approved by the USFWS and the ADFG. The plans shall include specific measures identified in the current USFWS Polar Bear Mitigation Plan and be adapted as needed for grizzly bears.</p>	<p><b>A-9 Required Operating Procedure</b></p> <p><u>Objective:</u> Reduce air quality impacts.</p> <p><u>Requirement/Standard:</u> All oil and gas operations (vehicles and equipment) that burn diesel fuels must use "ultra-low sulfur" diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality.</p>	<p><b>A-9 Required Operating Procedure</b></p> <p><u>Objective:</u> Reduce air quality impacts.</p> <p><u>Requirement/Standard:</u> All oil and gas operations (vehicles and equipment) that burn diesel fuels must use "ultra-low sulfur" diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality.</p> <p>To the extent practicable, all oil and gas operations (vehicles and equipment) must be powered by natural gas or electric power rather than diesel fuel. To the extent natural gas and electric power are not practicable, the permittee will use gasoline rather than diesel to the extent practicable. Any vehicles and equipment that require diesel fuel must use ULSD as defined by the Alaska Department of Conservation, Division of Air Quality.</p>
<p><b>A-10 Required Operating Procedure</b></p> <p><u>Objective:</u> Prevent unnecessary or undue degradation of the lands and protect health.</p> <p><u>Requirement/Standard:</u> This measure includes the following elements:</p> <p>a. Prior to initiation of a NEPA analysis for an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source (hereafter project), the authorizing officer (BLM) may require the project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutant(s) of concern as determined by BLM if no representative air monitoring data are available for the project area, or existing representative ambient air monitoring data are insufficient, incomplete, or do not meet minimum air monitoring standards set by the Alaska DEC or the EPA. If BLM determines that baseline monitoring is required, this pre-analysis data must meet Alaska DEC</p>		



Alternative B	Alternative C	Alternative D
<p>and EPA air monitoring standards, and cover the year immediately prior to the submittal. Pre-project monitoring may not be appropriate where the life of the project is less than one year.</p> <p>b. The BLM may require monitoring for the life of the project depending on the magnitude of potential air emissions from the project, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within or proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project.</p> <p>c. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the project proponent shall prepare (and submit for BLM approval) an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project, including reasonably foreseeable air pollutant emissions of criteria air pollutants, volatile organic compounds, hazardous air pollutants, and greenhouse gases estimated for each year for the life of the project. The BLM will use this estimated emissions inventory to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the proposed project.</p> <p>d. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM may require the proponent to provide an emissions reduction plan that includes a detailed description of operator-committed measures to reduce project related air pollutant emissions including, but not limited to greenhouse gases and fugitive dust.</p> <p>e. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the authorized officer may require air quality modeling for purposes of analyzing project direct, indirect or cumulative impacts to air quality. The BLM may require air quality modeling depending on the magnitude of potential air emissions from the project or activity, duration of the proposed action, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. The BLM will determine the information required for a project specific modeling analysis through the development of a modeling protocol for each analysis. The authorized officer will consult with appropriate federal, State, and/or local agencies regarding modeling to inform his/her modeling decision and avoid duplication of effort. The modeling shall compare predicted impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds (such as impacts to air quality related values, incremental cancer risks, etc.).</p> <p>f. The BLM may require air quality mitigation measures and strategies within its authority (and in consultation with local, state, federal, and tribal agencies with responsibility for managing air resources) in addition to regulatory requirements and proponent committed emission reduction measures, and for emission sources not otherwise regulated by Alaska DEC or EPA, if the air quality analysis shows potential future impacts to NAAQS or AAQs or impacts above specific levels of concern for air quality related values (AQRVs).</p> <p>g. If ambient air monitoring indicates that project-related emissions are causing or contributing to impacts that would cause unnecessary or undue degradation of the lands, cause exceedances of NAAQS, or fail to protect health (either directly or through use of subsistence resources), the authorized officer may require changes in activities at any time to reduce these emissions to comply with the NAAQS and/or minimize impacts to AQRVs. Within the scope of BLM's authority, the BLM may require additional emission control strategies to minimize or reduce impacts to air quality.</p> <p>h. Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results developed in conformance with this required operating procedure shall be provided by the project proponent to the North Slope Borough and to local communities and tribes in a timely manner.</p> <p><i>Objective: Provide BLM oversight and technical review of air quality monitoring near the GMTI project; address concerns in the local community regarding oversight for air quality.</i></p> <p>a. <i>Requirement/Standard: The permittee will provide funding for monitoring to identify and address concerns related to air quality in the Nuiqsut area. Reports from the monitoring station in Nuiqsut will be provided to BLM, the State, NSB, and the local community and tribal government pursuant to BMP A-10(h). The permittee will provide funding for BLM technical review of these documents. The permittee will also provide funds to BLM, via an ongoing cost reimbursement agreement, to support BLM's independent verification of the air quality monitoring and reports!</i></p>		
<b>A-11 Required Operating Procedure</b>		
<i>Objective:</i> Ensure that permitted activities do not create human health risks through contamination of subsistence foods.		
<p><i>Requirement/Standard:</i> A lessee/operator/contractor proposing a permanent oil and gas development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The monitoring study shall examine subsistence foods for all contaminants that could be associated with the proposed development. The study shall identify the level of contaminants in subsistence foods prior to the proposed permanent oil and gas development and monitor the level of these contaminants throughout the operation and abandonment phases of the development. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the operator shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the operator's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the operator's activities, the authorized officer may require changes in the operator's processes to reduce or eliminate emissions of the contaminant. The design of the study/studies must meet the approval of the authorized officer. The authorized officer may coordinate with appropriate entities prior to approving the study/studies design. The authorized officer may require/authorize changes in the design of the studies throughout the operations and abandonment period, or terminate or suspend studies if results warrant.</p>		
<b>WATER USE FOR PERMITTED ACTIVITIES</b>		
<b>B-1 Required Operating Procedure</b>		
<i>Objective:</i> Maintain populations of, and adequate habitat for, fish and aquatic invertebrates.		
<i>Requirement/Standard:</i> Withdrawal of unfrozen water from rivers and streams during winter is prohibited. The removal of ice aggregate from grounded areas ≤4-feet deep may be authorized from rivers on a site-specific basis.		
<b>B-2 Required Operating Procedure</b>		
<p><i>Objective:</i> Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, aquatic invertebrates, and waterfowl.</p> <p><i>Requirement/Standard:</i> Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are:</p> <p>a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume</p>		
<b>B-2 Required Operating Procedure</b>		
<p><i>Objective:</i> Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, aquatic invertebrates, and waterfowl.</p> <p><i>Requirement/Standard:</i> Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-</p>		



Alternative B	Alternative C	Alternative D
<p>deeper than 7 feet; only ice aggregate may be removed from lakes that are <math>\leq 7</math>-feet deep.</p> <p>b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are <math>\leq 5</math> feet deep.</p> <p>c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume.</p> <p>d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations.</p> <p>e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern.</p> <p>f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury.</p> <p><b>Note:</b> All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat.</p> <p>g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.</p>	<p>specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are:</p> <p>a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are <math>\leq 7</math>-feet deep.</p> <p>b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are <math>\leq 5</math> feet deep.</p> <p>c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume.</p> <p>d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations.</p> <p>e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern.</p> <p>f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. <b>Note:</b> All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat.</p> <p>g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.</p> <p>h. Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds are maintained.</p>	<p>specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are:</p> <p>a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are <math>\leq 7</math>-feet deep.</p> <p>b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are <math>\leq 5</math> feet deep.</p> <p>c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume.</p> <p>d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations.</p> <p>e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern.</p> <p>f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. <b>Note:</b> All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat.</p> <p>g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.</p> <p>h. Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds are maintained.</p>
<p><b>WINTER OVERLAND MOVES AND SEISMIC WORK</b></p> <p>The following required operating procedures/best management practices apply to overland and over-ice moves, seismic work, and any similar cross-country vehicle use and heavy equipment on non-road surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.</p>		
<p><b>C-1 Required Operating Procedure</b></p> <p><u>Objective:</u> Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.</p> <p><u>Requirement/Standard:</u></p> <p>a. Cross-country use of heavy equipment and seismic activity is prohibited within 0.5 mile of occupied grizzly bear dens identified by the Alaska Department of Fish and Game unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game.</p> <p>b. Cross-country use of heavy equipment and seismic activity is prohibited within 1 mile of known or observed polar bear dens or seal birthing lairs. Operators near coastal areas shall conduct a survey for potential polar bear dens and seal birthing lairs and consult with the USFWS and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.</p>		<p><b>C-1 Required Operating Procedure</b></p> <p><u>Objective:</u> Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.</p> <p><u>Requirement/Standard:</u></p> <p>a. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 0.5 mile of known or observed grizzly bear dens unless alternative protective measures are approved by the authorized officer in consultation with US Fish and Wildlife Service and Alaska Department of Fish and Game.</p> <p>b. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed polar bear dens unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.</p> <p>c. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed seal birthing lairs unless alternative protective measures are approved by the authorized officer in consultation with the National Oceanographic and Atmospheric Administration.</p> <p>d. Between October 30 and April 15 of any year, a lessee/operator/contractor working within polar bear denning, and seal birthing habitat, shall conduct a survey for polar bear dens and seal birthing lairs in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or</p>



Alternative B	Alternative C	Alternative D																								
<p><b>C-2 Best Required Management Procedure</b></p> <p><b>Objective:</b> Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.</p> <p><b>Requirement/Standard:</b></p> <p>a. Ground operations shall be allowed only when frost and snow cover are at sufficient depths to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 5 in the foothills area where elevations reach or exceed 500 feet and approximately May 15 in the northern coastal areas). The exact dates will be determined by the authorized officer.</p> <p>b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. <b>Note:</b> This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction.</p> <p>c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed.</p> <p>d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety, or superseding environmental concern as approved by the authorized officer. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons.</p> <p>e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.</p>		<p>both as appropriate, throughout the planned area of activities and before initiating activities.</p> <p><b>C-2 Required Management Procedure</b></p> <p><b>Objective:</b> Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.</p> <p><b>Requirement/Standard:</b></p> <p>a. Ground operations shall be allowed only when frost depth are at sufficient depths and snow cover is at sufficient depths and density to protect the tundra, as determined by the authorized officer and the US Fish and Wildlife Service. Soils should be frozen to at least -5C to at least 30 centimeters below the lowest surface height (e.g. intertussock space). Snow depth and snow density should amount to no less than a Snow Water Equivalent of 3 inches over the highest vegetated surface (i.e., top of tussock). Ground operations shall cease when snow depth and density no longer meet criteria. Snow depth and density shall reflect the time of the planned operation.</p> <table border="1"><tr><th colspan="2">Snow Depth x Density to achieve Snow Water Equivalent of 3 Inches</th></tr><tr><th>Snow Specific Gravity</th><th>Needed Snow Depth (inches)</th></tr><tr><td>0.05</td><td>60</td></tr><tr><td>0.1</td><td>30</td></tr><tr><td>0.15</td><td>20</td></tr><tr><td>0.2</td><td>15</td></tr><tr><td>0.25</td><td>12</td></tr><tr><td>0.3</td><td>10</td></tr><tr><td>0.35</td><td>9</td></tr><tr><td>0.4</td><td>8</td></tr><tr><td>0.45</td><td>7</td></tr><tr><td>0.5</td><td>6</td></tr></table> <p>b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. Note: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction.</p> <p>c. Bulldozing of tundra mat and vegetation to create trails or seismic lines is prohibited. Clearing of drifted snow is allowed on existing snow trails, snow pads for camps, ice roads, or ice pads to the extent that the tundra mat is not disturbed.</p> <p>d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons.</p> <p>e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.</p> <p>f. To minimizes changes in snow distribution resulting from oil and gas activities that could impact bear denning habitat and water quality and quantity, the use of snowfences will require approval by the authorized officer in consultation with the US Fish and Wildlife Service.</p>	Snow Depth x Density to achieve Snow Water Equivalent of 3 Inches		Snow Specific Gravity	Needed Snow Depth (inches)	0.05	60	0.1	30	0.15	20	0.2	15	0.25	12	0.3	10	0.35	9	0.4	8	0.45	7	0.5	6
Snow Depth x Density to achieve Snow Water Equivalent of 3 Inches																										
Snow Specific Gravity	Needed Snow Depth (inches)																									
0.05	60																									
0.1	30																									
0.15	20																									
0.2	15																									
0.25	12																									
0.3	10																									
0.35	9																									
0.4	8																									
0.45	7																									
0.5	6																									



Alternative B	Alternative C	Alternative D
<b>C-3 Required Operating Procedure</b> <u>Objective:</u> Maintain natural spring (break-up) runoff patterns and fish passage, minimize flooding from human-made obstructions, prevent streambed sedimentation and scour, protect water quality and protect stream banks. <u>Requirement/Standard:</u> Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice ("bridges") shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.		g. Seismic operations and winter overland travel may be monitored by agency representative(s) and operator may be required to accommodate the agency representative(s) during operations.
<b>C-4 Required Operating Procedure</b> <u>Objective:</u> Avoid additional freeze-down of deep-water pools harboring over-wintering fish and aquatic invertebrates used by fish. <u>Requirement/Standard:</u> Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the aquatic invertebrates they rely on. Rivers, streams, and lakes shall be crossed at areas of grounded ice whenever possible.		<b>C-4 Required Operating Procedure</b> <u>Objective:</u> Avoid additional freeze-down of aquatic habitat harboring over-wintering fish and aquatic invertebrates used by fish. <u>Requirement/Standard:</u> Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the aquatic invertebrates they rely on and water quality. Rivers, streams, and lakes shall be crossed at areas of grounded ice or with the approval of the authorizing officer and US Fish and Wildlife Service, and it has been demonstrated no additional impacts will occur to fish or aquatic invertebrates.
<b>C-5 Required Operating Procedure</b> <u>Objective:</u> Minimize the effects of high-intensity acoustic energy from seismic surveys on fish. <u>Requirement/Standard:</u> <ol style="list-style-type: none"> <li>When conducting vibroseis-based surveys above potential fish overwintering areas (water 6 feet deep or greater, ice plus liquid depth), lessees/operators/contractors shall follow recommendations by Morris and Winters (2005): only a single set of vibroseis shots should be conducted if possible; if multiple shot locations are required, these should be conducted with minimal delay; multiple days of vibroseis activity above the same overwintering area should be avoided if possible.</li> <li>When conducting air gun-based surveys in freshwater, lessees/operators/contractors shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): lessees/operators/contractors will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained).</li> <li>When conducting explosive-based surveys, lessees/operators/contractors shall follow setback distances from fish-bearing waterbodies based on requirements outlined by Alaska Department of Fish and Game (2013 or most current).</li> </ol>		<b>C-5 Required Operating Procedure</b> <u>Objective:</u> Minimize the effects of high-intensity acoustic energy from seismic surveys on fish. <u>Requirement/Standard:</u> <ol style="list-style-type: none"> <li>Seismic surveys will not be conducted over unfrozen water with fish overwintering potential.</li> <li>When conducting air gun-based surveys in freshwater, lessees/operators/contractors shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): lessees/operators/contractors will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained).</li> <li>Explosive-based surveys are prohibited.</li> </ol>
<b>Required Operating Procedure</b> <u>Objective:</u> Reduce changes in snow distribution associated with the use of snowfences in order to protect water quantity and wildlife habitat, including snow drifts used by denning polar bears. <u>Requirement/Standard:</u> The use of snowfences to reduce or increase snow depth requires permitting by the authorized officer in consultation with the US Fish and Wildlife Service.		
<b>OIL AND GAS EXPLORATORY DRILLING</b>		
<b>D-1 Required Operating Procedure</b> <u>Objectives:</u> Protect water quality in fish-bearing waterbodies and minimize alteration of riparian habitat. <u>Requirement/Standard:</u> Exploratory drilling is prohibited in fish-bearing rivers and streams and their active floodplain, and other fish-bearing waterbodies.		<b>D-1 Required Operating Procedure</b> <u>Objectives:</u> Protect water quality in fish-bearing waterbodies and minimize alteration of riparian habitat. <u>Requirement/Standard:</u> Exploratory drilling is prohibited in fish-bearing rivers and streams and other fish-bearing waterbodies. On a case-by-case basis, the authorized officer may consider exploratory drilling within floodplains of fish-bearing rivers and streams.
<b>D-1 Required Operating Procedure</b>		



Alternative B	Alternative C	Alternative D
<b>Objective:</b> Minimize surface impacts from exploratory drilling.		
<b>Requirement/Standard:</b> Construction of gravel or permanent oil and gas facilities shall be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.		
<b>FACILITY DESIGN AND CONSTRUCTION</b>		
<b>E-1 Required Operating Procedure</b>		
<p><b>Objective:</b> Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources.</p> <p><b>Requirement/Standard:</b> All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies prior to approving construction of roads. Subject to approval by the authorized officer, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee/operator/contractor unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.</p>		<p><b>E-1 Required Operating Procedure</b></p> <p><b>Objective:</b> Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources.</p> <p><b>Requirement/Standard:</b> All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies and the Native Village of Kaktovik and the Venetie Tribal Government prior to approving construction of roads. Subject to approval by the authorized officer in consultation with the USFWS, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee/operator/contractor unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.</p>
<b>E-2 Required Operating Procedure</b>		
<b>Objective:</b> Protect water quality and the diversity of fish, aquatic invertebrates and wildlife populations and habitats.		
<b>Requirement/Standard:</b>		
<p>a. Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 feet as measured from the ordinary high watermark of fish-bearing waterbodies unless further setbacks are stipulated under <a href="#">Lease Stipulation K-2</a>.</p>		
<p>Pipeline and road crossings will be permitted on a case-by-case basis by the authorized officer following coordination with the US Fish and Wildlife Service and other appropriate federal, State, and North Slope Borough regulatory and resources agencies, and the Native Village of Kaktovik and the Venetie Tribal Government.</p>		
<p>b. Exploration and construction camps are prohibited on frozen lakes and river ice.</p>		
<p>Siting of camps on river sand and gravel bars is allowed and encouraged. Where leveling of trailers or modules is required and the surface has a vegetative mat, leveling shall be accomplished through blocking in a way that preserves the vegetative mat.</p>		
<b>E-3 Required Operating Procedure</b>		
<b>Objective:</b> Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing.		
<b>Requirement/Standard:</b> Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas.		
<b>E-3 Required Operating Procedure</b>		
<b>Objective:</b> Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing.		
<p><b>Requirement/Standard:</b> Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and the Native Village of Kaktovik, shall be required to address the objectives of water quality and free passage of fish.</p>		
<b>E-5 Required Operating Procedure</b>		
<b>Objective:</b> Minimize impacts of the development footprint.		
<p><b>Requirement/Standard:</b> Facilities shall be designed and located to minimize the development footprint. Issues and methods that are to be considered include: (a) use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads; (b) sharing facilities with existing development; (c) collocation of all oil and gas facilities, except airstrips, docks, base camps, and seawater-treatment plants, with drill pads; (d) use of gravel- reduction technologies, e.g., insulated or pile-supported pads, (e) coordination of facilities with infrastructure in support of adjacent development. <b>Note:</b> Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.</p>		<p><b>E-5 Required Operating Procedure</b></p> <p><b>Objective:</b> Minimize impacts of the development footprint.</p> <p><b>Requirement/Standard:</b> Facilities shall be designed and located to minimize the development footprint <b>and impacts to other purposes of the Arctic National Wildlife Refuge</b>. Issues and methods that are to be considered include: (a) use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads; (b) sharing facilities with existing development; (c) collocation of all oil and gas facilities, except airstrips, docks, base camps, and seawater-treatment plants, with drill pads; (d) use of gravel- reduction technologies,</p>



Alternative B	Alternative C	Alternative D
		e.g., insulated or pile-supported pads, (e) coordination of facilities with infrastructure in support of adjacent development; (f) location of facilities and other infrastructure outside of areas identified as important for wildlife habitat, subsistence uses, recreational uses; and (g) where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.
<p><b>E-6 Required Operating Procedure</b></p> <p><b>Objective:</b> Reduce the potential for ice-jam flooding, damage from aulais, impacts to wetlands and floodplains, erosion, alteration of natural drainage patterns, and restriction of fish passage.</p> <p><b>Requirement/Standard:</b></p> <p>a) To allow for sheet flow and flood plain dynamics and to ensure fish passage and passage of other organisms, bridges are preferred over culverts if technically feasible. When necessary, culverts can be constructed on smaller streams, if they are large enough to avoid restricting fish passage or adversely affecting natural stream flow.</p> <p>b) To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in "Fish Passage Design Guidelines" developed by the US Fish and Wildlife Service Alaska Fish Passage Program (June 29, 2018), the basis of these guidelines, "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" (U.S. Forest Service 2008), and other generally accepted best management procedures prescribed by the authorized officer and the US Fish and Wildlife Service.</p> <p>In addition to the best management practices outlined in the aforementioned documents for stream simulation design, the design engineer should ensure that crossing structures are designed for aulais, permafrost, sheet flow, additional freeboard during breakup, and other unique conditions of the arctic environment.</p>		
<p><b>E-7 Required Operating Procedure</b></p> <p><b>Objective:</b> Minimize disruption of caribou movement and subsistence use.</p> <p><b>Requirement/Standard:</b> Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Listed below are the accepted design practices:</p> <p>a. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members.</p> <p>b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer after consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility).</p> <p>c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road for pipeline road crossings will be considered by the authorized officer.</p> <p>d. Above-ground pipelines shall have a non-reflective finish.</p>		<p><b>E-7 Required Operating Procedure</b></p> <p><b>Objective:</b> Minimize disruption of caribou movement and subsistence use.</p> <p><b>Requirement/Standard:</b> Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Listed below are the accepted design practices:</p> <p>b. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members.</p> <p>c. In areas where facilities or terrain may funnel caribou movement, or impede subsistence or public access, ramps of appropriate angle and design over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer in consultation with the USFWS and other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility) and the Native Village of Kaktovik and the Venetie Tribal Government.</p> <p>d. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road for pipeline road crossings will be considered by the authorized officer.</p> <p>e. Above-ground pipelines shall have a non-reflective finish.</p>
<p><b>E-8 Required Operating Procedure</b></p> <p><b>Objective:</b> Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.</p> <p><b>Requirement/Standard:</b> Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider:</p> <p>a. Locations outside the active floodplain.</p> <p>b. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use.</p> <p>c. Potential use of the site for enhancing fish and wildlife habitat.</p> <p>d. Potential storage and reuse of soil/overburden for the mine site or at other disturbed sites on the North Slope.</p>		<p><b>E-8 Required Operating Procedure</b></p> <p><b>Objective:</b> Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.</p> <p><b>Requirement/Standard:</b> Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall consider:</p> <p>a. Design and construction of gravel mine sites to serve as water reservoirs for future use may not be considered within active floodplains of the four rivers that support populations of freshwater, anadromous, or endemic fish (Canning, Sadlerochit, Hulahula, and Aichilik rivers).</p> <p>b. Locations outside the active floodplain for all other rivers.</p>



Alternative B	Alternative C	Alternative D
		<p>c. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use.</p> <p>d. Potential use of the site for enhancing fish and wildlife habitat while preventing entrapment of native fishes.</p> <p>d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.</p> <p>e. All constructed water storage reservoirs shall be a sufficient distance from drill sites, fueling stations, or other temporary or permanent site that generates or maintains more than 220 gallons of fuel, drilling fluids, or other hazardous materials to avoid contamination via surface or groundwater of the storage reservoir. The lessee/operator/contractor shall implement a water quality and contaminants monitoring program for any constructed water storage facility.</p>
<p><b>E-9 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize human-caused increases in populations of predators of ground-nesting birds.</p> <p><u>Requirement/Standard:</u></p> <ol style="list-style-type: none"> <li>Lessee/operator/contractor shall use best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee/operator/contractor shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites.</li> <li>Feeding of wildlife is prohibited.</li> </ol>		<p><b>E-9 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize human-caused increases in populations of predators of ground-nesting birds.</p> <p><u>Requirement/Standard:</u></p> <ol style="list-style-type: none"> <li>Lessee/operator/contractor shall use best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee/operator/contractor shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites.</li> <li>Feeding of wildlife and allowing wildlife to access human food or odor-emitting waste, is prohibited.</li> </ol>
<p><b>E-10 Required Operating Procedure</b></p> <p><u>Objective:</u> Prevention of migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions.</p> <p><u>Requirement/Standard:</u> Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.</p>		<p><b>E-10 Required Operating Procedure</b></p> <p><u>Objective:</u> Reduction of risk of attraction and collisions between migrating birds and oil and gas and related facilities during low light conditions.</p> <p><u>Requirement/Standard:</u> Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.</p>
<p><b>E-11 Required Operating Procedure</b></p> <p><u>Objective:</u> Minimize the take of bird species, particularly those listed under the Endangered Species Act and BLM Special Status Species from direct or indirect interaction with oil and gas facilities.</p> <p><u>Requirement/Standard:</u> In accordance with the guidance below, before the approval of facility construction, aerial surveys of the following species shall be conducted within any area proposed for development.</p> <p><i>Special Conditions in Spectacled and/or Steller's Eiders Habitats:</i></p> <ol style="list-style-type: none"> <li>Surveys shall be conducted by the lessee/operator/contractor for at least 3 years before authorization of construction, if such construction is within the USFWS North Slope eider survey area and at least 1 year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below.</li> <li>If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with the USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels.</li> <li>To reduce the possibility of spectacled and/or Steller's eiders and other birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to the USFWS when exceptions are authorized: <ol style="list-style-type: none"> <li>Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad;</li> <li>Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or</li> <li>Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.</li> </ol> </li> <li>To reduce the likelihood of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to</li> </ol>		



Alternative B	Alternative C	Alternative D
buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS.		
<p><b>Special Conditions in Yellow-billed Loon Habitats:</b></p> <p>a. Aerial surveys shall be conducted by the lessee/operator/contractor for at least 3 years before authorization of construction of facilities proposed for development which are within 1 mile of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August.</p> <p>b. Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. The default standard mitigation is a 1-mile buffer around all recorded nest sites and a minimum 1,625-foot (500-meter) buffer around the remainder of the shoreline. Development will generally be prohibited within buffers unless no other option exists.</p> <p><b>Protections for Birds</b></p> <p>a. To reduce the possibility of birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases, which are to be few in number and limited in extent. Exceptions are limited to the following situations:</p> <ol style="list-style-type: none"> <li>1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad;</li> <li>2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or</li> <li>3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.</li> </ol> <p>To reduce the likelihood of birds colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS.</p> <p><b>E-12 Required Operating Practice</b></p> <p><b>Objective:</b> Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development.</p> <p><b>Requirement/Standard:</b> An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the authorized officer, before approval of the exact facility location and facility construction.</p> <p><b>E-13 Required Operating Procedure</b></p> <p><b>Objective:</b> Protect cultural and paleontological resources.</p> <p><b>Requirement/Standard:</b> The lessee/operator/contractor shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity, based on a study designed and approved by the authorized officer. Upon finding any potential cultural or paleontological resource, the lessee/operator/contractor shall notify the authorized officer and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer.</p> <p><b>E-14 Required Operating Procedure</b></p> <p><b>Objective:</b> Ensure the passage of fish at stream crossings.</p> <p><b>Requirement/Standard:</b> To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in "Stream Crossing Design Procedure for Fish Streams on the North Slope Coastal Plain" by McDonald et al. (1994), "Fundamentals of Culvert Design for Passage of Weak-Swimming Fish" by Behlke et al. (1991), and other generally accepted best management procedures prescribed by the authorized officer. To adhere to these best management practices, at least 3 years of hydrologic and fish data shall be collected by the lessee/operator/contractor for any proposed crossing of a stream whose structure is designed to occur, wholly or partially, below the stream's ordinary high watermark. These data shall include, but are not limited to, the range of water levels (highest and lowest) at the location of the planned crossing, and the seasonal distribution and composition of fish populations using the stream.</p> <p><b>E-15 Required Operating Procedure</b></p> <p><b>Objective:</b> Prevent or minimize the loss of nesting habitat for cliff nesting raptors.</p> <p><b>Requirement/Standard:</b></p> <p>a. Removal of greater than 100 cubic yards of bedrock outcrops, sand, and/or gravel from cliffs shall be prohibited.</p> <p>Any extraction of sand and/or gravel from an active river or stream channel shall be prohibited unless preceded by a hydrological study that indicates no potential impact by the action to the integrity of the river bluffs.</p> <p>Same as Alternative C.</p> <p><b>E-16 Required Operating Procedure</b></p> <p><b>Objective:</b> Prevent or minimize the loss of raptors due to electrocution by powerlines. <b>Requirement/Standard:</b> Comply with the most up-to-date industry-accepted suggested practices for raptor protection on powerlines. Current accepted standards were published in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" in 2006 by the Avian Power Line Interaction Committee and are updated as needed.</p> <p>Same as Alternative C.</p> <p><b>E-18 Required Operating Procedure</b></p> <p><b>Objective:</b> Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests.</p>		



Alternative B	Alternative C	Alternative D
<p><b>Requirement/Standard:</b> Ground-level activity (by vehicle or on foot) within 200 meters of occupied Steller's and/or spectacled eider nests, from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 meters of occupied Steller's and/or spectacled eider nests will be prohibited. In instances where summer (June 1 through August 15) support/construction activity must occur off existing thoroughfares, USFWS-approved nest surveys must be conducted during mid-June prior to the approval of the activity. Collected data will be used to evaluate whether the action could occur based on employment of a 200-meter buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. The BLM will also work with the USFWS to schedule oil spill response training in riverine, marine, and inter-tidal areas that occurs within 200 meters of shore outside sensitive nesting/brood-rearing periods or conduct nest surveys. The protocol and timing of nest surveys for Steller's and/or spectacled eiders will be determined in cooperation with the USFWS, and must be approved by the USFWS. Surveys should be supervised by biologists who have previous experience with Steller's and/or spectacled eider nest surveys.</p> <p>Same as Alternative C.</p>		
<p><b>E-19 Required Operating Procedure</b></p>		
<p><b>Objective:</b> Provide information to be used in monitoring and assessing wildlife movements during and after construction.</p>		
<p><b>Requirement/Standard:</b> A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features.</p> <p>Ancillary data shall include construction beginning and ending dates.</p> <p>Same as Alternative C.</p>		
<p><b>USE OF AIRCRAFT FOR PERMITTED ACTIVITIES</b></p>		
<p><b>F-1 Required Operating Procedure</b></p>		
<p><b>Objective:</b> Minimize the effects of low-flying aircraft on wildlife, subsistence activities, local communities, and recreational users of the area, including sport hunters and anglers.</p>		
<p><b>Requirement/Standard:</b> The operator shall ensure that aircraft used for permitted oil and gas activities and associated studies maintain altitudes according to the following guidelines (<b>Note:</b> This required operating procedure is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and required operating procedures. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.):</p> <ol style="list-style-type: none"> <li>Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests.</li> <li>Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges.</li> <li>Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by the USFWS and appropriate federal, State, and borough agencies, as well as the Native Village of Kaktovik. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility.</li> <li>Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.</li> <li>Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Porcupine Calving and Post-Calving Area (<b>Maps 2-3K and 2-4K, depending upon alternative</b>) from May 20 through July 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas operators over any identified goose molting area should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices.</li> <li>Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away.</li> <li>Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.</li> <li>Aircraft shall maintain an altitude of at least 1,500 feet AGL for polar bear and grizzly bear.</li> </ol>		
<p><b>OIL AND GAS FIELD ABANDONMENT</b></p>		
<p><b>G-1 Required Operating Procedure</b></p>		
<p><b>Objective:</b> Ensure ongoing and long-term restoration of land to meet the purposes of the Refuge.</p>		
<p><b>Requirement/Standard:</b> Prior to final abandonment, land used for oil and gas infrastructure—including but not limited to well pads, production facilities, access roads, and airstrips—shall be reclaimed to ensure eventual restoration of ecosystem function. The leaseholder shall develop and implement an abandonment and reclamation plan approved by the BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, and habitat condition. The BLM may grant exceptions to satisfy stated environmental or public purposes.</p>		
		<p><b>G-1 Required Operating Procedure</b></p>
		<p><b>Objective:</b> Ensure ongoing and long-term reclamation of land to its previous condition and use.</p>
		<p><b>Requirement/Standard:</b></p>
		<ol style="list-style-type: none"> <li>Oil and gas infrastructure, including gravel pads, roads, airstrips, wells and production facilities, will be removed and the land restored on an ongoing basis, as extraction is complete.</li> <li>Prior to final abandonment, land used for oil and gas infrastructure—including but not limited to well pads, production facilities, access roads, and airstrips—shall be restored to ensure eventual restoration of ecosystem function and meet minimal</li> </ol>



Alternative B	Alternative C	Alternative D
		standards for eligibility of Wilderness designation. The leaseholder shall develop and implement an abandonment and reclamation plan approved by the authorized officer. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, and habitat condition, and Wilderness eligibility. The authorized officer may grant exceptions to satisfy stated environmental or public purposes.
<b>SUBSISTENCE CONSULTATION FOR PERMITTED ACTIVITIES</b>		
<b>H-I Required Operating Procedure</b>		<b>H-I Required Operating Procedure</b>
<b>Objective:</b> Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities.		<b>Objective:</b> Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities.
<b>Requirement/Standard:</b> Operator/permittee shall consult directly with affected communities using the following guidelines:		<b>Requirement/Standard:</b> Operator/permittee shall consult directly with affected communities using the following guidelines:
<p>a. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, the North Slope Borough, and the North Slope and Eastern Interior Subsistence Advisory Panels to discuss the siting, timing and methods of their proposed operations to help discover local traditional and scientific knowledge, resulting in measures that minimize impacts to subsistence uses. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the authorized officer shall consult with the directly involved parties and determine which activities will occur, including the timeframes.</p> <p>b. The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to the North Slope and Eastern Interior Subsistence Advisory Panels for review and comment. The applicant must allow time for the BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it.</p> <p>c. A plan shall be developed that shows how the activity, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan will also describe the methods used to monitor the effects of the activity on subsistence use. The plan shall be submitted to the authorized officer as part of the plan of operations. The plan should address the following items:</p> <ul style="list-style-type: none"> <li>• A detailed description of the activity(ies) to take place (including the use of aircraft).</li> <li>• A description of how the operator/permittee will minimize and/or deal with any potential impacts identified by the authorized officer during the consultation process.</li> <li>• A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community.</li> <li>• Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc.</li> <li>• Procedures necessary to facilitate access by subsistence users to conduct their activities.</li> <li>• Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters.</li> <li>• All vessels over 50 ft. in length engaged in operations requiring a BLM permit must have an Automatic Identification System (AIS) transponder system on the vessel.</li> </ul> <p>d. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the authorized officer and North Slope and Eastern Interior Subsistence Advisory Panels.</p> <p>e. Permittees that propose barging facilities, equipment, supplies, or other materials to the Coastal Plain in support of oil and gas activities in the Coastal Plain shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and the North Slope Borough to minimize impacts from the proposed barging on subsistence whaling activities.</p>		<p>a. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, including the Native Village of Kaktovik, the North Slope Borough, and the North Slope and Eastern Interior Subsistence Advisory Councils to discuss the siting, timing and methods of their proposed operations to help discover local traditional and scientific knowledge, resulting in measures that minimize impacts to subsistence uses. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the authorized officer shall consult with the directly involved parties and determine which activities will occur, including the timeframes.</p> <p>b. The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to the North Slope and Eastern Interior Subsistence Advisory Panel for review and comment. The applicant must allow time for the BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it.</p> <p>c. A plan shall be developed that shows how the activity, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan will also describe the methods used to monitor the effects of the activity on subsistence use. The plan shall be submitted to the authorized officer and the USFWS as part of the plan of operations. The plan should address the following items:</p> <ul style="list-style-type: none"> <li>• A detailed description of the activity(ies) to take place (including the use of aircraft).</li> <li>• A description of how the operator/permittee will minimize and/or deal with any potential impacts identified by the authorized officer during the consultation process.</li> <li>• A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community.</li> <li>• Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc.</li> </ul>



Alternative B	Alternative C	Alternative D
		<ul style="list-style-type: none"> <li>• Procedures necessary to facilitate access by subsistence users to conduct their activities.</li> <li>• Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters.</li> <li>• All vessels over 50 ft. in length engaged in operations requiring a BLM permit must have an Automatic Identification System (AIS) transponder system on the vessel.</li> </ul> <p>d. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the authorized officer and North Slope and Eastern Interior Subsistence Advisory Panels.</p> <p>Permittees that propose barging facilities, equipment, supplies, or other materials to the Coastal Plain in support of oil and gas activities in the Coastal Plain shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and the North Slope Borough to minimize impacts from the proposed barging on subsistence whaling activities.</p>
<b>Required Operating Procedure</b>		
<u>Objective:</u> Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration.		
<u>Requirement/Standard:</u> In addition to the consultation process described in Required Operating Procedure H-1 for permitted activities, before activity to conduct geophysical (seismic) exploration commences, applicants shall notify the local search and rescue organizations of proposed seismic survey locations for that operational season. For the purpose of this standard, a potentially affected cabin/campsite is defined as any camp or campsite used for subsistence purposes and located within the boundary of the area subject to proposed geophysical exploration and/or within 1 mile of actual or planned travel routes used to supply the seismic operations while it is in operation.		
a. Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify all potentially affected subsistence-use cabin and campsite users.		
b. The official recognized list of subsistence-use cabin and campsite users is the North Slope Borough's most current inventory of cabins and campsites, which have been identified by the subsistence users' names.		
c. A copy of the notification letter, a map of the proposed exploration area, and the list of potentially affected users shall also be provided to the office of the appropriate Native Tribal government.		
d. The authorized officer will prohibit seismic work within 1 mile of any known subsistence-use cabin or campsite unless an alternate agreement between the cabin/campsite owner/user is reached through the consultation process and presented to the authorized officer.		
e. The permittee shall notify the appropriate local search and rescue (e.g., Kaktovik Search and Rescue) of their current operational location within the Coastal Plain on a weekly basis. This notification should include a map indicating the current extent of surface use and occupation, as well as areas previously used/occupied during the course of the operation in progress. The purpose of this notification is to allow hunters up-to-date information regarding where seismic exploration is occurring, and has occurred, so that they can plan their hunting trips and access routes accordingly. Identification of the appropriate search and rescue offices to be contacted can be obtained from the coordinator of the North Slope and Eastern Interior Subsistence Advisory Panels in the BLM's Arctic Field Office.		
<b>H-3 Required Operating Procedure</b>		
<u>Objective:</u> Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals.		
<u>Requirement/Standard:</u> Hunting and trapping by lessees/operators/contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Kaktovik, Utqagvik, or Deadhorse). Use of operator/permittee facilities, equipment, or transport for personnel access or aid in hunting and trapping is prohibited.		
<b>ORIENTATION PROGRAMS ASSOCIATED WITH PERMITTED ACTIVITIES</b>		
<b>I-1 Required Operating Procedure</b>		<b>I-1 Required Operating Procedure</b>
<u>Objective:</u> Minimize cultural and resource conflicts.		<u>Objective:</u> Minimize cultural and resource conflicts.
<u>Requirement/Standard:</u> All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, required operating procedures, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The operator shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer for review and approval and should:		<u>Requirement/Standard:</u> All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, required operating procedures, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The operator shall ensure that all personnel involved in permitted activities shall attend an orientation program at
a. provide sufficient detail to notify personnel of applicable stipulations and required operating procedures as well as inform individuals working on the project of specific		



Alternative B	Alternative C	Alternative D
<p>types of environmental, social, traditional, and cultural concerns that relate to the region.</p> <p>b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species.</p> <p>c. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating.</p> <p>d. Include information concerning avoidance of conflicts with subsistence and pertinent mitigation.</p> <p>e. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities.</p> <p>f. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site.</p> <p>g. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee.</p> <p>h. Include a module discussing bear interaction plans to minimize conflicts between bears and humans.</p> <p>i. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel.</p> <p>j. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment.</p> <p>k. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment.</p>		<p>least once a year. The proposed orientation program shall be submitted to the authorized officer and the Native Village of Kaktovik for review and approval and should:</p> <p>a. provide sufficient detail to notify personnel of applicable stipulations and required operating procedures as well as inform individuals working on the project of specific types of environmental, social, traditional, and cultural concerns that relate to the region.</p> <p>b. Address the importance of not disturbing archaeological and biological resources and habitats, including threatened, endangered, and sensitive species, fisheries, migratory birds, and marine mammals, and provide guidance on how to avoid disturbance. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species.</p> <p>c. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating.</p> <p>d. Include information concerning avoidance of conflicts with subsistence and pertinent mitigation.</p> <p>e. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near Kaktovik's barrier islands and lagoon waters.</p> <p>f. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site.</p> <p>g. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee.</p> <p>h. Include a module discussing bear interaction plans to minimize conflicts between polar and grizzly bears and humans.</p> <p>i. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel.</p> <p>j. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment.</p> <p>Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment.</p>
<b>ENDANGERED SPECIES ACT SECTION 7 CONSULTATION</b>		
<p><b>Lease Notice.</b> The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity that is likely to adversely affect a proposed or listed endangered species, threatened species, or critical habitat. The BLM will not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.</p>		
<b>SUMMER VEHICLE TUNDRA ACCESS</b>		
<p><b>L-1 Required Operating Procedure</b></p> <p><b>Objective:</b> Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities.</p> <p><b>Requirement/Standard:</b> On a case-by-case basis, the authorized officer, in consultation with the USFWS, may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Required Operating Procedure C-2a. Permission for such use would only be granted after an applicant has:</p> <p>a. Submitted studies satisfactory to the authorized officer and the USFWS of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used.</p>		<p><b>L-1 Required Operating Procedure</b></p> <p><b>Objective:</b> Prevent erosion; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities.</p> <p><b>Requirement/Standard:</b> On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than</p>



Alternative B	Alternative C	Alternative D
<p>These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.</p> <p>b. Submitted surveys satisfactory to the authorized officer and the USFWS of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer.</p> <p>c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's and the USFWS's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.</p>		<p>those identified in Required Operating Procedure C-2a. Permission for such use would only be granted after an applicant has:</p> <p>a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.</p> <p>b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer.</p> <p>c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.</p>
<b>GENERAL WILDLIFE AND HABITAT PROTECTION</b>		
<b>M-1 Required Operating Procedure</b>		
<u>Objective:</u> Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the Coastal Plain.		
<u>Requirement/Standard:</u> Chasing wildlife with ground vehicles is prohibited. Particular attention will be given to avoid disturbing caribou.		
<b>M-2 Required Operating Procedure</b>		
<u>Objective:</u> Prevent the introduction, or spread, of non-native, invasive plant species in the Coastal Plain.		
<u>Requirement/Standard:</u> Certify that all equipment and vehicles (intended for use either off or on roads) are weed-free prior to transporting them into the Coastal Plain. Monitor annually along roads for non-native invasive species, and initiate effective weed control measures upon evidence of their introduction. Prior to operations in the Coastal Plain, submit a plan for the BLM's approval, detailing the methods for cleaning equipment and vehicles, monitoring for weeds and weed control.		
<b>M-3 Required Operating Procedure</b>		
<u>Objective:</u> Minimize loss of populations of, and habitat for, plant species designated as Sensitive by the BLM in Alaska.		
<u>Requirement/Standard:</u> If a development is proposed in an area that provides potential habitat for a BLM Sensitive Plant Species, the development proponent would conduct surveys at appropriate times of the summer season and in appropriate habitats for the Sensitive Plant Species that might occur there. The results of these surveys will be submitted to the BLM with the application for development.		
<b>M-4 Required Operating Procedure</b>		
<u>Objective:</u> Minimize loss of individuals of, and habitat for, mammalian species designated as Sensitive by the BLM in Alaska.		
<u>Requirement/Standard:</u> If a development is proposed in an area that provides potential habitat for the Alaska tiny shrew, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats in an effort to detect the presence of the shrew. The results of these surveys will be submitted to BLM with the application for development.		



**To:** Matthew Sturm[msturm1@alaska.edu]  
**Cc:** Paul Leonard[paul\_leonard@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-08-09T19:37:16-04:00  
**Importance:** Normal  
**Subject:** DRAFT snow depth ROPs  
**Received:** 2018-08-09T19:37:31-04:00  
[DRAFT snow ROPS for 1002.docx](#)

Hi Matthew,

Thank you for your continued advice on how we might work with BLM and industry to ensure seismic operations can get out when there is sufficient snow to protect the tundra. Attached are the draft ROPs in the internal draft of the DraftEIS (getting it ready for public review) that we are reviewing for how snow depth/tundra opening will be established. I hope that Melissa Head will also be reviewing these for the State as another cooperating agency. The column on the left (Alt B and C) reflects the language for NPRA. The column on the right, Alt D, reflects what I attempted to create from our previous emails and conversations. I have until next Tuesday COB to refine them in our comments back to BLM.

I welcome your comments and feedback.

Thank you!  
Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.277.2942 (mobile)



<p><b>Required Operating Procedure 12</b></p> <p><u>Objective:</u> Protect stream banks, minimize soils compaction and the breakage, abrasion, compaction, or displacement of vegetation.</p>	<p>activities and before initiating activities.</p> <p><b>Required Operating Procedure 12</b></p> <p><u>Objective:</u> Protect stream banks and minimize soil compaction and the breakage, abrasion, compaction, or displacement of vegetation.</p>
---	---

Alternative B	Alternative C	Alternative D																								
<p><u>Requirement/Standard:</u></p> <p>a. Ground operations would be allowed only when frost and snow cover are at sufficient depths to protect the tundra. Ground operations would cease when the spring snowmelt begins (approximately May 5 in the foothills, where elevations reach or exceed 500 feet and approximately May 15 in the northern coastal areas). The exact dates would be determined by the BLM Authorized Officer.</p> <p>b. Low-ground-pressure vehicles would be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra by shearing, scraping, or excessively compacting the tundra mat. <b>Note:</b> This provision does not include the use of heavy equipment, such as front-end loaders and similar equipment required during ice road construction.</p> <p>c. Bulldozing tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines, or camps, clearing drifted snow is allowed to the extent that the tundra mat is not disturbed.</p> <p>d. To reduce the possibility of ruts, vehicle operators would avoid using the same trails for multiple trips, unless necessitated by serious safety or superseding environmental concern, as approved by the BLM Authorized Officer. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles, such as Rolligons.</p> <p>e. The location of ice roads would be designed and located to minimize soil compaction and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.</p>	<p><u>Requirement/Standard:</u></p> <p>a. Ground operations would be allowed only when frost depth is at sufficient depths and snow cover is at sufficient depths and density to protect the tundra, as determined by the BLM Authorized Officer. Soils would be frozen to at least 23° Fahrenheit to at least 1 foot below the lowest surface height (e.g., intertussock space). Snow depth and snow density would amount to no less than a Snow Water Equivalent of 3 inches over the highest tussock. Ground operations would cease when snow depth and density no longer meet criteria. Snow depth and density would reflect the time of the planned operation.</p> <table><tr><th colspan="2">Snow Depth times Density to achieve Snow Water Equivalent of 3 Inches</th></tr><tr><th>Snow Specific Gravity</th><th>Needed Snow Depth (Inches)</th></tr><tr><td>0.05</td><td>60</td></tr><tr><td>0.1</td><td>30</td></tr><tr><td>0.15</td><td>20</td></tr><tr><td>0.2</td><td>15</td></tr><tr><td>0.25</td><td>12</td></tr><tr><td>0.3</td><td>10</td></tr><tr><td>0.35</td><td>9</td></tr><tr><td>0.4</td><td>8</td></tr><tr><td>0.45</td><td>7</td></tr><tr><td>0.5</td><td>6</td></tr></table> <p>b. Low-ground-pressure vehicles would be used for on-the-ground activities off ice roads or pads. The vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra by shearing, scraping, or excessively compacting the tundra mat. <b>Note:</b> This provision does not include the use of heavy equipment, such as front-end loaders and similar equipment required during ice road construction.</p> <p>c. Bulldozing tundra mat and vegetation to create trails or seismic lines is prohibited. Clearing drifted snow is allowed on existing snow trails, snow pads for camps, ice roads, or ice pads, to the extent that the tundra mat is not disturbed.</p> <p>d. To reduce the possibility of ruts, vehicle operators would avoid using the same trails for multiple trips, unless necessitated by serious safety or any superseding environmental concern. This provision does not apply to</p>	Snow Depth times Density to achieve Snow Water Equivalent of 3 Inches		Snow Specific Gravity	Needed Snow Depth (Inches)	0.05	60	0.1	30	0.15	20	0.2	15	0.25	12	0.3	10	0.35	9	0.4	8	0.45	7	0.5	6	<p>hardened snow trails for use by low-ground-pressure vehicles, such as Rolligons.</p> <p>e. The location of ice roads would be designed and located to minimize soil compaction and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.</p> <p>f. To minimizes changes in snow distribution resulting from oil and gas activities that could affect bear denning habitat and water quality and quantity, the use of snow fences would require approval by the BLM Authorized Officer.</p> <p>g. Seismic operations and winter overland travel may be monitored by agency representative, and the operator may be required to accommodate the representative during operations.</p>
Snow Depth times Density to achieve Snow Water Equivalent of 3 Inches																										
Snow Specific Gravity	Needed Snow Depth (Inches)																									
0.05	60																									
0.1	30																									
0.15	20																									
0.2	15																									
0.25	12																									
0.3	10																									
0.35	9																									
0.4	8																									
0.45	7																									
0.5	6																									

#### Alternative D

- hardened snow trails for use by low-ground-pressure vehicles, such as Rolligons.
- e. The location of ice roads would be designed and located to minimize soil compaction and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year.
- f. To minimizes changes in snow distribution resulting from oil and gas activities that could affect bear denning habitat and water quality and quantity, the use of snow fences would require approval by the BLM Authorized Officer.
- g. Seismic operations and winter overland travel may be monitored by agency representative, and the operator may be required to accommodate the representative during operations.



**To:** Wendy Loya[Wendy\_loya@fws.gov]  
**From:** O'Dell, Patrick  
**Sent:** 2018-08-14T17:47:38-04:00  
**Importance:** Normal  
**Subject:** O'Dell Review of Leasing EIS Sections  
**Received:** 2018-08-14T19:32:56-04:00  
[140L6318F0003\\_AdminDrftEIS\\_BLM-agency-cmnts\\_20180808\\_ODell.docx](#)

Hi Wendy,

See attached specific comments for the Section you ID'd for my review. Most are minor, but I've included a challenge to BLM's "interpretation" that surface use related to gravel mining do not count towards the 2000-acre land use limit in the Tax Act.

Generally though, I have an observation that might serve our management of the refuge...

A general premise of the analyses of alternatives is pretty honest and revealing. Basically, there is not enough information to differentiate oil production rates, jobs, public revenue, and direct surface disturbance among any of the action alternatives. It is a very defensible premise, and leads to a very logical conclusion: If all the action alternatives have projections of basically the same oil recovery, jobs, and public revenue, then it follows that avoidance and minimization of adverse environmental consequences and refuge uses must be the drivers for decision-making.

Good luck Wendy...let me know if you have any question of need additional information...

Pat O'Dell  
Petroleum Engineer  
National Wildlife Refuge System  
Division of Natural Resources  
Office: 303-236-4365  
Mobile: 303-667-7359  
[patrick\\_odell@fws.gov](mailto:patrick_odell@fws.gov)



**Administrative Draft EIS, for BLM and Cooperating Agency Review****To BLM and Cooperating Agency Reviewers:**

The **Administrative Review Draft EIS**, is intended for BLM and cooperating agency review. (Please do not distribute.)

- Please complete the MSWord comment matrix (provided at the end of these instructions) by saving this file with a new file name including your last name (for example, name your comment matrix "I40L6318F0003\_AdminDrftEIS\_BLM-agency-cmnts\_20180808\_HayesN.docx"), and then fill out your comments on the document.
- **Return to [wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov) by Tuesday Aug 14<sup>th</sup> COB**

**How to Provide Valuable Feedback****Commenting:**

For each comment, please fill in the following information under the appropriate column heading in the matrix:

- ✓ Page number, line number, or table number on which you are commenting. **The page and line numbers in the PDF file MUST be used.**
- ✓ Your comments:
  - **Your comments must be specific and provide exact changes to the text.** Please be unambiguous, clear, and directive, with exact wording changes stated. Ambiguous comments, such as "What?," "Poor," or "Is this right?," are not helpful and will not be considered.
  - If you have the same comment more than once, do not refer back to a previous comment number. Instead, please copy and paste your comment to a new row in the matrix and provide the specific page number, etc.
  - If you need additional space for comments, click in the table cell where you would like to comment, select the *Table* menu, *Insert*, and either *Rows Above* or *Rows Below*.
- ✓ Reviewers should keep this in mind, and constructive comments should focus on the following:
  - Adequacy of addressing the purpose and need.
  - Missing information, such as tribal, local and state planning documents or other readily-available data.
  - Inconsistencies between stipulations and required operating procedures in the alternatives.
  - Adequate illustrations of the alternatives in the maps.
  - Adequacy and appropriate level of direct, indirect, and cumulative impact analysis. Provide specific changes to improve analysis and note any gaps in logic.
  - Consistency of impact analysis between resource topic areas.



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
1.	App A	Map 3-3	O'Dell/FWS	The map does not include the KIC #1 exploration well.		
2.	3-31	Line 20	O'Dell/FWS	The KIC#1 well is the only well that has been drilled in what is now termed the "Coastal Plain". Suggest changing to "Data from most wells drilled near or in the Coastal Plain are held confidential..."		
3.	E-1	Row 17	O'Dell/FWS	There are definitely known plays. There are no "proven" plays. Suggest changing "known" to "proven".		
4.	3-33	Line 18	O'Dell/FWS	Area 1002 has not been "poorly studied" but studied extensively with low volume and quality of data. Suggest just saying: "Given the uncertainty involved in defining undiscovered resources within the Coastal Plain, attempting to define variances in production by alternative is too speculative to provide value in the analysis."		
5.	E-1	Line 10	O'Dell/FWS	"Reserves" are proven and economically producible, so term is inaccurately used until you get into the RFD assumptions. Change "reserves" to "undiscovered resources"		
6.	E-4	Line 13	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
7.	E-4	Line 16	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
8.	E-5	Line 4		Change "reserves" to "undiscovered resources"		
9.	E-5	Line 21		Change "reserves" to "undiscovered resources"		
10.	E-5	Line 22		Change "reserves" to "undiscovered resources"		
11.	E-5	Line 17		Add at the end: "Drilled in 1986 on village of Kaktovik land, the KIC-1 well is the only well drilled in the Arctic NWR. Data from the well has remained confidential."		
12.	E-8	Table E-3		3D Seismic is projected to take 2 winter seasons (2018/19 & 2019/20). Presumably, the first season would focus on high-potential area of the western part of Coastal Plain. Should the assumption be that 3D will be completed over the highest potential areas?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
13.	E-8	Table E-3		Additional Seismic Exploration on lease blocks. A more reasonable assumption would be that initial 3D is so designed as to enable targeting of specific exploration AND delineation wells – and would be available for sale to lease holders. Suggest re-evaluation of this progression. (Now noting the description doesn't include a second round of 3D seismic. Should probably be removed from the table.)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
14.	E-17	Lines 1-3		<p>Suggest that BLM provides justification rather than just a statement of its interpretation that gravel borrow pits are not a support facility under the Tax Cuts and Jobs Act of 2017. The interpretation seems arbitrary and contrary to the common definition of "facility" and inconsistent with seawater treatment plants and barge landing areas being considered as facilities. Note that gravel borrow pits are anticipated to occur on Federal land on the Coastal Plain adjacent to projected roads and pads (E-16, line 26-28), and are solely for the purpose of oil development.</p> <p>Note also, the impacts analyses of Chapter 3 consistently describe and quantify the impacts of gravel mining, but then provide an unexplained statement that gravel extraction does not apply to the 2000-acre land use restriction in the Tax Act.</p> <p>Finally, note the departure of BLM's interpretation in Arctic NWR's oil and gas program under the Tax Cuts and Jobs Act of 2017 from its own inclusion of gravel borrow pits as part of the "oil development complex" in the NPR-A Integrated Activity Plan/EIS. (See example Vol2_NPR-A_Final_IAP_FEIS, Table 4-3)</p> <p>Suggested change to text: Remove lines 1-3. Add projected acres of disturbance from gravel pits to Table E-4. Remove all text in other areas of the EIS that state gravel pits are not included in the 2000-acre land use limitation of the Tax Act.</p>		
15.	E-12	Line 19		Replace "per acre" with "per mile"		
16.						
17.						
18.						
19.						
20.						

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**To:** Drew Crane[drew\_crane@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-08-16T19:03:05-04:00  
**Importance:** Normal  
**Subject:** Add Mitch's comments into MAC\_wendy up to 303  
**Received:** 2018-08-16T19:03:35-04:00  
[140L6318F0003\\_AdminDrftEIS\\_BLM-agency-cmmts\\_201815\\_0500\\_FWScombined MAC\\_wendy.docx](#)  
[140L6318F0003\\_AdminDrftEIS\\_BLM-agency-cmmts\\_201815\\_0500\\_FWScombined\\_MRE and SLOR.docx](#)

Thank you!

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.227.2942 (mobile)



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
1.	General comment		Crane/FWS	The DEIS does not fully analyze nor distinguish how the various alternatives affect the other four purposes of the refuge. Recommend incorporating this analysis into the affected environment section as appropriate or clarify what the assumptions may be regarding each alternatives impact is on the other four refuge purposes.		
2.	General comment		Loya/FWS	The DEIS does not consistently analyze nor distinguish how the various alternatives affect individual resources of the refuge. We recommend that BLM provide more specific guidance to the chapter authors on how to incorporate the Reasonably Foreseeable Development Scenario and the Approach to Environmental Analyses (Appendix M) assumptions into the Chapter 3 Environmental Consequences analyses.		
3.	General comment		Loya/FWS	Splitting Alternative D into two alternatives (D1 and D2) is confusing and we recommend that Alternative D1 be eliminated. The primary difference is related to the elements of Stipulation 6 related to timing limitations of activity when caribou use the coastal plain, which are consistent, but less restrictive, than those required under the NPRA Integrated Activity Plan. Alternative D2 allows for the Authorized Officer to waive timing restrictions if caribou are not present in significant numbers (10% of the population) during calving and insect relief periods. If development proceeds in the high resource potential area and in a manner similar to NPRA, with one major construction project occurring at a time, it would be highly likely that timing restrictions could be waived. Recommend rewording Alternative D Stipulation 6 to highlight this flexibility when warranted.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
4.	General comment		Loya/FWS	We recommend including information referred to in other NEPA documents in the appendices, especially in the case of referring to another Draft EIS (e.g. GMT2), that may change in the Record of Decision. It is not clear what information readers are supposed to consider when the referral to other documents does not include chapter or page numbers.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

5.	General comment		Kaye/FWS	<p>The current Comprehensive Conservation Plan for the Arctic National Wildlife Refuge enacts minimal management prescriptions for the coastal plain and includes a recommendation for designating the area as Wilderness. Thus, we believe the DEIS should more thoroughly address how the addition of the oil and gas purpose to the Arctic National Wildlife Refuge coastal plain will affect wilderness values and characteristics. Further, wilderness provides the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists. A more complete description in the baseline conditions of all resources under Alternative A related to the wilderness context will further elucidate the impacts of the action alternatives.</p> <p>Recommend include a preface to the document, or to Wilderness section in Chapter 3.4.7, that states:</p> <p>A Note about Wilderness and Wilderness Terminology</p> <p>The Arctic Refuge was first proposed as "The Last Great Wilderness," and wilderness is an original (1960 PLO 2214) and continuing purpose of the coastal plain, which is officially recommended for Wilderness designation. As well, wilderness provides the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists. Given the significance of wilderness in Arctic Refuge issues, it is important to address confusion regarding use of the term. Wilderness can refer to characteristics, qualities, or values held by the entire Refuge, including the coastal plain, or just to areas designated as Wilderness such as the areas south and east of the 1002 area. To clarify, this document uses the non-capitalized word <i>wilderness</i> when describing wilderness-associated</p>		
----	-----------------	--	----------	--	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
				characteristics, qualities and special values (USFWS 2015) of the coastal plain, including the qualities referenced in ANILCA section 101(b) ("wilderness resource values") and Section 304(g) ("wilderness value"). It uses capitalized <i>Wilderness</i> when referring to effects upon the adjacent designated Wilderness areas and to post-development reclamation of the coastal plain to a level where it is again qualified for Wilderness designation.		
6.	General comment		Crane/FWS	Throughout the document there are references to the construction of ice roads and ice bridges to facilitate development similar to NPRA. However, the EIS also describes how the vast majority of lakes in the program area freeze solid and only contain a small volume of unfrozen water. The analysis of the various alternatives does not fully account for what will likely be a lack of sufficient fresh water resources for development needs and what that means for other resources (e.g. gravel mining and surface disturbance). Recommend reconciling the water needs of the RFDS with what water supplies will actually be in the program area.		
7.	General comment		Crane/FWS	Throughout the document, readers are directed to reference documents for additional analysis of impacts. Many of these documents are for impacts associated with development in NPRA. Given the significant difference in terrain and landscape of the program area when compared to NPRA, the affected environment of NPRA is in many cases not comparable to the program area. Recommend providing analysis that reflects the differences between the two areas.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
8.	General Comment		Crane/FWS	The EIS does not really address the forthcoming area wide seismic project currently being reviewed by BLM, despite being included in the list of actions in the Cumulative Impacts section of Appendix M. Recommend addressing the effects of this action either in the baseline or in the cumulative effects sections of each resource as future activities will be additive to the effect of the area wide seismic project.		
9.	General comment		Jorgenson/FWS	Readily available documents that should be cited in the EIS, including all relevant sections of Chapter 3:  National Research Council, 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press.)  Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geocological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.		
10.	General comment		JohnT/FWS	The topography and hydrology on the coastal plain, particularly in the area of high interest are different than that of the NPRA. NPRA scenario and effects will be different and should not be addressed solely by reference to NPRA documents.		
11.	1-1	21	JohnT/FWS	The introduction should include statement of all of the purposes of the Arctic Refuge. Insert ANILCA and PLO 2214 purposes here.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
12.	2-15	LS 9, Alt D, Requirement c.i.	Reed/FWS	Change "...impacts on subsistence uses..." to "...impacts on subsistence and other public uses (because transportation infrastructure would be closed to non-subsistence public users; see Section 3.4.9, Transportation)..."		
13.	2-15	LS 9, Alt D, Requirement c.ii.	Reed/FWS	Change "...impacts on subsistence uses..." to "...impacts on subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
14.	2-16	LS 9, Alt D, Requirement d	Reed/FWS	Change "...on area resources and subsistence uses..." to "...on area resources, and subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)"		
15.	2-17	ROP 2	Swem/FWS	Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made.		
16.	2-17	ROP 2	Putnam/FWS	Recommend the use of bear resistant containers for all waste materials and classes for all Alternatives (not just for Alternative D). Bear resistant containers for all waste materials and classes is the current best practice and will reduce or prevent the majority of human-bear conflict interactions under all Leasing Alternatives.		
17.	2-17, 2-18	ROP 2, 3	Matz/FWS	Under Waste Prevention, Handling, Spills, and Public Safety, ensure that Requirement/Standards match for each ROP. Currently Requirement/Standard for ROP 3 under Alternatives B and C is identical to Requirement/Standard under ROP 2 for Alternative D.		
18.	2-18	2	Matz/FWS	Required Operating Procedure 3 under Alternative D should be duplicated under Alternatives B and C, as the activities described therein are in fact required by law.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
19.	2-19		Burkart, Greta, USFWS	Something similar to NPR-A BMP A-4 should be included. In addition to the A-4 requirements, also include the following: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing <b>150%</b> of the stored volume <b>when considering terrain and weather conditions</b> , 3) "Except during overland moves <b>and seismic operations</b> , fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed <b>210</b> gallons shall be stored within an impermeable lined and diked area or within approved <b>bear-proof</b> alternate storage containers" and 4) <b>All temporary and permanent</b> Fueling Stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		
20.	2-19	ROP 5	Putnam/FWS	The last sentence of the Requirement/Standard states: "The plans would include specific measures identified in the current USFWS Polar Bear Mitigation Plan and would be adapted as needed for grizzly bears." This ROP is good and necessary, but I think the last sentence, as written, may confuse lease holders as to what is required. It isn't clear what the "current USFWS Polar Bear Mitigation Plan" is. The USFWS approved polar bear interaction, or mitigation, plans are developed on an individual basis by and for each project or company. Perhaps this is a reference to the mitigation measures described in the MMPA incidental take regulations? Please cite or clarify what "plan" is intended here. The preceding sentence is good, so perhaps that final sentence is not needed.		
21.	2-2	25	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
22.	2-2	7	JFox/FWS	We can't predict whether or not resource trends will remain the same. Suggest eliminating this part of the sentence.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
23.	2-20	ROP 7, Paragraph b.	FWS – BAWR (Allen and Collins)	Delete "sensitive" from sentence: Class I and Class II area (as identified . . . )		
24.	2-20	ROP 7, Paragraph d.	FWS – BAWR (Allen and Collins)	Add "mercury and other heavy metals" to the end of the sentence: ". . . including greenhouse gases, mercury and other heavy metals and fugitive dust."		
25.	2-21	ROP 7	JFox/FWS	Remove references to Greater Mooses Tooth Unit I and Nuiqsut and replace with Coastal Plain and Kaktovik.		
26.	2-21	ROP 7	JRose/FWS	Appears objective for GMTI was included by accident. If it was included intentionally modifications need to be made to make this relevant to the Refuge communities.		
27.	2-21	ROP 7, Paragraph f.	FWS – BAWR (Allen and Collins)	Replace with: If the air quality analysis shows potential future impacts on National Ambient Air Quality Standards (NAAQS) or Alaska Ambient Air Quality Standards (AAAQS) or impacts above specific levels of concern for Air Quality Related Values (AQRVs), the BLM will require air quality mitigation measures and strategies within its authority and in consultation with local, state, federal and tribal agencies with responsibility for managing air resources in addition to regulatory requirements and proponent committed emission reduction measures and for emission sources not otherwise regulation by the Alaska DEC or EPA."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
28.	2-21	ROP 7, Paragraph e.	FWS – BAWR (Allen and Collins)	FWS BAWR suggests the following language to provide additional clarity and accuracy. Replace paragraph with "For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM Authorized Officer will require air quality analysis for determining the project's direct, indirect, cumulative impacts on air quality. The BLM will evaluate the magnitude of potential air emissions from the project or activity, the durations of the proposed action, the proximity to a federally mandated Class I area and Class II area (as identified by EPA, Alaska DEC or a federal land management agency), location to a population center, location to a nonattainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude or existing development in the area, or other issues identified during the project's NEPA analysis. The BLM will determine the information required for a project-specific air quality analysis by developing a modeling protocol for each air analysis. The BLM will consult and inform the U.S. Fish and Wildlife Service and other appropriate federal, state, or local agencies regarding air quality analysis and analysis decisions to avoid duplication of effort. The air quality analysis will compare predicted impacts on all applicable local, state, and federal air quality standards and increments and impacts on air quality-related values (AQRVs), as well as other scientifically defensible significance thresholds such as incremental cancer risks."		
29.	2-21	ROP 7, Paragraph g.	FWS – BAWR (Allen and Collins)	Replace the beginning of the sentence with: "If ambient air monitoring indicates that project-related emissions cause or contribute to impacts or cause unnecessary or undue degradation of the lands, cause exceedances or NAAQS or AQRVs or fail to protect health. . ."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
30.	2-22	I	Matz/FWS	Add, "including human health or public health tribal, state, or federal agencies" after "appropriate entities."		
31.	2-22	ROP 10	Latty-Swem/FWS	Objective should read "Maintain .... and adequate habitat for fish, birds, and aquatic invertebrates." This change is intended to reflect that shorebirds and some passerines also rely on habitats and soils surrounding lakes and ponds (in addition to waterfowl, which is the only category of birds currently mentioned and associated with these habitats).		
32.	2-22	ROP 8	Carl/FWS	Makes it optional for the BLM Authorized Officer to require changes in operator processes to reduce contamination to subsistence foods ("the BLM Authorized Officer may require changes," emphasis added). This should not be optional, and should state "shall require changes."		
33.	2-23		Carl/FWS	None of the ROPs related to "Winter Overland Moves and Seismic Work" require any protection of winter subsistence activities. This is an oversight that needs to be corrected.		
34.	2-23	ROP 11	JRose/FWS	To meet refuge purposes set forth in ANILCA Requirement/Standard should be the same for all alternatives. Requirement/Standard "e" should be amended to read "... or lake of special concern to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds and terrestrial wildlife." Then requirement/Standard "h" should be removed from Alt D.		
35.	2-23	ROP 11	Swem/FWS	There seems to be an odd glitch in wording that complicates contrasting Alts B+C, item b, with Alt C, item d. They seem to be counterparts, yet were written using different language, presumably unintentionally. If they were intended to be the same, they should have identical wording. If they were intended to be different, the differences should be highlighted, not immersed in other subtle differences in wording that currently obscure the intended differences.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
36.	2-23	ROP 11	Putnam/FWS	Recommend that Requirement/Standard for Alternative D be used for all Alternatives. For polar bears, the standards described in the Alternative D, ROP 11, parts c and d are consistent with what will be required in any MMPA incidental take authorization.		
37.	2-23	ROP 11 for Alt D	R. Wilson/FWS	Requirements/Standard b should include a clause something like, '... by the BLM Authorized Officer and consistent with Incidental Take Regulations and Letters of Authorization issued by the USFWS as part of MMPA regulations' I don't think this issue can be solely addressed by the BLM because it is outside of their authority.		
38.	2-23	ROP 11, Req. a	S. Arthur/FWS	Grizzly bear dens will be identified by USFWS, not AK Dept. of Fish and Game		
39.	2-24	ROP 12	Loya/FWS	Language in b. was found to be confusing by reviewers. Recommended revision of "note" for both alternatives:  b. Low-ground-pressure vehicles would be used for on-the-ground activities off ice roads or pads. Low-ground-pressure vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra by shearing, scraping, or excessively compacting the tundra mat. Note: Heavy equipment required for ice road construction would be allowed and required to be operated in a manner that eliminates direct impacts on the tundra.		
40.	2-24	ROP 12, Alt B & C	Leonard/FWS	I would suggest adding (e): Seismic operations and winter overland travel may be monitored by agency representatives and the operator would be required to accommodate the representatives during operations.		
41.	2-24	ROP 12, Alt B and C	JRose/FWS	Requirement/Standard "a" is nebulous. What are "sufficient depths" and who determines it. Recommend amending first sentence to read "...protect the tundra as determined by the authorizing official."		

**Commented [EM1]:** Should be both USFWS and ADFG. Re-word to state dens will be identified by both or either.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
42.	2-24	ROP 12, Alt D: (a)	Leonard/FWS	Remove 'highest' and replace: 'over the tussock tops'. This will be an interpreted standard and this language will better reflect the intent of the standard. Because snow densification increases throughout the winter the standard will become easier to meet as the winter progresses.		
43.	2-25	Alt D: (g)	Leonard/FWS	Recommended wording change: Seismic operations and winter overland travel may be monitored by agency representatives and the operator is required to accommodate the representatives during operations.		
44.	2-26	ROP 17	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt B and C.		
45.	2-26	ROP 19	Reed/FWS	Use consistent language about recreationists and subtypes. Compare to F I ROP language for "...recreationists of the area, including sport hunters and anglers." Specify transportation infrastructure would be closed to non-subsistence public users.		
46.	2-26	ROP 19	Carl/FWS	Under "Facility Design and Construction," this is the first reference to any requirement to protect subsistence use and access. It should be required throughout the entire process. Giving oil and gas exploration, development and production a superior right regarding uses and take of subsistence resources would be inconsistent with the mandates of Title VIII of ANILCA. As acknowledged in oil and gas development elsewhere on the North Shore, even disturbance of wildlife is a "take."		
47.	2-27	ROP 21 & 22	Reed/FWS	End both <u>objective</u> sentences with "...anadromous fish, protect subsistence use and access to subsistence hunting and fishing, and opportunities for primitive recreationists of the area, including sport hunters and anglers."		
48.	2-27	ROP 23	JRose/FWS	Requirements/Standards for all alternatives should be the same. Regardless of which alternative is selected the Refuge must minimize the impacts to other Refuge purposes by law.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
49.	2-28	ROP 23	JFox/FWS	Incorporate language in Alternative D f. and g. into Alternative C to meet all Refuge purposes.		
50.	2-29	ROP 26	JFox/FWS	Replace Requirement/Standards in Alternative C with those in Alternative D to meet all Refuge purposes.		
51.	2-29	ROP 26	Berendzen/ FWS	Alt B doesn't explain how it would consider the "a. locations outside the active floodplain", relative to item "b". Alternative D is more protective of refuge purposes.		
52.	2-29	ROP 27	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt D. The difference is under 'b.' which prohibits allowing wildlife access to human food or odor-emitting waste. Engaging in conduct that attracts bears to human food and garbage is illegal under 5 AAC 92.230(a)(1). Bears conditioned to human food and food odors would prove fatal for hunters and recreationalists.		
53.	2-29	ROP 27	Swem/FWS	ROP 27: Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made. And, Requirement/Standard b for both Alt B/C and D should include "Feeding of wildlife and allowing wildlife to access human food or odor-emitting waste is prohibited."		
54.	2-3	3	JFox/FWS	Do you mean to say "would" or "could" here? As written, this implies that all stipulations would be permanently exempted, exempted on a one-time basis, or changed.		

Deleted: Consider i

Deleted: ating

Deleted: Consider r

Deleted: ing

Commented [EM2]: Stronger language needed here I think, so I edited.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
55.	2-30	ROP E-11	Swem/FWS	<p>ROP E-11: Knowledge of spectacled eiders, Steller's eiders, and yellow-billed loons in the ARCP is inadequate. Standardized aerial surveys using a stratified sampling approach have been conducted from 1997 until the present but the survey sample fraction (surveyed area/total area in ARCP) has been &lt; 0.5% in all years except 2018 (3.2%) so observations are few and drawing inference regarding distribution, actual abundance, or breeding effort and success in the ARCP is probably not possible (although efforts to compile and appropriately interpret the available information are ongoing).</p> <p>At this point, given the preliminary and incomplete status of reviewing the available information on those three species, and the considerable range in the Alternatives and their potential effects, we suggest leaving ROP E-11 in place. Additionally, Alternative B contains reliance on site-specific surveys at the time of development to inform decisions by the AO regarding application of ROPs and design features as conditions of approval.</p>		
56.	2-31	ROP E-12	Swem/FWS	Was this accidentally called a "Required Operating Practice" rather than a "Procedure?"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
57.	2-31	ROP E-14	Randy Brown/FWS	: The Requirement standard for fish passage at stream crossings in ROP 24 (b) (p. 2-28) is the recommended guidance; however, E-14 ROP provides requires different guidance adhered to for fish passage (Behlke et al 1991). Recommend the FWS 2018 Fish Passage Design Guidelines be the standard guidance applied to all ROPs. Change to: To ensure that crossings provide for fish passage, all proposed crossing designs would adhere to the best management practices outlined in Fish Passage Design Guidelines, developed by the USFWS Alaska Fish Passage Program (June 29, 2018), Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (US Forest Service and other generally accepted best management procedures prescribed by the BLM Authorized Officer and the USFWS.		
58.	2-32	ROP E-15	Swem/FWS	Cliff-nesting raptors are so scarce in the ARCP that this measure may not be needed. Depending on its implications to industry, as well as the potential implications to other resources where gravel extraction would be re-directed in order to comply with this ROP, the ROP could be counterproductive. Possibly this ROP could be targeted to the limited specific areas where it might provide benefits or could maybe be eliminated altogether.		
59.	2-32	ROP E-17	Swem/FWS	The dates for restrictions associated with this ROP can be changed to June 1 through July 31 to reflect FWS efforts to ensure consistency in the restrictions and better reflect improved information on hatching dates across the North Slope. (This change will relax the requirement/standard).		
60.	2-33	F-I Req/Std d	Reed/FWS	End sentence with "...moose hunting) and when recreationists are present."		

**Commented [EM3]:** I see his point and don't feel too strongly about this one, but should we keep this in to protect river bluffs/bank habitats?

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
61.	2-33	ROP F-I	Reed/FWS	Throughout: use consistent language about recreationists and subtypes throughout Stips/ROPS Requirements and Standards or specify why not consistent.		
62.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part f states that "hazing wildlife by aircraft is prohibited." The use of helicopters to haze polar bears is an approved method of hazing polar bears under certain circumstances and with appropriate training and MMPA authorization. Recommend adding something like "...unless otherwise authorized..." or something like that, to allow for the use of this method.		
63.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part g. Recommend adding "and 0.5 miles horizontal distance" after "1,500 AGL feet". This is what will be required in MMPA incidental take authorizations.		
64.	2-34	ROP G-I	Berendzen/ FWS	Alternatives B & C are inadequate for meeting refuge purposes – the standards in Alt D are more protective. All Alternatives should ensure that reclamation result in Wilderness eligibility.		
65.	2-34	ROP G-I	JRose/FWS	The Presidential Recommendation for Designation as Wilderness still stands. Suggest amending Requirement/Standard to read "...restoration of ecosystem function and meet minimal standards for eligibility of Wilderness designation.		
66.	2-34	ROP G-I	JRose/FWS	In Alternative D Wilderness should be capitalized		
67.	2-34	ROP G-I Req/Std b	Reed/FWS	Change "...habitat condition, and wilderness eligibility." to "...habitat condition, wild and scenic river eligibility/suitability, and wilderness eligibility."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
68.	2-34	ROP H-I	Carl/FWS	Under H-I Required Operating Procedures, Requirement/Standard (a), for all alternatives, it references "North Slope and Eastern Interior Subsistence Advisory Panels" or "North Slope and Eastern Interior Subsistence Advisory Councils." I am not aware of such entities. The only "subsistence advisory panel" I am familiar with is the NPR-A Subsistence Advisory Panel. If this is referring to the FACA-charted Federal Subsistence Regional Advisory Councils created under Section 805 of ANILCA, the correct names are "North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils." And, specifically for the Alternative D ROP, the only legally appropriate way to "coordinate with" these Councils is through their publicly-noticed meetings. These meetings are held in February-March and August-November. As such, the timing of such coordination must take into account those schedules.		
69.	2-35	H-I	Carl/FWS	Under H-I Required Operating Procedures, Requirement/Standard (b), for all alternatives, it references "North Slope and Eastern Interior Subsistence Advisory Panels." I am not aware of such entities. The only "subsistence advisory panel" I am familiar with is the NPR-A Subsistence Advisory Panel. If this is referring to the FACA-charted Federal Subsistence Regional Advisory Councils created under Section 805 of ANILCA, the correct names are "North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils." And, specifically for the Alternative D ROP, the only legally appropriate way for these Councils to "review and comment" on any proposed plan of operations is through their publicly-noticed meetings. These meetings are held in February-March and August-November. As such, the timing of such solicitation for input must take into account those schedules.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
70.	2-36	H-2	Carl/FWS	For the H-2 Required Operating Procedures, the Objective notes: "Prevent unreasonable conflicts ..." How is "unreasonable" defined, and from whose perspective. Most certainly, a subsistence user will have a very different understanding of "unreasonable" than an oil and gas service company.		
71.	2-36	H-2	Carl/FWS	Under H-2 Required Operating Procedures, Requirement/Standard (e), for all alternatives, it references "North Slope and Eastern Interior Subsistence Advisory Panels." I am not aware of such entities. The only "subsistence advisory panel" I am familiar with is the NPR-A Subsistence Advisory Panel. If this is referring to the FACA-charted Federal Subsistence Regional Advisory Councils created under Section 805 of ANILCA, the correct names are "North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils." Additionally, those Federal Subsistence Regional Advisory Councils are not coordinated by the BLM Arctic Field Office. They are administered by the Office of Subsistence Management, at the USFWS Regional Office in Anchorage.		
72.	2-37	H-3	Carl/FWS	For the H-3 Required Operating Procedures, Requirement/Standard, it notes that "Hunting and trapping by lessees/operators/contractors are prohibited when persons are on work status." It must be noted that only residents (as defined by 50 C.F.R. §100.4) may hunt or trap under federal subsistence regulations. It is unlikely that any of the lessees/operators/contractors would qualify as federally-qualified subsistence users, and thus would be prohibited by law at any time in engaging in any activities only authorized for such users.		
73.	2-37	H-3 ROP	Putnam/FWS	This Requirement/Standard is good, appropriate, and necessary. Recommend keeping this for all Alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
74.	2-39	General Wildlife Protection	Latty-Swem/FWS	<p>The number of helicopter take-offs and landings that may occur associated with permitted activities in the program area may be substantial, but is currently not addressed. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates from the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different sites. Depending on the type of activity and it's duration associated with these take-offs and landings, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information)</p> <p>Because the number of potential take-offs and landings at unimproved sites during summer is large and may affect the productivity of breeding birds, please consider adding a Required Operating Procedure to minimize negative impacts to productivity.</p> <p>For example, please consider adding a ROP with an Objective to minimize the disturbance to breeding birds on the Coastal Plain, and a Requirement/Standard that includes a timing restriction on aircraft take-offs and landings at unimproved sites to avoid the nesting season except when doing so would impact the purpose of the approved project.</p>		
75.	2-39	ROP M-2		Invasive Species add additional ROP to address rodent introduction from barge traffic.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
76.	2-39	ROP M-3	Carl/FWS	For the M-3 Required Operating Procedures, the Objective notes: "Minimize loss of populations and habitat for plant species designated as sensitive by the BLM in Alaska." <del>We recommend keeping the responsibility of designating sensitive plant species for these purposes to the U.S. Fish and Wildlife Service.</del>		
77.	2-4	Table 2-2 LS 1	JohnT/FWS	Terminology: active flood plain, bank, and ordinary high water mark are used interchangeably. This comment may apply throughout the document.		
78.	2-4	Table 2-2 and throughout document	Reed/FWS	Change spelling from Aichilak to Aichilik throughout document		
79.	2-5	LS 2	Loya/FWS	Lakes are a unique habitat within the Arctic Refuge given their scarcity, especially in comparison to NPRA. Thus, lakes may serve as irreplaceable habitat for avian and aquatic species, especially in the biological productive area around the Canning River. Requiring a 0.5 mi buffer is a common BMP in the NPRA IAP for protecting wildlife and habitat. This includes the minimum river setbacks (K-1); Brant nests (K4b); caribou approaching a road crossing (K5a, K12); Grizzly bear dens (C-1) and Raptor nests (C-2, F-1). Therefore, we recommend that the LS 2 for Alt D- Canning River Delta and Lakes be applied across all alternatives.		
80.	2-5	LS 2	Carl/FWS	Notes objective to "protect and minimize ... the loss of cultural and paleontological resources." Do applicable laws allow for the destruction of such resources? How will this objective be legally met if the existing resources have not been adequately catalogued, which has been acknowledged in agency scoping meetings?		

**Deleted:** The Tax Act did not delegate authority to BLM to designate plant species as "sensitive" within the Arctic National Wildlife Refuge. That

**Deleted:** is solely within the purview of

**Commented [EM4]:** Concerned about the tone of this comment, but agree with it. Made edits.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
81.	2-5	LS 3	Loya/FWS	<p>Springs and aufeis create unique habitats within the Arctic Refuge in both summer and winter. Therefore, we recommend that the LS 3 for Alt D Springs/Aufeis requiring studies be included under all alternatives. Recommend adding to Alt B and C:</p> <p>Objective: Protect the water quality, quantity, and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the Coastal Plain. River systems with springs provide year-round habitat and host the most diverse and largest populations of fish, aquatic invertebrates, and wildlife; they are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs. It helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could be disturbed by drilling or fracking, use buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.</p> <p>Requirement/Standard: a. Before drilling, the lessee/operator/permittee would conduct studies in areas containing springs to ensure subsequent drilling activities would not disrupt flow of the perennial springs, unless such studies have already been completed. Study plans would be developed in consultation with the BLM and USFWS and other agencies, as appropriate.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

82.	2-6	LS 3	Loya/FWS	<p>It was not the intent of LS 3b. to restrict leasing or have NSO below springs. The language in the DEIS suggests these restriction by the use of "Within 3 miles of or above ...." We recommend revising to state:</p> <p>i. No leasing and no new non-subsistence infrastructure will be permitted within 3 miles adjacent to or above Sadlerochit Spring (04N031E) nor within a 1 mile buffer below the spring to where it enters the Saddlerochit river and along the aufeis formation (04N031E &amp; 05N031E). This spring supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.</p> <p>ii. No leasing will be permitted within 3 miles adjacent to or above the perennial spring at Fish Hole 1 on the Hulahula River (05N032E). Further, no new non-subsistence infrastructure within 4 miles of the perennial spring at Fish Hole 1 on the Hulahula River (05N032E) per LS 1, nor within 1 mile of the aufeis field (05N032E &amp; 06N032E). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.</p> <p>iii. No leasing will be permitted within 3 miles adjacent to or above the perennial Tamayariak Spring, and no new non-subsistence infrastructure will be permitted within 1 mile of the associated aufeis field (07N026E).</p> <p>iv. No leasing will be permitted within 3 miles adjacent to or above the perennial Okerokavik Spring (04N036E), and no new non-subsistence infrastructure will be permitted within 1 mile of the associated aufeis field in the Jago River drainage (05N035E &amp; 05N036E).</p>		
-----	-----	------	----------	---	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
83.	2-6	LS 4	Carl/FWS	Lease Stipulation 4 for Alternative B or Alternative C does not acknowledge obligations regarding ESA designated critical habitat for polar bears. In fact, none of the ROPs acknowledge this.		
84.	2-7	First 3-4 lines of Lease stip 7, Requirement/Standard for Alt D	R. Wilson/FWS	This statement '... between May 15 and November 1 or when sea ice is within 10 miles of the coast each season, whichever is later.' should actually be '... between May 15 and November 1 or when sea ice extent (as defined by Fetterer et al. 2017) is beyond 10 miles of the coast each season, whichever is later.' As written, it would imply that when sea ice is right up on shore in December that exploration could not occur. The intent is to say that when ice has retreated from shore, and is beyond a distance that may cause physical distress for bears to swim, activity should cease because bears are likely to be on shore for the summer/autumn. Here is the citation for the sea ice extent data: Fetterer, F., K. Knowles, W. Meier, M. Savoie, and A. K. Windnagel. 2017, updated daily. Sea Ice Index, Version 3. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. doi: <a href="https://doi.org/10.7265/NSK072F8">https://doi.org/10.7265/NSK072F8</a> .		
85.	2-9	LS 6	Loya/FWS	Delete the following sentence at the end of the paragraph on this page last line of the stipulation for Alt D:  The intent of this requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of oilfields in the region.		
86.	3-1	13	Leonard/FWS	Reference to Chapter 4, Cumulative Effects. There is not a Chapter 4. It appears each section in Chapter 3 deals with all the alternatives within each subject. Remove reference to Chapter 4 and clarify reference to Cumulative Effects.		
87.	3-1	25	Leonard/FWS	Reference the 30 yr average as the definition of climate.		
88.	3-1	36	Carl/FWS			

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Deleted:** "Summer" does not last through September on the North Slope. Autumn peaks in mid-August. Additionally, this sentence only recognizes the existence of two seasons – summer and winter. It should reflect the existence of the other two (spring and autumn).



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
89.	3-105	27	R. Wilson/FWS	Not a valid assumption that all grizzly dens would be detected during den surveys. I would omit ", assuming all such dens are located on those surveys" and replace with ", although complete detection of dens is unlikely (Amstrup et al. 2004)."		
90.	3-108	21	S. Arthur/FWS	Revise sentence as: "areas adjacent to the PCH calving grounds contain less high-quality forage and higher predator densities, and exhibit more topographic relief than do the current PCH calving grounds..."		
91.	3-108	3	Crane/FWS	The citation in this line is incorrect (Boulanger et al 2020).		
92.	3-110	26	Matz/FWS	Add this sentence, "Dust generated during creation of and travel on gravel roads may contaminate roadside vegetation, upon which mammals forage."		
93.	3-110	28-31	Loya/FWS	Limited description of seismic activity, but impacts not quantified.		
94.	3-110	37	S. Arthur/FWS	Citation of Wilson et al. (2012) refers to the TCH, not the PCH		
95.	3-111	25	S. Arthur/FWS	Revise as: "defines the time period as the caribou calving season" rather than "when caribou are present". As stated on line 26, caribou are present in this area well past June 15.		
96.	3-111	37	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		
97.	3-112	17-20	R. Wilson/FWS	It is inconsistent to say that seismic won't be able to occur in areas off limits to leasing when it's scheduled to happen this winter, before a record of decision. This text should be modified to say something to the effect of "following area-wide seismic expected to be conducted prior to the implementation of this plan, future seismic would not occur in areas off limits to leasing."		
98.	3-112	19	Loya/FWS	'Southwestern' should be changed to 'southeastern' if referring the calving area		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
99.	3-113	14	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		
100.	3-113	39	S. Arthur/FWS	Delete "activity"		
101.	3-114	1-2	S. Arthur/FWS	Sentence does not make sense. Revise as "Alternative D would also prohibit ...." (beginning on previous page)		
102.	3-114	6	S. Arthur/FWS	Revise "3 mil" as "3 miles"		
103.	3-115	40	S. Arthur/FWS	Revise "documents" as "documented"		
104.	3-116	Table 3.3.5-I	Matz/FWS	Under Potential Effects for "Gravel and Pipeline Infrastructure," add "Contamination of roadside forage due to dust."		
105.	3-117	10	S. Arthur/FWS	Citation should be "Griffith" rather than "Griffiths"		
106.	3-117	13	S. Arthur/FWS	Revise sentence beginning "Additional oil development..." as: "Infrastructure constructed to support development within the program area is likely to facilitate additional oil development west of the program area, which will increase exposure of CAH caribou to development. This could alter their behavior and movements..."		
107.	3-117	Table 3.3.5-I	S. Arthur/FWS	Effect type for Gravel Mine should be "Adverse" rather than "Low"		
108.	3-118	26	Hamilton/FWS	The worldwide population of polar bears should be updated to reflect Regehr et al. Following is copied from IUCN Report - The total number of polar bears worldwide is estimated to be 26,000 (95% CI=22,000–31,000; Regehr et al. 2016)		
109.	3-119	23	Crane/FWS	There are more recent stock assessments for polar bears than 2010. The most recent one is from 2017 and has an estimate of ~ 900 bears. Recommend updating this section.		
110.	3-119	LI-6	R. Wilson/FWS	Need to state that only the SBS stock is being considered for this analysis. Suggest something like the following: "... thus, the program area is in the core activity area of the SBS and the below analyses only consider impacts to the SBS stock"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
111.	3-12	36	FWS – BAWR (Allen and Collins)	Cumulative Impacts Section – The FWS BAWR continues to not recommend a qualitative approach to addressing these air impact concerns. Appropriate time and resources needed to be allocated after the delivery of the Reasonably Foreseeable Development (RFD) documentation for quantitative analysis (project and cumulative level) to be conducted.		
112.	3-12	6	Matz/FWS	Change to: "Collect baseline ambient air data for a time period sufficient to support air quality modeling to analyze direct, indirect, and cumulative impacts (typically, one year) prior to...."		
113.	3-120	11-18	R. Wilson/FWS	If this section is only talking about all polar bears in the US, then also need to include text about the Bilateral Agreement with Russia, the I-I (native-native agreement) between natives in the US and Canada, and a MOU between the US and Canada, signed by the Sec of the Interior. If only referring to the SBS stock, then only the later 2 need to be mentioned. For the first, updated text could be "Polar bears in the Chukchi Sea stock are managed bilaterally with Russia under the Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska—Chukotka Polar Bear Population. The Inupiat-Inuvialuit Agreement is a Native to Native Agreement between the U.S. and Canada for managing the harvest of bears in the SBS stock. It is a voluntary agreement. Finally, the Memorandum of Understanding between Environment Canada and the United States Department of the Interior Concerning the Conservation and Management of Shared Polar Bear Populations enhances the coordination between the U.S. and Canada on the conservation and management of polar bears in the SBS stock."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
114.	3-120	8	Crane/FWS	The existing ITRs for the Beaufort Sea do not cover the program area. Recommend correcting this statement to clarify that new ITRs will need to be developed to address take of polar bears in the program area.		
115.	3-121	12	R. Wilson/FWS	I would change this sentence to read as follows because all age/sex classes are represented on shore: "... besides denning females, adult females with and without cubs, sub adults, and adult males all come ashore."		
116.	3-121, 3-122	39; 1	R. Wilson/FWS	Herreman and Peacock 2013 did not study the Kaktovik Bone pile, or estimate the number of bears using it. It was the bone pile at Point Barrow. They also didn't claim that at least 15% of the SBS used it, but that it could represent 15% of the SBS stock if they all were from the SBS stock, which is unlikely given the large overlap in that area between the CS and SBS stocks. The dissertation by Lillie (2018), however, does provide an estimate of bone pile use in Kaktovik. So, you could include the following text: "As many as 146 (SE=21) bears from the SBS stock were estimated to have used the bone pile in Kaktovik in 2012 based on hair-snare data." Here is the link to the dissertation <a href="https://digitalcommons.usu.edu/etd/7252">https://digitalcommons.usu.edu/etd/7252</a>		
117.	3-123	18-19	R. Wilson/FWS	This citation (Amstrup 2003a) is too outdated to make this statement. Should probably cite Atwood et al. (2016) and statement something like "Up to 37% of adult females have been estimated to use land in the summer, spending an average of 56 days on shore. Given that adult males and sub-adult animals are not able to be collared to track their movements, it's unclear what proportion of those bears use land. However, it is clear that they also use land in the summer and autumn (Miller et al. 2015)"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
118.	3-127	L2-4	R. Wilson/FWS	While it might be true that the amount of critical barrier island habitat present in the 1002 area is only a small proportion available to bears, it does receive a disproportionate amount of use compared to most of the other barrier islands. Thus, the statement is misleading. Add an additional sentence at the end stating that, "Even though the overall proportion of critical barrier island habitat potentially affected is not large in the 1002 area, it does receive a disproportionately high level of use (Wilson et al. 2017) and thus if it were to be affected by program-related activities, it could have a larger impact on bears than indicated based on the proportion of the total amount it represents"		
119.	3-128	32-33	R. Wilson/FWS	It is inaccurate to say that all three alternatives would lead to similar levels of disturbance and displacement. Alt D provides protection for a significant proportion of important denning habitat, which would lead to significantly less potential for disturbance than Alt B, for instance.		
120.	3-13 to 3-14	42& 43 1 & 2	FWS – BAWR (Allen and Collins)	The conclusion that these air impacts are cumulative and are not project is incorrect. Suggested language: "Cumulative visibility impacts and deposition levels for all sources included in the BOEM analysis were above thresholds, and warrant additional quantitative (project and cumulative level) analysis." - Delete the rest of the sentence from "often" to . . . "of all sources."		
121.	3-130	41	Crane/FWS	While the current statement is correct regarding population level effects to polar bears, those analyses were based on activities occurring in NPRA and there being no industrial activity in Arctic National Wildlife refuge, where the habitat is used by a greater proportion of the SBS polar bear population. Recommend clarifying this statement to reflect this detail.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
122.	3-131	26-27	R. Wilson/FWS	It is highly unlikely that the assumption that all dens will be detected by pre-construction den surveys. Under a best-case scenario, where FLIR was used to attempt to detect known dens, Amstrup et al. (2004) only successfully detected 62% of dens after a single FLIR survey. It is likely that this value would be considerably lower when den locations are not previously known. This assumption is not valid.		
123.	3-134	35	Crane/FWS	According to NMFS, past exploration activities have resulted in the death of at least one seal due to a lair being crushed. Recommend coordinating with NMFS for additional details and updating this section as appropriate.		
124.	3-134	4-6	R. Wilson/FWS	It is inaccurate to state that the only type of marine program-related spill that could occur is related to marine vessels. It's my impression that Alternatives B and C would allow for some development on coastal islands or waters. Why wasn't the potential for an underwater pipeline release considered?		
125.	3-136	L	R. Wilson/FWS	Should be changed to '... and as maternal females search for den locations in autumn and leave dens with dependent young in late winter'		
126.	3-14	21-28	Loya/FWS/FWS	It is insufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents and search for information. If DEIS is used, then provide further information such as Chapter and/or page numbers.		
127.	3-140	24	Crane/FWS	There are no current ITRs that cover the program area. Recommend correcting this statement to reflect this detail.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
128.	3-141	30	Crane/FWS	Recommend deleting the sentence that begins "Compared with climate change..." as the effects analysis should not discount nor attempt to justify the adverse effects of the action on natural resources by comparing it to other adverse actions or activities that may occur in the area.		
129.	3-143	10-11	Berendzen/ FWS	Unclear what "Of the remaining surface area, 99 percent (138,700 acres) is water" is referring to? Suggests that it would be lagoon waters, but those inside the refuge are administered by FWS. KIC lands are not 99% water??		
130.	3-143	21	Berendzen/ FWS	Only aware of one airport. Old Air Force runway is no longer used		
131.	3-145	13-15	Berendzen/ FWS	Inaccurate statement - Kaktovik is bordered on south by KIC lands		
132.	3-147	36	LaKonski/ FWS	After the sentence ending with "...a 20-mile tractor trail.", I recommend either adding the following sentence (or add as a footnote): "The RS 2477 trails have been identified and asserted by the State of Alaska, but the validity of all RS 2477 trails must be determined either via a determination of perfection prior to FLPMA or through appropriate judicial proceedings."		
133.	3-153	24	DeCleva/USF WS	Insert "documented" before "cultural resources"		
134.	3-154	6	DeCleva/USF WS	Insert "documented" before "cultural resources"		
135.	3-155	11	Carl/FWS	Change "are transported" to "migrate."		
136.	3-155	12-13	Carl/FWS	The Federal Subsistence Board has legally recognized the customary and traditional uses of Dall sheep and moose for the communities of Point Hope and Anaktuvuk Pass in Unit 26C. See 50 C.F.R. §100.24(a)(1). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of Dall sheep for the communities of Chalkyitsik and Fort Yukon in Unit 26C. See id. The Draft EIS needs to analyze the potential impacts to the communities based on activities in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Commented [EM6]:** tone

**Deleted:** The use of the word "transported" suggests that they are carried through in shipments. This is not accurate.



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
137.	3-155	13	Carl/FWS	In reference to the term "contemporary uses." The correct standard under Title VIII is whether the community has an established customary and traditional use. This should be changed to reflect the correct standard.		
138.	3-156	28	JReam/FWS	It would be helpful to know the actual number of respondents as "all respondents" could indicated a single household.		
139.	3-156	3	JReam/FWS	ANILCA lists one additional element of subsistence that should be included in this line – traditional. It may be inherently part of "cultural" but I would suggest that the sentence be consistent with the legislation.		
140.	3-156	32-33	Carl/FWS	List of terrestrial mammals for residents of Kaktovik should include musk ox. See 50 C.F.R. §100.24(a)(1).		
141.	3-156	33	Carl/FWS			
142.	3-156	4/5	JReam/FWS	I would restructure the sentence a bit and mention explicitly that, concerning the harvest of fish and wildlife, corporation owned land is managed by the State.		
143.	3-156	7	Carl/FWS	This sentence asserts that private lands within the program area are subject to federal subsistence regulations. This is not correct. See 50 C.F.R. §100.4 (definition of "public lands").		
144.	3-157	26/27	JReam/FWS	Define a "core species"		

**Deleted:** Change "grizzly bear" to "brown bear" for correct term used under applicable State and Federal regulations. Make change throughout document.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
145.	3-158	1-2	JReam/FWS	The use of the terms "material" and "cultural" in this sentence and the associated table (J-6) to be awkward. Perhaps "Harvest Contribution (Usable Weigh)" could replace "Material Importance." I do not think it is appropriate to measure "cultural importance" simply by analyzing % of households trying to harvest and those receiving a given resource. Sure, these can be indicators, but what happens when a resource is scarce, regulations hinder harvest attempts, and sharing is minimal due to unforeseen challenges? Suggest changing the reference to something like "Effort and Sharing Indices." Same in each community section. Alternatively, we could qualify "importance" as "nutritional importance."		
146.	3-158	17	JReam/FWS	This should read "for the most recent period [in which information is available]"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
147.	3-162	11	Carl/FWS	Two general comments on this section. First, the analysis does not include communities in Canada that rely on the PCH for customary and traditional uses. The analysis must include those communities in order to "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd by ... in Yukon and Northwest Territories, Native users as defined ..." Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd, Section 2(b)(2). See also id. at Section 3(b) ("The Parties will ensure that the Porcupine Caribou Herd, its habitat and the interests of users of Porcupine Caribou are given effective consideration in evaluating proposed activities within the range of the Herd.") and Section 3(g) ("When evaluating the environmental consequences of a proposed activity, the Parties will consider and analyze potential impacts, including cumulative impacts, to the Porcupine Caribou Herd, its habitat and affected users of Porcupine Caribou."). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of caribou in Unit 26C by the residents of Point Hope, see 50 C.F.R. §100.24(a)(1), who are omitted from this analysis.		
148.	3-163	13-14	Carl/FWS	It is not sufficient to defer analysis because "project details are uncertain or unknown." The locations and types of activities are known well enough, as well as the location and uses of fish and wildlife resources. This, along with known impacts of other similar activities on the North Slope, can inform a more thorough analysis.		
149.	3-163	26	Carl/FWS	This sections should include: (1) destruction of habitat and related impacts to subsistence resources, and (2) deflection of migratory species that are relied upon for subsistence.		
150.	3-163	32	Carl/FWS	What does the label of "short term" mean?		

**Commented [EM8]:** I'm okay with this comment, but wonder if the RD and others will be? We certainly do have some obligations under the IPCB agreement to notify and coordinate with Canada.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
151.	3-163	35	Carl/FWS	Change "have the potential" to "will," as there is enough data to know for certain that impacts will occur. The only uncertainty is the degree of impact.		
152.	3-164	17	Carl/FWS	Change "may result" to "will result," as there is enough data to know for certain that these activities will occur in connection with oil and gas exploration, leasing, development and production.		
153.	3-164	27	Carl/FWS	After reference to traditional knowledge, add that biological science shows that marine mammals are sensitive to such disturbance. That is why CAAs are required for all oil and gas offshore operations during marine mammal migratory seasons.		
154.	3-164	41	Carl/FWS			
155.	3-165	39-40	Carl/FWS	This sentence suggests that there may be times where development may not occur within harvesting areas or during harvesting times. Once the infrastructure is in place in a harvesting area, it will always occur during harvesting times – infrastructure will not be removed on a seasonal basis to accommodate subsistence activities.		
156.	3-166	18-19	Carl/FWS			
157.	3-166	2	JReam/FWS	I would posit that "simply dislike the experience" has a connotation of being "minimal". Perhaps consider "noise pollution and increased human activity may be considered to degrade the subsistence experience."		
158.	3-166	24	Carl/FWS	Change "could pose" to "will pose" – it is the only appropriate phrasing given the rest of that sentence.		
159.	3-166	39-40	Carl/FWS	How many residents of the villages you are analyzing do not have either an ATV or snowmachine? Quantify that in order to justify including this as a benefit.		
160.	3-166	4	Carl/FWS	Change "could include" to "would include." These types of infrastructure are guaranteed with oil and gas operations.		

**Deleted:** Change "could experience a decline" to "would experience a decline." Under no circumstances will the PCH not experience a decline if there is "large scale displacement from PCH calving grounds." Calf survival is crucial to the health of the PCH, or any caribou herd.

**Deleted:** The Tax Act did not authorize the BLM to lease in areas of "medium and low potential for oil and gas development." It only authorizes areas "that have the highest potential for the discovery of hydrocarbons." Title II, Section 20001 (c)(1)(B)(i)(I). So, such development related to medium and low potential should not be "expected," as it is not authorized by law.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
161.	3-167	16	Carl/FWS	The assertion "infrastructure is not expected to divert caribou migration altogether" is not supported. Testimony in the transcripts for the meetings of the Western Interior Alaska Subsistence Regional Advisory Council, along with correspondence from that Council to federal agencies, indicates that the development of the Dalton Highway permanently altered caribou migration patterns. This should be considered in the analysis.		
162.	3-167	25-36	Carl/FWS	Why is there only reference to traditional knowledge regarding the impacts discussed in this paragraph? There should be reference to biological research that touches on the subject discussed.		
163.	3-167	3	Crane/FWS	Impacts of increased access to the area via corridor built to support oil and gas development also include an increase in the likelihood of illegal harvest. Recommend addressing this in the effects analysis.		
164.	3-167	42	Carl/FWS	The assertion that oil spills "would be largely contained" is unsupported and fails to recognize the difference in the water regimes in the Coastal Plain compared to the Prudhoe Bay area. There are a significantly number more of river systems in the Coastal Plain by comparison (most water in the Prudhoe Bay industrial area is ponds), and such rivers would not provide for containment of an oil spill. During break-up and associated with sheetflow spills would not be contained. Rivers with oil spills in the Lower 48 have shown challenges with containment.		
165.	3-167	5	JReam/FWS	Another important impact to consider is how project roads could facilitate increased access by <u>nonlocal</u> hunters and recreational users (resulting in increased competition), especially if project roads connect to statewide road systems, either now or in the future. This fear is commonly voiced at subsistence regional advisory council meetings.		

Deleted: NONLOCAL

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
166.	3-168	12	Carl/FWS	Change "could result" to "will result." That there will be reduced access is guaranteed; the only issue is to what degree.		
167.	3-168	22-32	Carl/FWS			
168.	3-168	32	Carl/FWS	Affirmatively state who will provide the "dividends" referred to, and how many residents of what communities will receive such dividends. There are no revenue projections that suggest such dividends will be issued.		
169.	3-169	11-13	Joshua Rose/USFWS	It is unclear how "an increase in employment rates or income" will impact "user access". Does this mean more individuals will have money to buy materials needed to access subsistence resources, won't be able to get in and out of the villages because more people will be using the limited flights in and out of communities, they won't have time to access subsistence resources because they will be working? Need to clarify what this means.		
170.	3-169	24-25	Joshua Rose/USFWS	Clarify "timing restrictions on human activity". Does this apply to oil and gas activity, subsistence, all human activity? If this applies to subsistence access there will be greater restrictions than just "timing" once infrastructure is in place.		
171.	3-169	24-25	Carl/FWS	There will be more than timing restrictions. Once infrastructure is in place, it will create access restrictions (likely permanent given the pervasiveness of abandoned oil and gas infrastructure in the Prudhoe Bay area) as well.		

**Deleted:** Reduced user access and resource availability means exactly what in practical terms? Less food, more food costs, changes in diet, loss of culture, etc. North Slope and Northwest Arctic communities use the term "starvation" when they discuss periods of time when caribou were not abundant.

**Commented [RJ12]:** Rewrote in comment 198 to clarify.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
172.	3-17; 3-18	30-40; 1-21	Loya/FWS	Noise disturbance from construction and aircraft to humans and wildlife are of great concern to communities across the Arctic. The DEIS does not adequately analyze or attempt to quantify the level of activity and how it will vary across alternatives. An estimate annual activity and of the acres or proportion of the area that would be affected by noise is needed. Further, the DEIS largely considers Kaktovik Airport to be the hub of aircraft disturbance and does not adequately consider air traffic coming from Prudhoe Bay or other sites on the Dalton highway with airstrips. Further, the DEIS does not account for the impacts associated with support activities, such as surveys, stick-picking and research, much of which is done by helicopters which have been used only rarely under current management. The DEIS should reference the aviation data collected by BLM for landings in NPRA as an example/analog for activity (e.g. ~10,000 landings in 2018) and describe where it is likely to occur under each alternative.		
173.	3-170	15	Carl/FWS	Change "which could" to "which will" as it will be impossible for there to be no impacts to subsistence harvest opportunity or subsistence activity. The only question is degree of impact.		
174.	3-170	33	Carl/FWS	Change "would lead" to "will," as, by definition, creating an entirely new area for oil and gas activity will further expand oil and gas development in the North Slope.		
175.	3-170	38-39	Carl/FWS	Describe in detail exactly how increased income will help offset impacts to subsistence resources, both in the short term and the long term.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
176.	3-171	37-38	Carl/FWS	The Federal Subsistence Board has legally recognized the customary and traditional uses of Dall sheep and moose for the communities of Point Hope and Anaktuvuk Pass in Unit 26C. See 50 C.F.R. §100.24(a)(1). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of Dall sheep for the communities of Chalkyitsik and Fort Yukon in Unit 26C. See id. The Draft EIS needs to analyze the potential impacts to the communities based on activities in the program area. This does not include discussion of all communities that rely upon caribou for subsistence.		
177.	3-172	11	Carl/FWS	Change "1970 passage" to "1971 passage."		
178.	3-173	21	Crane/FWS	Recommend clarifying what permit authority the EIS is referring to for the FWS.		
179.	3-173	30-31	Carl/FWS	↓		
180.	3-174	32	Carl/FWS	↓		
181.	3-175	24	Carl/FWS	↓		
182.	3-176	21	Carl/FWS	Change "may make these" to "will make these," as there is no question as to the impact; the only question is degree.		
183.	3-176	22	Carl/FWS	Change "wherewithal" to "capacity" or "ability." ↓		
184.	3-178	34-35	Carl/FWS	Change "has the potential to" to "will likely," as there is no question that it will affect sociocultural systems – this analysis clearly states that. The only question is degree.		
185.	3-179	15	Carl/FWS	This is a general comment on the section starting on this line, this page. There is no indication as to the amount or quality of local employment resulting from oil and gas development in this area. A recent State economic report cited by the Anchorage Daily News indicates that the oil and gas industry has a higher rate of hiring nonresidents, and a considerable amount of North Slope workers live out of state. <a href="https://www.adn.com/business-economy/2018/08/10/how-alaskas-single-family-homes-held-their-value-through-the-recession/">https://www.adn.com/business-economy/2018/08/10/how-alaskas-single-family-homes-held-their-value-through-the-recession/</a>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Deleted:** Two comments. First, quantify exactly how and which communities have shared in financial gains related to oil and gas development on the North Slope. Second, acknowledge that no similar benefits have been or will be shared with the villages of Arctic Village and Venetie.

**Deleted:** Add additional sentence at the end: "As such, those communities do not receive any financial benefit associated with resource development or shares therein by ANCSA corporations."

**Deleted:** The end of this sentence is highly editorial. It is a "driving force" according to whom? Do all communities of the North Slope believe that their economies are driven by oil and gas development?

**Deleted:** No one really uses the word "wherewithal" in normal conversation.



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
186.	3-179	36	Carl/FWS	Specify by percentage how many super-harvester households also have high income, in order to weigh the merits of this statement.		
187.	3-18 to 3-20		Jorgenson/FWS	The descriptions of the program area should be rewritten using the map in Nowacki et al. 2001. It is a newer, more detailed map than the one used. The two maps differ greatly in the program area.		
188.	3-180	29	Carl/FWS			
189.	3-180	3	Carl/FWS	Previously, text indicates that "many" super-harvesters are high income earners, and here it asserts that they are "often." Be consistent with terminology, as one word indicates number, the other frequency.		
190.	3-181	31	JReam/FWS	Decreased use of certain traditional areas may be influenced by more than resource availability and user access changes – consider how noise, human activity, and competition effect a meaningful subsistence "experience."		
191.	3-182	21-23	Carl/FWS			
192.	3-184	14	Carl/FWS			
193.	3-185	5-6	Carl/FWS	The Federal Subsistence Board has legally recognized the customary and traditional uses of Dall sheep and moose for the communities of Point Hope and Anaktuvuk Pass in Unit 26C. See 50 C.F.R. §100.24(a)(1). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of Dall sheep for the communities of Chalkyitsik and Fort Yukon in Unit 26C. See id. The entire Environmental Justice section needs to consider the impacts to these additional communities. This is in addition to including discussion of all communities that rely upon caribou for subsistence, as noted in comments on 3-162, line 11.		
194.	3-186	15	JReam/FWS	I would add "subsistence resources [and their uses]" to encapsulate that subsistence values are broader than the availability of resources for nutritional purposes.		

**Deleted:** Given they do not enjoy revenue-sharing, what "limited" economic benefit will Arctic Village and Venetie enjoy as the result of oil and gas development in the program area?

**Deleted:** People in Kaktovik have expressed concerns about their community becoming a new, major logistical hub, a so-called "Deadhorse East." This is far beyond what has been experienced in Nuiqsut. This particular concern by Kaktovik residents needs to be squarely addressed.

**Deleted:** General comments on this entire section. First, it does not analyze the loss of spirituality for the Gwich'in that will result from impacts to the PCH. Second, this section fails to analyze or consider "historical patterns of exposure to environmental hazards" (or the fact that these communities have not been so exposed, except for Nuiqsut) as required by the 1997 CEQ guidance on Environmental Justice analyses.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
195.	3-186	7	Carl/FWS	Need to explicitly refer to history indicating that all of these communities have been forced to change their culture based on external forces (missionaries, federal government, state government).		
196.	3-188	16	Carl/FWS	Change "could" to "will" as it is not a question of if, but to what degree.		
197.	3-188	27	Carl/FWS	Insert the word "adverse" in between "lasting" and "effects."		
198.	3-188	42	Carl/FWS	Quantify the expected revenue that will accrue, and the basis for the estimate. The estimate provided during the discussion of the Tax Act was not in accord with recent comparable oil and gas lease sales in the NPR-A.		
199.	3-188	8-9	Carl/FWS	The loss of subsistence resources, and thus increased reliance upon store-bought foods and a cash economy would be an adverse economic impact – and it would be significant, not just "few potential."		
200.	3-189	10-11	Carl/FWS	The history of oil and gas operations reflects that there are potential contamination sources for subsistence foods beyond just oil spills. This should be thoroughly acknowledged and detailed.		
201.	3-189	11	Matz/FWS	Change sentence to read, "...with the possible exception of contamination through an oil spill or through contaminants mobilized through erosion or permafrost degradation."		
202.	3-189	18-19	Carl/FWS	"Until site-specific development activities are proposed, the extent of this effect is not possible to determine." is inaccurate. Yes it is. Analysis can be done of the likely effects if activities were to occur near those areas, given known impacts of such activities elsewhere in the North Slope area. Recommend completing analysis of likely effects should development occur near the areas listed in line 17 using known impacts of such activities in the North Slope area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
203.	3-189	28	Carl/FWS	Rationale needed for how and why there is going to be an increased level of recreation use in the program area under all alternatives.		
204.	3-189	7-9	Carl/FWS	The history of oil and gas operations on the North Slope shows that best practices, regulation and monitoring does not prevent numerous and significant oil spills related to operation. This sentence should be significantly altered to reflect this reality or simply be stricken as inaccurate.		
205.	3-19	18-36	Loya/FWS	Recommend revising permafrost text to reflect updated information available in Jorgenson et al. 2015. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a1898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a1898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		
206.	3-19	34 - 36	Jorgenson/FWS	Delete last sentence in this paragraph. The systematic field sample described in Jorgenson et al. 1994 (and a number of other data sets) shows that low-centered polygons are in the minority in the program area; polygons with centers that are drier than the edges (flat centered polygons) are much more common. Low-centered polygons occur in very wet tundra, which is more common west of the refuge than in the refuge.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
207.	3-19	9-17	Loya/FWS	<p>This section is largely duplicated in Section 3.2.8 and could be combined. Text references language (Teshekpuk (1a) and White Hills (1b)) not depicted in Map 3-1 and inconsistent with section 3.2.8 Soil Resources. Map 3-1 uses Coastal Plain, Foothills and Arctic Mountains, as does 3.2.8. Recommended revising this section to be more concise and updated. According to the map included in the DEIS, the majority of the program area is considered to be coastal plain physiography (Map3-1), characterized by relatively flat lowlands with scattered lakes. However, due to the proximity of the Brooks Range to the coast in the eastern end of the Alaskan Arctic, large alluvial fans extend into the program area creating upland terrain with moderate slopes which can extend to the coast, especially south of Camden Bay (Jorgenson et al. 2015). It is misleading to suggest all of the area show in Map3-1 is similar to the coastal plain described as Teshekpuk by Wahrhaftig 1965.</p> <p>Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalog/maps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalog/maps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a>.</p>		
208.	3-190	12-13	Carl/FWS	Explain exactly what impacts would be to belief systems, cultural identity, and sacred site of calving grounds. How do you measure the loss of sacred sites, rituals and beliefs to a people? That needs to be explained.		
209.	3-190	25	Carl/FWS	Strike "potentially" from this line. Reduction in harvest will result in this shift. The only question is degree.		

**Commented [RJ17]:** Possibly combine with Janets comment line 215.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
210.	3-192	12	Carl/FWS	Strike the words "perceived as" from this line. It is not a legitimate scientific question that climate change is affecting the North Slope of Alaska.		
211.	3-192	12	Joshua Rose/ USFWS	Strike the words "perceived as" from this line. There is significant documentation of climate driven changes in northern Alaska and that these changes have affected subsistence activities (Hinzman et al. 2005, "Evidence and Implications for recent climate change in northern Alaska and other arctic regions". DOI: 10.1007/~10584-005-5352-2).		
212.	3-192	27	Carl/FWS	Change "could" to "will" at the beginning of this line. The question is not whether, but to what degree.		
213.	3-192	38	Carl/FWS			
214.	3-192	40-42	Carl/FWS	Quantitative data is lacking as to the extent of enhanced government revenues and increased job opportunities for Alaskans. How much will be provided for both areas?		
215.	3-193	32-33	Carl/FWS	This sentence indicates that hunting and fishing for federally qualified subsistence users is a "primary recreation opportunity." This assertion should be deleted, as it will be inflammatory to federally qualified subsistence users for their customary and traditional activities to be equated with recreational activities.		
216.	3-193	33	Reed/FWS	Correct sentence to read "...to non-Federally qualified..." (recreational hunting, or general hunting, as the SOA refers to it, does not include federally-qualified subsistence users)		
217.	3-193	37-38	Reed/FWS	Replace beginning of second sentence in last paragraph with: "Until recently, most...", and add this sentence after: "Increasingly, visitors come later in the fall season, experiencing rapid decreases in average daily daylight and increased opportunity to view the Northern Lights."		
218.	3-194	10	Reed/FWS	Begin paragraph with: "Visitor use in the project area has increased in recent years with the emergence of polar bear viewing on waters immediately surrounding Kaktovik."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Commented [RJ18]:** Rewrote in next comment.

**Deleted:** The line references "increased TAPS throughput." The impact of increased oil throughput from a Coastal Plain oil and gas program on the TAPS, which has far exceeded its originally planned lifespan, needs to be considered in the cumulative impacts analysis. When the TAPS ROW was renewed in the early 2000s, the possibility of oil from the Coastal Plain was not likely analyzed in that EIS document

**Deleted:** .



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
219.	3-194	10	Reed/FWS	Change sentence beginning with: "More than 90 percent..." to "Prior to the emergence of polar bear viewing, more than 90 percent..."		
220.	3-194	11-15	Reed/FWS	Change following two sentences (beginning with "Other visitors..." and "During the summer...") to past-tense.		
221.	3-194	15	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace paragraph content beginning with "In 2017..." with "In 2017, guided polar bear viewing accounted for approximately 54 percent of all reported guided recreation activities in the program area. Polar bear viewing occurs on waters immediately adjacent to Kaktovik. Of the remaining 46 percent of visitors to the project area, use was more dispersed, and river floaters accounted for the majority (60 percent), while backpackers, base campers, and hunters each made up a portion of the minority of activity types (40 percent). Visitors conducting each of these four recreational activity types depend predominantly on use of river corridors during all or a portion of their visits.		
222.	3-194	23	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace "In 2017, approximately 8 percent..." with "In 2017, approximately 4 percent..." and add the following sentence. "Of the visitors to the project area whose use was focused on river corridors (i.e.: not polar bear viewers), approximately 8 percent were hunters."		
223.	3-194	6-7	Reed/FWS	End sentence with "...arrive by chartered aircraft." Strike "..., which is part of their special use permit."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
224.	3-194	7	Reed/FWS	Replace sentence beginning with "They..." with "Air operators providing transportation services to visitors are regulated through a special use permit system, which conditions their operations. There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land where surface conditions permit it."		
225.	3-194	8	Reed/FWS	Replace first part of sentence beginning with "Individual hikers..." with "Visitors enter the program area directly via chartered aircraft, from the north via Kaktovik, or to a lesser extent..."		
226.	3-195	25	Reed/FWS	Replace "...unique primitive recreation experiences..." with "...primitive recreation experiences that are unique on a world scale (such as expedition-length float hunts and polar bear viewing)..."		
227.	3-198	11	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		
228.	3-198	39-40	Reed/FWS	Change to read: "This would also <i>minimize impacts</i> to the viability of specially-permitted..."		
229.	3-199	1-2	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

230.	3-2	17-26	Loya/FWS	<p>Weather data, especially wind and precipitation, from Kaktovik is insufficient to describe conditions across the program area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.</p> <p>Katabatic winds from the mountains have a significant effect on snow distribution in the area.</p> <p>Recommend adding this info after line 26: Inland near the Brooks Range, monthly mean wind speeds are slightly lower (4.2ms<sup>-1</sup>; Olsson and others, 2002), but strong winds from the south, readily exceeding exceed 20ms<sup>-1</sup>, can originate as katabatic flows down the many north-oriented valleys of the Brooks Range (Sturm and Stuefer 2013). In general, snow depth and snow water equivalent (SWE) decrease from inland to the coast (SWE values of 15–20cm near the foothills to 6–12 cm near the coast; Liston and Sturm, 1998), while bulk snow density and the prevalence of wind slabs increase (Sturm and Liston, 2003).</p> <p>Liston GE and Sturm M (1998) A snow-transport model for complex terrain. J. Glaciol., 44(148), 498–516</p> <p>Olsson PQ, Hinzman LD, Sturm M, Liston GE and Kane DL (2002) Surface climate and snow–weather relationships of the Kuparuk Basin on Alaska's Arctic Slope. ERDC/CRREL Tech. Rep. TR-02-10)</p> <p>Sturm M and Liston GE (2003) The snow cover on lakes of the Arctic Coastal Plain of Alaska, USA. J. Glaciol., 49(166), 370–380 (doi: 10.3189/172756503781830539)</p>		
------	-----	-------	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
				Sturm, M & Stuefer, S (2013). Wind-blown flux rates derived from drifts at arctic snow fences. Journal of Glaciology. 59. 21-34. doi:10.3189/2013JoG12J110		
231.	3-2	21-22	Reed/FWS	No wind rose appears in figure referenced		
232.	3-2	9-22	Leonard/FWS	Meteorology from Kaktovik is unlikely to be representative of large portions of the study area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.		
233.	3-200	11	Reed/FWS	Change to read: "...four additional purposes..."		
234.	3-200	Table 3.4.7-1	Kaye- FWS	Table 3.4.7-1 ANWR Purposes lists only EIS sections relevant to ANILCA purposes but does not include the still applicable PLO 2214 purposes. While ANILCA purpose (i) includes the PLO wildlife purpose, the PLO wilderness and recreational purposes are not referenced. They should be.		
235.	3-201	1-3	Reed/FWS	Change to read: "...opportunity to prioritize using existing management authorities and better understand..."		
236.	3-201	20	Reed/FWS	Break first sentence into two. End first sentence of paragraph with "... (NVSRS)." Second sentence should read: "Federal managers of recommended rivers are obligated to use existing management authorities to protect the characteristics of rivers for the conditions under which they were found eligible and suitable (in this instance, as described in the Wild and Scenic River Review)." .		

Commented [RJ20]: Added this section to comment 258

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

237.	3-202	2	Kaye/FWS	<p>Recommend expanding description of the Wilderness Characteristics, Qualities and Values section to include the following:</p> <p>Arctic Refuge Coastal plain wilderness characteristics and values</p> <p>The Arctic Range, including the coastal plain, was initially proposed by the National Park Service as "The Last Great Wilderness" (Kaye 2006) and Public Land Order 2214 (1960) which established the Range identified preservation of wilderness values as one of the area's three purposes. So to clarify, the wilderness characteristics and values described herein are not based on designated (big W) Wilderness, but on the still applicable 1960 wilderness purpose of the original Arctic Range and the wilderness values referenced in ANILCA sections 101(b) and 304(g). Consistent with this wilderness purpose, the Refuge's 2015 Comprehensive Conservation Plan (CCP) declared that "The Arctic Refuge serves a distinctive role in the National Wildlife Refuge System—exemplifying the qualities of natural condition, wild character, and ecological wholeness." The Refuge's CCP went on to recommend the 1002 area for Wilderness designation because it exemplifies these qualities. Studies of Refuge visitors (Christensen and others 2009) and the broader national public's values and interests related to the Refuge (Bengston and others 2010) show that these wilderness qualities are highly prominent in the public's perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge's Special Values (FWS 2015) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain's wilderness purpose and its function within the larger Refuge. It includes the experiential values of those who visit, and vicarious values for those who find satisfaction just knowing the area exists. Wilderness associated values include ecological,</p>		
------	-------	---	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>scientific, wildlife, aesthetic, recreational, and symbolic values, and are summarized as follows:</p> <p>Underpinning the coastal plain's ecological value is its wildness, the characteristic most at risk to development. Wildness is the landscape's freedom from human intent to alter, control, or manipulate its components and ecological and evolutionary processes. This freedom is integral to the area's high degree of biological integrity and natural diversity. It is also integral to the area's scientific value, as a natural laboratory of international significance. Investigations here have and can continue to provide insights into how arctic ecosystems function, transition, and respond to anthropogenic change such as climate change when left alone. Wildlife of the coastal plain remain wild to an unsurpassed degree here, their behavior, interactions, cycles and ecological roles continuing. Caribou, widely recognized as a symbol of the area's wildness, continue their migratory patterns, their ancient memory of unbounded movements to and within their calving grounds, unimpeded by developments. This wild quality of caribou and several of the Refuge's other species led to the research finding that "the national public's interest in the refuge's wildlife would be best served by maintaining the natural roles, interactions, and population dynamics of all species (Bengston and others 2010).</p> <p>Recreational visitors come to the coastal plain seeking a "wilderness experience," enhanced by all the aforementioned values. A 2009 study of Refuge visitors found that wilderness and wildness values were highly important as both motivations for visiting and as conditions that were experienced.</p> <p>As was intended by the Arctic Range's founders, the Arctic Refuge has become a symbolic landscape (Kaye 2006). Since the first efforts to establish a "Last Great Wilderness" here, most people who value this landscape have been less interested in how it can be used than in what its continued preservation represents. Millions who will never set foot in the area find satisfaction, inspiration,</p>	
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>and even hope in just knowing it exists. Bequest value is a component of the area's symbolism. For many people, the Refuge represents the hope of a past generation that one of the finest remnants of our natural inheritance will be passed on to future generations, undiminished. For many, the question of the coastal plain's future has come to symbolize daunting questions the nation faces regarding energy policy, sustainability, and our effect upon the larger biosphere we jointly inhabit.</p> <p>The intangible, ineffable yet foundational symbolic value of the area is well summarized by Refuge founder Lowell Sumner (1985) who compared the Refuge to the statue of liberty. In the far north, he wrote, is another American symbol:</p> <p>... and this one too symbolizes freedom . . . freedom to continue, unhindered and forever if we are willing, the particular story of Planet Earth unfolding here—freedom for us as well who need to come to the few out-of-the-way places still remaining . . . but also where we can learn to appreciate and respect the intricate and inscrutable unfolding of the Earth's destiny—when free from meddling human concerns and the urge to take possession of and use up what we so imperfectly understand.</p> <p>Literature Cited  Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. <i>International Journal of Wilderness</i>. 16: 13-20.  Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.  Kaye, R. 2006. Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge. University of Alaska Press, Fairbanks, Alaska.</p>		
--	--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
				Sumner, L. 1985. Arctic National Wildlife Refuge address, 25 <sup>th</sup> anniversary. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska. U. S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.		
238.	3-202	17	Brady/FWS	If you are going to quote the Wilderness Act – then use the language: 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation an use in an unimpaired condition and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.		
239.	3-202	8	Kaye/FWS	Change to "a natural and wild condition"		
240.	3-203	36	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
241.	3-205	15-16	Reed/FWS	Maintain water quality using Bureau of Land Management's (BLM's) policy and program direction for management of eligible and suitable wild and scenic rivers (WSRs) which directs its plans to "protect and, where feasible, enhance the free-flowing condition, water quality"—through baseline data on quality of water at time of eligibility not by using State water quality standards.		
242.	3-207	17-18	Kaye/FWS	Change to "... measured by the overall visual quality and naturalness and wildness of an area that may be affected by changes to the types and levels of recreational activities, management actions, and surrounding land use."		
243.	3-207	31	Kaye/FWS	Change "could" impact to "would" impact		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
244.	3-207	36	Kaye/FWS	Change "natural appearance" to naturalness		
245.	3-208	18	Kaye/FWS	Change "no impacts" top "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
246.	3-208	25	Kaye/FWS	Delete "apparent"		
247.	3-208	29	Brady/FWS	Need a more robust analysis of the direct/indirect and cumulative effects that an oil and gas program would have on designated wilderness on Arctic Refuge and how an oil and gas program would affect each element of the wilderness; untrammeled; natural, undeveloped, outstanding opportunity for solitude		
248.	3-208	3	Kaye/FWS	Change "could" diminish to "would" diminish		
249.	3-208	9	Kaye/FWS	Change "no impacts" to "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
250.	3-209	23-24	Leonard/FWS	Replace 'on' with 'to' in 2 places since there is no demarcation mentioned between east and west sections.		
251.	3-21	10	Crane/FWS	Impacts from gravel infrastructure will likely persist in the form of no vegetation, compaction, and thermos-karsting even if infrastructure is removed. Recommend clarifying the statement made on page 3-21.		
252.	3-210	30-31	Leonard/FWS	Replace 'Buildings' with 'Human-built structures' AND 'modify' with 'modified'. Begin next sentence by replacing 'Buildings' with 'These structures'		
253.	3-211	14	Leonard/FWS	'dominate' needs explanation. Suggest removing entire sentence unless quantified differences between air and surface.		
254.	3-211	32-34	Leonard/FWS	But the outcome of such an analysis would not be tied to the lease itself (i.e., Stip) but only to a ROP for that action. This should be made very clear. Suggest adding 'and will inform ROPs on such actions, such as the APD phase'.		
255.	3-213	10	Leonard/FWS	Remove 's' from 'surfaces'		
256.	3-213	12	Leonard/FWS	Subject-verb: Change 'is' to 'are'		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
257.	3-215	16	Leonard/FWS	Change 'result' to 'resulting'		
258.	3-215	2-22	Leonard/FWS	Cumulative Impacts, and most of the visual resource section, are purely descriptive. One way to quickly produce quantitative information is to include a viewshed analysis based on different alternatives.		
259.	3-215	24-40+	Berendzen/ FWS	Affected Environment section is repeated on following page		
260.	3-215	32	Berendzen/ FWS	Several short airstrips are used by small fixed-wing aircraft for landing on wheels to transport recreationalists and researchers.		
261.	3-215	32	Reed/FWS	Change sentence to read: "...snow or <i>land</i> ..." See Reed comment for 3-194, line 7--There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land		
262.	3-215	4-8	Berendzen/ FWS	Anticipated miles of disturbed trail is expected to far exceed the 125 miles of disturbance left after damage that occurred 25 years prior. This habitat damage is in direct conflict with refuge purpose #1. Conflict with refuge purpose needs to be discussed.		
263.	3-216	28	Berendzen/ FWS	The message in these paragraphs is unclear, but suggests that enhancement of public and subsistence transportation would be a benefit. Refuge purposes would be compromised by additional transportation infrastructure.		
264.	3-216	3-4	Reed/FWS	Commercial snowmachine use for recreation has not been authorized to my knowledge; recommend striking word "commercial" from sentence beginning in Line 3.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
265.	3-217	5	Loya/FWS	The FWS recommends that roads be closed to motorized use by the public. Subsistence access would be determined under LS 11. Recommended revision:  New transportation infrastructure, such as seasonal or year-round roads, airstrips, or other facilities, would not be available for public use using motorized vehicles. Thus, new infrastructure may enhance only non-motorized public access.		
266.	3-217	6-7	Berendzen/ FWS	Industry developed infrastructure is not intended or expected to enhance public access opportunities. Sentence not needed.		
267.	3-22	1-24	Loya/FWS	Estimate of gravel footprint is not an adequate analysis of impacts to the physiography or how physiography would affect infrastructure placement. The info presented in this section belongs in the RFDS section.		
268.	3-233	6	Matz/FWS	Change sentence to read, "...completed (ADEC 2018), although cleanup thresholds may have changed since the date of closure (e.g., ADEC 2017)."  ADEC 2017 is Draft Cleanup Levels Guidance for Methods Two and Three, available at: <a href="http://dec.alaska.gov/spar/csp/guidance-forms/">http://dec.alaska.gov/spar/csp/guidance-forms/</a> . There are other documents describing changes in cleanup guidance and levels on there as well.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
269.	3-24	6; 16	Loya/FWS	No geologic map is present. Recommend using Jorgenson et al. 2015 Figure 11. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		
270.	3-240	10-20	Berendzen/ FWS	These adverse impacts are likely to occur and conflict with other refuge purposes. Need to evaluate conflict with other refuge purposes		
271.	3-240	38-40	Berendzen/ FWS	Proposed activities would likely result in chronic impacts as stated. This conflicts with refuge purposes. Need to evaluate conflict with other refuge purposes		
272.	3-241	23	Berendzen/ FWS	Add " Loss of genetic diversity of wildlife species displaced by development activities"		
273.	3-25	17	Reed/FWS	After the paragraph's first sentence, add this sentence: "The August 12, 2018, M6.4 earthquake with epicenter near Kaktovik changes the level of earthquake activity understood to be foreseeable in the Coastal Plain."		
274.	3-25	17-25	FWS	Earthquake analysis is outdated. A 6.4 magnitude quake struck the area along and adjacent to the Sadlerochit mountains, and potential impacts to infrastructure in the shake zone should be analyzed.		
275.	3-29	10	Crane/FWS	Recommend expanding the discussion and analysis on the effects of subsidence and permafrost thaw as a result of oil and gas development and on development itself. In 2017, a well failed in NPRA and was attributed to thawing permafrost. With increasing temperatures, it is expected that permafrost thawing will also increase and potentially result in similar incidents.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
276.	3-3	14-15	Leonard/FWS	There are weather stations with data from inside and around the project area that are far closer than Barrow. See <a href="#">GTN-P</a> sites as well former NRCS run <a href="#">SNOTEL</a> sites		
277.	3-3	21-22	Leonard/FWS	Statement about discernable trends is not fully accurate. Most of the precip is driven by inter-annual variability and there are numerous studies that predict an increasing trend for the arctic and some that show a decreasing trend ( e.g., Stafford, J. M., Wendler, G., & Curtis, J. (2000). Temperature and precipitation of Alaska: 50 year trend analysis. Theoretical and Applied Climatology, 67(1-2), 33-44) However, Nearly all models agree that with increasing temps, we will see increasing precip. The current problem is that we don't have enough weather stations to properly monitor these changes. More importantly though: Total precipitation (assuming authors are excluding snow per 3-2 lines 10-11) is not the salient measurement for change as it relates to temperature above. Changes in the timing of precipitation are important here (e.g., rain on snow events). See: Bieniek, P., Bhatt, U., Walsh, J., Lader, R., Griffith B., Roach, J., Thoman, R. 2018. Assessment of Alaska Rain-on-Snow Events Using Dynamical Downscaling. American Meteorological Society. 57.1847-1863. <a href="https://doi.org/10.1175/JAMC-D-17-0276.1">https://doi.org/10.1175/JAMC-D-17-0276.1</a>		
278.	3-31	20	O'Dell/FWS	The KIC#1 well is the only well that has been drilled in what is now termed the "Coastal Plain". Suggest changing to "Data from most wells drilled near or in the Coastal Plain are held confidential..."		
279.	3-31	8	LaKonski/FWS	Recommend changing "... (previously known as the 1002 Area)..." to "(also known as the 1002 Area)"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
280.	3-31	9	Crane/FWS	Recommend stating that while the Coastal Plain was not designated wilderness, it was recently recommended for designation in the CCP and executive letter to congress and has been managed as such.		
281.	3-33	Line 18	O'Dell/FWS	Area 1002 has not been "poorly studied" but studied extensively with low volume and quality of data. Suggest just saying: "Given the uncertainty involved in defining undiscovered resources within the Coastal Plain, attempting to define variances in production by alternative is too speculative to provide value in the analysis."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
282.	3-35	1-5	Loya/FWS	<p>Because of the USGS assessment is being used as the basis for oil recovery, and it assumes that oil is not evenly distributed across the program area, recommend the following revision. It is not clear where the "medium" oil potential zone comes from, it does not appear to be described in the USGS assessment. Figures AO6 – AO15 suggest that only the "Thin-skinned Thrust Belt Play" may have indicators of oil bearing sand, otherwise the area is assumed to be more favorable for gas than oil. Using the two zones described in the current USGS assessment seems to be the "best available science". The USGS describes two zones: undeformed (high potential) and deformed (low potential). Appendix E summarizes the oil potential as 6.420 BBO for high and 1.267 for low areas. Thus, the text in this section should be revised to reflect the estimated unequal distribution of oil.</p> <p>Further, there is quantified uncertainty which should be preserved in the text. The amount of oil that may not be recovered is difficult to determine as directional drilling may make oil accessible even where no leasing occurs. To quantify the amount that may be "unrecovered" divide the value of total oil in Table E-1 (7.668 BBO (range 4.254 to 11.8) by the value for the deformed part in Table E-2 (1.267 (range 0 to 3.185)) and account for the variation reported by USGS which is 0 BBO to:</p> <p>This closure represents approximately 30 percent of the program area; however the area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
283.	3-35	17-19	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
284.	3-35	29-31	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
285.	3-36	17-22	Loya/FWS	Recommend moving this section on contribution to greenhouse gases to Page 3-4 Section beginning on line 15L Impacts of the proposed action on climate change		
286.	3-36	22	Trawicki/FWS	Is the 9.32 bbo and 4.01 bmt consistent with 3.2.1-2. Use similar units.		
287.	3-39	36	Jorgenson/FWS	Soils are described for lowlands but not for uplands		
288.	3-39	8-16	Loya/FWS	Due to NSO and No leasing, the impacts would not be the same across all alternatives, recommend revising text to reflect at least what percentages of the surface would be undisturbed by development and relate to table 3.2.7-1 PFYC Values of Program Area.		
289.	3-4	24	Leonard/FWS	Add 'and' after 'drilling production'		
290.	3-4	26-30	Hopkins/FWS	Statement about amount of available oil/gas by this project does not cite a study or an analysis and is thus 100% speculation, not factual and should be deleted. Statistics on anticipated oil and gas production are cited later in the EIS – could move those forward to this spot.		

**Commented [RJ21]:** Not sure why this is highlighted

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
291.	3-4	29	Crane/FWS	The statement regarding no additive effects of combustion of fuels from the program area is based on flawed assumption that development of the program area will preclude the need to develop the same amount of resources elsewhere and vice versa. There does not appear to be a basis for that assumption and is inconsistent with the cumulative impacts language on page 3-36 regarding how production and consumption of fuels from the program area would contribute to climate change. Recommend removing this statement.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
292.	3-4	3-10	Loya/FWS	<p>It is does not seem sufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents. If DEIS is used, then provide further information such as Chapter and/or page numbers. Further, rather than taking an entire paragraph to send the reader to the DEIS for GMT2, it is worth copying that info into this important, programmatic document without taking up too much space. Recommend deleting lines 3-10 and replacing:</p> <p>The North Slope experiences the same climate trends as the Arctic as a whole, including increased average temperatures, thawing of permafrost, expanded growing season and decreases in sea ice and snow cover extent (Walsh et al. 2014). Tundra travel open season on the North Slope decreased from approximately 200 days in 1969 to approximately 120 days in 2004 as a result of regulatory changes, a warming climate and methods for measuring frost depth (North Slope Borough Oil and Gas Technical Report 2014). Tundra travel season is likely to continue to shorten in response to rising average temperatures and changes in precipitation patterns on the North Slope. Precipitation on the North Slope is projected to increase in both summer and winter, while snow cover duration is expected to drop (BLM 2014). Projections for snowfall include a later date of first snowfall and an earlier snowmelt (BLM 2014).</p>		
293.	3-4	31-32	Leonard/FWS	This is conjecture without regard to market timing or any of the various complex factors involved with making an equivalency. Remove sentence. Begin following sentence by removing 'However' and combine with previous section.		
294.	3-4	5-10		Provide links to DEIS and GMT2		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
295.	3-40	2	JRose/FWS	Check citation. Jorgenson et al. was published 8 June 2015.		
296.	3-40	24	JRose/FWS	seems to be a typo "...ground surface and, which is..." should read "...ground surface and is ..." or "...ground surface, which is..."		
297.	3-40	4 - 6	Jorgenson/FWS	Clarify when soils are frozen vs. unfrozen, summer vs. winter. Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
298.	3-40	6	JRose/FWS	Clarify, notNot sure where "usually unfrozen on south-facing slopes" came from. If there is a source please cite. If it is from Jorgenson et al. 2015 it is miss represented. Jorgenson et al. state "Unusually unfrozen on south-facing slopes in the boreal zone" for upland Loess in Table 3 of that document. No portion of the 1002 is in the boreal zone. Also, Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
299.	3-41	1	JRose/FWS	Need to consider impacts from seismic activities associated with leasing. Various levels of impact have been recorded and last from 2 to greater than 40 years. Impacts include subsidence, thickening of the active layer, and changes in soil moisture (Kemper and Macdonald 2009, Jorgenson et al. 2010, Siobhan et al. 2017,		

Commented [RJ22]: Added from comment 327

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
300.	3-41	25 – 28	Jorgenson/FWS	<p>Citation to add for this paragraph: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevsky, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.</p> <p>(Note to FWS: this paper should be cited multiple times in the EIS. They really should also cite: National Research Council, 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press.)</p>		
301.	3-41	31-32	JRose/FWS	<p>Need to better explain mechanism "This can increase thermal conductivity... (USACE, 2018)". Decreased albedo in and of itself does not change thermal conductivity. I do not have access to the reference but I am assuming they are indicating that the decrease in albedo results in a warmer denser snowpack with increased thermal conductivity. If this is the case it may be better to say "This can lead to a denser snowpack with increased thermal conductivity, leading to permafrost thaw (USACE 2018)." Or reword in another way to better reflect the mechanism the original reference is referring to.</p>		
302.	3-42	11-26	Loya/FWS	<p>Impacts by alternative are not specific to the soil resources, which vary considerably across the program area. Alt B should consider if there are particular soil types more susceptible to impacts from gravel fill placement across the program area, while surface restrictions under Alt D would likely concentrate impacts in the western third of the program area, requiring consideration on impacts to the soil types occurring there.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
303.	3-42	29	JRose/FWS	Does not provide context of historic impacts. Recommend "Previous seismic surveys covered 2,500 miles of trail of which 125 miles remained disturbed in 2009. Disturbance from seismic survey exploration and an exploratory test well in the program area included disruption of surface vegetation and increased thaw of permafrost, changes... (Jorgenson et al. 2010, USFWS, 2018)." (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		
304.	3-42	29 - 31	Jorgenson/FWS	Add text in red: Previous seismic survey explorations and an exploratory test well in the program area have resulted in disturbance to the surface vegetation and impacted the thaw of permafrost, changes in drainage patterns, and changes in vegetation growth for 25 years after disturbance (Jorgenson et al. 2010, USFWS 2018). (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
305.	3-42	31	JRose/FWS	<p>Cumulative effects do not consider currently proposed seismic or future seismic work. Recommend "...Vegetation growth (USFWS, 2018). Additional seismic surveys over the program area are required at significantly higher density. While improvements have been made to avoid impacts new seismic surveys may have similar impacts as previous seismic activity."</p> <p>Under the currently proposed seismic work I estimate a minimum of 200 miles of camp move, 800 miles of seismic lines run by vibroseis equipment, and 30,000 miles of layout lines run by tucker and snowmachines. This estimate does not include daily trips to and from camp or scouting operations. Any additional seismic activity conducted after the initial surveys will increase the total miles of seismic trails. Recommend using current plans and data from NPR-A to develop more realistic estimates of miles of trails for seismic activities.</p>		
306.	3-44	36	JRose/FWS	Change "...cumulative impacts for soils and permafrost is..." to "...cumulative impacts for sand and gravel resources is..."		
307.	3-45	3.2.10	JohnT/FWS	<p>The fourth purpose of the refuge is (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.</p> <p>Ensuring water quality and quantity (i) to conserve fish and wildlife populations and habitats in their natural diversity including..... is an explicit purpose of the refuge.</p> <p>All alternative at a minimum need to address and meet all purposes of the refuge.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
308.	3-46	19	JohnT/FWS	Edit: ...snowmelt or rain on snow events have produced flood events.		
309.	3-46	19-21	Randy Brown USFWS	"Table G-5 provides historic data of measured discharge..." However, Table G-5 presents stream lengths of major streams in the Coastal Plain. Other references to specific table contents in this section are also incorrect. All should be checked and resolved.		3-46
310.	3-46	35	JohnT/FWS	Add sub heading for lakes and wetlands		
311.	3-47	14-16	JohnT/FWS	Move this statement to 3-50, Changes in Surface Water Flow		
312.	3-47	23	JRose/FWS	Amend to read "...summer season and represent at least one third of the cumulative annual base flow (Yoshikawa et al. 2007); some spring-fed..." "Spring and aufeis (icing) hydrology in Brooks Range, Alaska"		
313.	3-47	5-6	JohnT/FWS	Not sure what was sampled. Trawicki et al., 1991 conducted bathymetry, but did not conduct water quality sampling. Bayha 1996 also characterized the wet meadow zones associated with most lakes across the coastal plain.		
314.	3-48	17	JohnT/FWS	360 maybe reservations ADNR has on file. USFWS has filed 202 reservations with ADNR since 1994, of which 1 reservation has been adjudicated.		
315.	3-48	36-38	JohnT/FWS	Trawicki et al. 1991 is not the appropriate reference for this statement.		
316.	3-48	4-8	JohnT/FWS	The spring break-up flows also play an important role in the break-up, temperature, and salinity of near marine and lagoon environments. (check with Randy for language to match fisheries near shore marine habitat)		
317.	3-49	2	JohnT/FWS	Add to list and impacts common to all alternatives: reduction in water quality, reduction in water availability, permafrost degradation, alteration of aquatic habitats (rivers, streams, lakes, and wetlands)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
318.	3-49	20	JohnT/FWS	Add to list and impacts common to all alternatives: Saltwater treatment plant, construction and operation of barge facility, road use (dust), aerial deposition of contaminants,		
319.	3-49	26	JohnT/FWS	Delete "avoidance", water will be used.		
320.	3-50	17-18	JohnT/FWS	Permits will require reclamation plans to be implemented when pit is decommissioned.		
321.	3-50	19	JRose/FWS	Include "ground surface subsidence under some seismic trails" with examples of exploration activities.		
322.	3-50	2	JohnT/FWS	Based on 3-47 lines 14-17; surface disturbance can lead to the development of thaw lakes. Development of additional thaw lakes are likely due to surface disturbance should be added to page 3-50, line 2 Changes in Surface Water Flow		
323.	3-50	5	JRose/FWS	Include "Changes in surface runoff processes and drainage networks" with examples of potential impacts. On steeper slopes especially these changes could result in gullying, thermokarst features, and surface detachment		
324.	3-51	11-15	JohnT/FWS	Please reference ROP 24 and alter language to be consistent with ROP 24		
325.	3-51	32-36	JohnT/FWS	Impacts natural drainage patterns on tundra are permanent and irreversible- reclamation has not been proven for gravel removal in an Arctic environment. This would also apply to vegetation...impacts would be for period of operation.		
326.	3-51	3-5	JohnT/FWS	Objective is to design to minimize permafrost degradation, please reference the ROP # this refers to.		
327.	3-51	37-38	JohnT/FWS	Reference ROP 13, for consistent language. Waterway crossing that have been reinforced will be removed, breached or slotted prior to breakup.		
328.	3-51	7	Matz/FWS	Change sentence to read, "...have higher suspended solids concentrations, greater turbidity, and contaminant concentrations (dependent on the underlying geology)."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
329.	3-51	7-12	JohnT/FWS	How much water per activity for conceptual lay out E-1? Analyze water availability (volume by source and distribution)?		
330.	3-52	13	Crane/FWS	Fresh water resources are limited within the program area (see pages 3-73 and 3-74). Recommend providing estimated water withdrawal amounts associated with the RFD scenario, if water resources are adequate to meet those needs, and then analyzing what the effects may actually be. The referenced IAP does not provide an analysis for an area comparable to the program area and the limited fresh water resources found within.		
331.	3-52	34	Crane/FWS	Dust deposition on ice and snow can accelerate melt rates. Recommend addressing this effect in the water quality section.		
332.	3-52	35	Matz/FWS	Change sentence to read, "increasing turbidity and contaminant concentrations (dependent on the underlying geology)."		
333.	3-52	36-39	JohnT/FWS	Logic: Water will be withdrawn from lakes during summer. Lakes will have less water going into winter, therefore loss of available water, winter habitat, and lower water quality. Full recharge may or may not occur in some lakes. Surface water hydrology is not the same on coastal plain as the NPRA (2%/22%)		
334.	3-52	38	Crane/FWS	The statement "water would be recharged in the spring when snow and ice melt increases..." assumes withdrawal rates will not exceed recharge rates. Recommend discussing how this assumption will be met for the various alternatives (i.e. do ROPs ensure this, will water use permits...) given the lower snow totals that occur in the program area vs NPRA.		
335.	3-53	1-2	JohnT/FWS	At a minimum identify/list the water quality/contaminants discussed in BLM 2004.		
336.	3-54	19-20	JohnT/FWS	Delete lines 19-20		
337.	3-57	Table 3.2.11-4	Matz/FWS	Add a column with the material that was spilled.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
338.	3-58	10	Matz/FWS	Delete "promptly," as this is a values statement (i.e., definition could vary depending on one's values).		
339.	3-58	23	Matz/FWS	Add at end of sentence, "...or at the surface, except where permafrost thaw is exacerbated by climate change and anthropogenic earth-disturbing activities."		
340.	3-6	10	Crane/FWS	The statement regarding summer sea ice extent recovering slightly from the past decade fails to acknowledge that there is still a downward trend in sea ice extent from for the last several decades. Recommend clarifying the existing statement to reflect this.		
341.	3-6	10	Hamilton/FWS	"recovered" in this sentence implies responding to new action, suggest replacing with the word risen		
342.	3-6	20	Leonard/FWS	Add a space between 'program' and 'area'		
343.	3-6	29-35	Leonard/FWS	The Cumulative Impacts here are not summarized, Global emissions increase with increasing human development, <u>and can</u> be calculated. This needs to be evaluated inside the framework of this project. There is better detail on page 3-36 Lines 17-22. This can be used with Appendix E details to actually provide a quantitative assessment.		
344.	3-6	30	Leonard/FWS	Remove word 'provided' after 'projection'		
345.	3-60	1	Matz/FWS	Define location of, or give examples of, "offsite," such as, "in the permitted Kaktovik municipal landfill."		
346.	3-61	20	Jorgenson/FWS	The vegetation mapping available to quantify..... Change to: the vegetation mapping chosen to quantify.... Justification: There are 5 other vegetation maps covering the area in question, all made from Landsat satellite data.		

**Deleted:** even

**Deleted:** (much less calculated) but simply explained away by the tragedy of the commons

**Deleted:** Just because g

**Deleted:** does not mean they cannot

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
347.	3-61	23 - 24	Jorgenson/FWS	"The primary data source used was a low resolution map prepared by Ducks Unlimited, Inc. (2013). " That is not actually correct for the program area. DU did not map the program area. The data source for the program area was a land cover map published in 1986 (Markon 1986), made from classified Landsat-MSS satellite imagery from 1981. The map was more recently improved by Torre Jorgenson by applying topographic modelling to the existing map. However, it is still low resolution and a satellite image from 37 years ago. There are at least 5 newer Landsat maps covering the program area, some produced from newer Landsat-TM data, which is higher resolution than Landsat-MSS.		
348.	3-61	8	Matz/FWS	Change, "...detected spills are promptly contained..." to "...detected spills would be contained..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
349.	3-66	34 - 36	Jorgenson/FWS	<p>Comment on direct and Indirect Impacts subsection: This section uses a Landsat-MSS land cover map to calculate percentages of different vegetation types affected by different development alternatives. Landsat maps available for the area, including the one chosen, are all adequate for making general statements about the vegetation of the area but are not accurate enough to provide good estimates of the percentages of areas covered by each mapped vegetation type. They tend to overestimate prevalence of some vegetation types, such as tussock tundra, and underestimate prevalence of others, such as other moist sedge-shrub types. The document cited below provides better estimates of percentages, based on field data rather than classified satellite imagery. The data set includes 756 systematically-located field-visited plots spanning the whole coastal plain in a grid, visited in 1989 – 1990. 540 of the plots are in the 1002 area. The mapped classes are all readily cross-walked to Vierecks Alaska vegetation classification. Although the data are from ~28 years ago, they are more recent than imagery for the map that was chosen (37 years ago). The data set is described in this document and is available from FWS:</p> <p>Jorgenson, J. C., P. E. Joria, T. R. McCabe, B. E. Reitz, M. K. Reynolds, M. Emers, and M. A. Willms. 1994. User's guide for the land-cover map of the coastal plain of the Arctic National Wildlife Refuge. U. S. Fish and Wildlife Service, Anchorage, AK. 46 p.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
350.	3-67	12 - 25	Jorgenson/FWS	Rewrite of this paragraph: Seismic exploration is proposed to occur during winter with direct surface impacts occurring by passage of camp trains on skis pulled by a tracked dozer directly over the snow-covered tundra surface (Appendix E, RFD Scenario). Impacts to vegetation and wetlands typically includes changes in plant community composition caused by altered hydrology or direct damage to above ground structures such as tussocks or woody stems and branches. Long term studies have shown that the overall impact of seismic vehicle traffic on tundra is low, but impacts can still be measured up to 25 years after exploration (Jorgenson et al. 2010). Seismic vibrator lines and camp train trails on the North Slope were found to be generally visible in summer vegetation for about 5 years after disturbance, and the longer-term impacts involved limited ground subsidence where the trail became a wetter trough (Jorgenson et al. 2003; Jorgenson et al. 2010; Yokel and Ver Hoef 2014). Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree than wetter types dominated by sedges. Studies on best management....		
351.	3-67	23	Crane/FWS	Seismic trails have persisted for much longer than 5 years after disturbance in NPRA. Recommend clarifying the statement made here.		
352.	3-67	23-28	Berendzen/FWS	Habitat destruction and subsidence conflict with refuge purposes. Protective measures including more snow and frozen soil depth should be discussed.		

Deleted: utilized

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
353.	3-68	14 - 16	Jorgenson/FWS	Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to 15 the footprint edge. Thermokarst results in ponded areas extending into the tundra and altering the vegetation and wetland plant community structure. Change to: Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to the footprint edge, with ponded areas extending into the tundra and altering the vegetation and wetland plant community structure (Raynolds et al. 2014). Citation: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224. (Note to FWS: this paper should be cited in the EIS, at least here for thermokarst around pads and roads, on page 3-41 and probably other places in document too.		
354.	3-70	26-33	Berendzen/FWS	In addition to loss of vegetation to placement of fill, there will be vegetation loss to tundra scarring from equipment travel such as seismic or other. This conflicts with refuge purpose . . . Need to evaluate conflict with other refuge purposes ! !		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
355.	3-73	3.2.10	John T/FWS	The entire impact analysis is qualitative and references BLM 2004 and BLM 2018. The coastal plain hydrology is significantly different (22% vs 2% of surface area is water) and cannot be evaluated based on different hydrologic conditions or without water use by season, year, and activity. Information on water availability has been identified, but there is no information on water needs by industry (please add table in Appendix E- Water Use and Requirements). How much water is required for ice road construction and exploration? Development? Dust abatement?... How does this compare to water availability and distribution across the coastal plain? Trawicki et al. 1991 identified winter water was limited in quantity and distribution. How will this be addressed?		
356.	3-73	Table 3.3.3-I	Randy Brown USFWS	Spelling issue, correct spelling is: Katakaturuk; I've never heard of a West Canning River. Note c indicates that the Marsh Fork is included with the Canning River entry four down from the top so that isn't what is referred to here as West Canning. Sadlerochit River is not included in this list even though it supports resident dwarf Dolly Varden and Arctic Grayling within the program area during summer and winter.		
357.	3-74	Lines 5-7	Randy Brown USFWS	I would rephrase the sentences here to read: "...however, by late fall the lagoons become saline again as freshwater input declines. As ice forms on the lagoons the water below becomes hypersaline and very cold, the result of ion exclusion during ice formation, restricted flow between the lagoons and the open sea beyond, and freezing point depression with greater salinity. These cold, hypersaline lagoon environments become unsuitable habitats for both anadromous and marine fishes during winter."		
358.	3-75	23-29	Randy Brown USFWS	This paragraph is very awkward and aside from the first sentence (lines 23-24), which would be a suitable concluding sentence on an earlier paragraph, should be deleted.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
359.	3-75	5-6	Randy Brown USFWS	The statement that "...only the Dolly Varden, ninespine stickleback and arctic grayling overwinter in freshwater habitats in the program area..." is not correct. The lower Canning River is in the program area and there are burbot and round whitefish in that drainage including the lower reaches. This point is brought up in the next paragraph on line 12, but the original sentence should be modified so it becomes a true statement.		
360.	3-76	7-8	JohnT/FWS	2 Acts are identified, but are not included in Appendix D. Sustainable Fisheries Act, Magnuson-Stevens Fishery.....		
361.	3-76	Table 3.3.3-2	Randy Brown USFWS	Spelling errors: Gadidae is misspelled; scientific name for ninespine stickleback is Pungitius pungitius; as of 2013, the American Fisheries Society (AFS) classifies Arctic Flounder as Pleuronectes glacialis, Fishbase.org currently uses Liopsetta glacialis but we should probably follow AFS;		
362.	3-76	Table 3.3.3-2	Randy Brown USFWS	I would delete sheefish from the table; they are present in the Mackenzie River but rarely go west of Shingle Point, which is far to the east of Herschel Island, which is east of the border between the US and Canada. I have seen no documents suggesting they have ever been encountered at Herschel Island. They should not be in this list.  In a related manner, Slimy Sculpin should also be removed from this list. Appropriate habitats in the Canning River have been sampled many times since the 1970s and nobody has found them. They are very apparent when present. They are present in the Sagavanirktok River drainage and have been found in a small stream to the west of the Canning River but it would require a marine migration to get to the Canning River. They should be removed from the list.		
363.	3-78	15	Matz/FWS	Add to end of sentence, "...decreasing habitat quality, including through mobilization of contaminants specific to the underlying geology."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
364.	3-79	17	Matz/FWS	Change sentence to read, "...can increase sediment runoff, turbidity, and contaminant concentrations in streams."		
365.	3-79	5	Randy Brown USFWS	Edit: should read "...of fish in the program area."		
366.	3-80	27	Matz/FWS	Missing from this section (and from throughout the document) is discussion of how erosion, either from climate change or anthropogenic earth-disturbing activities can mobilize contaminants – elements and minerals found in the underlying geology (e.g., uranium). Also missing is a discussion of contaminant mobilization from melting permafrost (e.g., methyl mercury). These sources have ramifications for Water Quality, Fish and Aquatic Invertebrates, Birds, Marine Mammals and Subsistence. A suggested edit to the paragraph starting on line 28 is: "...hazardous materials, potential spills from wells, pipelines, or other infrastructure, and mobilization of contaminants into aquatic or terrestrial systems from erosion, fugitive dust, and permafrost degradation."		
367.	3-81	20	Crane/FWS	The statement regarding long-term survival and distribution of freshwater fish in the program area be negatively affected implies that this alternative is not consistent with the other 4 purposes of the refuge. This is an example of my general comment above. It is not clear if the alternatives affect the other 4 purposes of the refuge and if they do, to what extent. Recommend discussing this aspect further in the document.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
368.	3-81	21	Loya/FWS	An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt C on fish, aquatic species and habitat. Recommend adding:  Due to lack of protection of fish habitat and water resources in areas where fish are mostly present, Alternative C would have similar impacts to Alternative B, which include adversely affecting the long-term survival and distribution of freshwater fish in the program area. Lack of protection of springs and auefs could result in the loss of fish overwintering habitat.		
369.	3-81	31	Loya/FWS	An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt D on fish, aquatic species and habitat. Recommend adding:  Impacts to fish and aquatic species would be limited under Alt D and occur mostly in the western portion of the program area. Impacts would be predominantly be indirect effects of changes in hydrology associated with infrastructure outside river and lake buffers or where infrastructure crosses river corridors. Protection of springs through studies and NL and NSO would reduce likelihood of disruption of groundwater that supports fish habitat.		
370.	3-81	32	Loya/FWS	Cumulative Impacts does not address the potential for any of the other actions to affect fish resources, including those that may pose the risk of an offshore oil spill. Recommend considering actions in Table M-I.		
371.	3-81	37	Loya/FWS	Recommend adding sentence to cumulative impacts section that addresses seismic impacts: Impacts from areawide seismic may result in changes in hydrology and water quality, potentially affecting fish habitat, if surface damage results in thermokarst and water channel formation.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
372.	3-82	14-15	Latty/FWS	<p>The sentence states that small-bodied birds dominate the ARCP, with shorebirds the guild with the largest population size and provides the Pearce et al. (2018) citation. It doesn't appear that citation states this Arctic Refuge area, but rather for the whole of the Arctic Coastal Plain and originates from Liebezeit et al. (2009). Please consider removing that statement, as there is likely not adequate information to support the conclusion of the predominance of any species group in the program area. Outside of a few species, the lack of data is even greater for the number of birds that stopover or stage in the Refuge foothills, coastal plain, and lagoons.</p> <p>Liebezeit, J. R., S. J. Kendall, S. Brown, C. B. Johnson, P. Martin, T. L. McDonald, D. C. Payer, C. L. Rea, B. Streever, A. M. Wildman, and S. Zack. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications 19:1628-1644.</p>		
373.	3-82	14-16	Latty/FWS	Please define species groups here as it's currently unclear if they align with definitions described later in this section.		
374.	3-82	29-30	Latty/FWS	Please consider changing: "most of the current information on bird abundance and distribution for the program was" to, "detailed distribution and abundance data for the program area are lacking for many, and contemporary data is lacking for most bird species. In addition, much of the contemporary data was ..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
375.	3-82	9	Latty/FWS	<p>This line introduces the number of bird species known to occur in the Arctic Refuge Coastal Plain. It appears this information comes from the Arctic NWR CCP. If that is correct, than the description of the area this encompasses is not clearly defined here. The CCP states, "In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded". Please consider replacing, "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" for "Arctic Refuge Coastal Plain" as the aforementioned area includes lands outside the Coastal Plain. A citation for the Arctic Refuge CCP should also be provided it this is the source.</p> <p>This line also states, "as of 2015, 156 bird species have been recorded...". I was unable to find specific language in the Refuge CCP that states this list was updated in 2015 (the year the CCP was adopted). Please consider removing, "As of 2015".</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
376.	3-83	2-3	Latty/FWS	<p>The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a>.</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		
377.	3-83	25-31	Latty/FWS	<p>Spectacled eider have been documented breeding in the program area with the most recent known nest occurring at the Canning River Delta in 2017. Please consider adding a sentence stating that spectacled eider have been documented breeding in the program area in recent years citing USFWS, unpublished data. Contact Chris Latty <a href="mailto:Christopher_latty@fws.gov">Christopher_latty@fws.gov</a> for more details. Spectacled eider are an uncommon breeder in the program area.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
378.	3-84	13-16	Latty/FWS	Please consider changing this sentence to: "Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, prior to 2018 only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution across the program area relatively unreliable."		
379.	3-85	40	Swem-Latty/FWS	Please consider changing "diversity in abundance" to "differences in distribution among".		
380.	3-86	32	Swem-Latty/FWS	Please consider adding the sentence, "Northern harrier are an uncommon summer resident and both northern harrier and merlin may breed in the program area (U.S. Fish and Wildlife Service 2015)."  U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. US Fish and Wildlife Service.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
381.	3-88	11	Latty/FWS	<p>In addition to changes in predator behavior, impacts may include changes in predator abundance and distribution. Development on Alaska's North Slope, near oilfields and villages, has been demonstrated to lead to increased predator densities, mainly due to anthropogenic food sources, and possibly to a changing composition of predators (Eberhardt et al. 1982, Truett et al. 1997, Burgess 2000, Stickney et al. 2014). Please consider adding, "and changes in predator abundance" after "facilities."</p> <p>(Burgess, R. 2000. Arctic fox. The natural history of an arctic oil field: development and the biota. Academic Press, San Diego, California, USA:159-178. Eberhardt, L. E., W. C. Hanson, J. L. Bengtson, R. A. Garrott, and E. E. Hanson. 1982. Arctic fox home range characteristics in an oil-development area. The Journal of Wildlife Management:183-190. Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. Arctic 67:196-202. Truett, J. C., M. E. Miller, and K. Kertell. 1997. Effects of Arctic Alaska Oil development on brant and snow geese. Arctic 50:138-146.)</p>		
382.	3-88	19-21	Latty/FWS	An additional indirect impact could occur if habitat quality is impacted from water removal on which many birds rely. Please consider adding, "and impacts to habitat quality from water removal" after "...and terrain surfaces"		
383.	3-89	30	Crane/FWS	The statement "use of ice roads is extensive under all action alternatives..." is an example of how this resource need requires further analysis within the document given the limited amount of freshwater resources in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
384.	3-89	37-38	Latty/FWS	<p>Landbirds occur in similar number to waterbirds (e.g., shorebirds, loons, waterfowl, larids) during the breeding season in the program area. For example, Bart et al. (2013) estimated ~ 400,000 waterbirds and Bart et al. (2012) estimated ~300,000 passerines and ptarmigan occur on the Refuge coastal plain (i.e. excluding foothills which was calculated separately) during the breeding season. Because landbirds are also abundant in the program area, they should be considered in this section. Please consider adding a sentence regarding the potential impacts to landbirds which occur at similar or higher densities in moist areas and uplands of the on the Arctic Refuge coastal plain, compared to wetlands (varies by species). Suggest, removing, "which support lower densities of waterbirds" and changing to, "which support higher densities of passerines, ptarmigan, and some shorebirds like whimbrel and American golden-plover".</p> <p>Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. Arctic shorebirds in north america: a decade of monitoring. University of California Press.</p> <p>Bart, J., R. M. Platte, B. Andres, S. Brown, J. A. Johnson, and W. Larned. 2013. Importance of the National Petroleum Reserve-Alaska for Aquatic Birds. Conservation Biology 27:1304-1312.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
385.	3-89	5-7	Swem-Latty/FWS	Please consider changing the sentence in lines 5-7 to the following.  "When estimating the incidental take of spectacled eiders that would be caused by the construction and operation of oilfield infrastructure, the USFWS considers the direct loss of habitat due to gravel fill plus indirect loss in an adjacent zone of influence (estimated to be ~ 200 m, or 656 ft wide) where disturbance could prevent spectacled eiders from nesting. Implicit in this method of estimating impacts is the unproven and conservative assumption that displaced pairs will not move and nest successfully elsewhere."		
386.	3-90	1-2	Latty/FWS	Please consider changing this sentence to, "Effects to birds from habitat alternation of ice roads is currently unknown, but it is expected to be minor compared to some other risk factors listed below."		
387.	3-90	12-13	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or add a discussion of the risks to red-throated and Pacific loons that do regularly breed in the program area.		
388.	3-90	15	Loya/FWS	Provide a reference or detail what is meant by: "Rehabilitation would follow North Slope reclamation guidelines." Ensure that paragraph on gravel is consistent with ROP 26 and differences between the B/C and D are evaluated.		
389.	3-90	17 and 21	Latty/FWS	Line 17 states that non-breeding and brood rearing waterbirds may benefit from grave pits, but then line 21 states breeding birds may also benefit. Please clarify by adding breeding birds to line 17.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
390.	3-90	17-21	Latty/FWS	The habitat alternation from gravel mining would affect different species differently; therefore, it is not advisable to consider all birds together. These sentences would be more accurate if it stated some species may be harmed, while other species may benefit from habitat alterations associated with gravel extraction.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
391.	3-90	2	Latty/FWS	<p>Jorgenson et al. (2010) reported that severe impacts to tundra vegetation persisted for two decades after disturbance under some conditions in the program area. Kemper and Macdonald (2009) reported that seismic lines in low arctic tundra areas had less vascular plants and more bare ground compared to reference areas and that in upland areas, mosses and lichens also occurred less frequently. In addition, they reported that the active layer increased after seismic disturbance. Although data is not available for the program area, in areas of discontinuous permafrost linear disturbances, such as winter roads and seismic lines, have been reported to alter the hydrology, ecology, and ground thermal regime (Williams et al. 2013, Braverman and Quinton 2015).</p> <p>Given there have not been any studies to examine short- or long-term impacts to birds from ice roads, nor research on how hydrology and subsequently surrounding habitat might be impacted on the Alaska coastal plain, please consider removing, "and the extent would be limited to the immediate area covered by ice."</p> <p>Jorgenson, J. C., J. M. Ver Hoef, and M. T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. <i>Ecol Appl</i> 20:205-221.  Kemper, J. T., and S. E. Macdonald. 2009. Effects of Contemporary Winter Seismic Exploration on Low Arctic Plant Communities and Permafrost. <i>Arctic, Antarctic, and Alpine Research</i> 41:228-237.  Williams, T. J., W. L. Quinton, and J. L. Baltzer. 2013. Linear disturbances on discontinuous permafrost: implications for thaw-induced changes to land cover and drainage patterns. <i>Environmental Research Letters</i> 8:025006.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
392.	3-90	7-8	Latty/FWS	It's stated here that water withdrawal may affect water chemistry. Because changes in water chemistry may impact the aquatic invertebrate that some birds forage on, please consider adding, "and impacts to aquatic invertebrate communities" after, "in some fish mortality".		
393.	3-90	9	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or change "yellow-billed loons" to "loons".		
394.	3-90	9-13	Latty/FWS	Water-source lakes may include lakes used by a variety of birds, not just yellow-billed loons. And because yellow-billed loons are not listed as a known breeder in the program area, suggest changing to, "Water-sourced lakes may include lakes used by a variety of birds during the breeding and non-breeding seasons. Drawdowns may lead to changes in the abundance and distribution of foods on which tundra birds rely. Drawdowns may also impact shorelines, thereby degrading the quality of areas as breeding and non-breeding habitat for a variety of waterbirds including shorebirds, loons, and waterfowl."		
395.	3-91	16	Latty/FWS	This section is described as "disturbance and displacement", but the terms are not well defined. Please consider defining these terms at the beginning of this section.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

396.	3-91	22-24	Latty/FWS	<p>Because winter is not defined here, it's unclear if this statement is accurate. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002, p. 16). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995, p. 377). Some Snowy Owls (<i>Bubo scandiacus</i>) winter on Arctic breeding grounds, but most arrive during Apr and May, with egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (<i>Falco peregrinus</i>), Rough-legged Hawks (<i>Buteo lagopus</i>), and Short-eared Owls (<i>Asio flammeus</i>), arrive to the Arctic and initiate nesting in May and early June (summarized in Pitelka et al. 1955, p. 12, Cade 1960, Bechard and Swem 2002, p. 16).</p> <p>Please define the period winter is meant to describe. If it overlaps with periods where breeding raptors occur, please update the document to reflect this.</p> <p>Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (<i>Buteo lagopus</i>). in A. F. Poole, and F. B. Gill, editors. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. <i>University of California Publications in Zoology</i> 63:151-290.</p> <p>Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (<i>Bubo scandiacus</i>). in P. G. Rodewald, editor. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (<i>Aquila chrysaetos</i>). in A. F. Poole, and F. B. Gil, editors. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. <i>The Condor</i> 57:3-18.</p>		
------	------	-------	-----------	--	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. <i>Journal of Field Ornithology</i> 66:373-379.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
397.	3-91	36-38	Latty/FWS	<p>No definitions are provided of the various levels of disturbance, therefore it difficult to interpret this sentence. If "low" disturbance is intended to include changes in incubation constancy (as is implied here) please consider adding, "increased predation risk" after "incubation constancy." Although this is also mentioned in "high disturbance" discussion, reduced productivity due to human disturbance by foot traffic at nest sites is the most consistently reported effect of human presence. Reduced nest survival has been demonstrated for many tundra nesting birds, including cackling and greater white-fronted geese; common, king, and spectacled eider; and pacific and yellow-billed loons (Bowman and Stehn 2003, Bentzen et al. 2008, Wilson et al. 2012, Uher-Koch et al. 2015, Meixell and Flint 2017).</p> <p>Bentzen, R. L., A. N. Powell, and R. S. Suydam. 2008. Factors influencing nesting success of king eiders on northern alaska's coastal plain. Journal of Wildlife Management 72:1781-1789.</p> <p>Bowman, T. D., and R. A. Stehn. 2003. Impact of investigator disturbance on spectacled eiders and cackling Canada geese nesting on the Yukon-Kuskokwim Delta. in Unpublished report prepared for US Fish and Wildlife Service, Anchorage, Alaska.</p> <p>Meixell, B. W., and P. L. Flint. 2017. Effects of industrial and investigator disturbance on Arctic-nesting geese. The Journal of Wildlife Management:n/a-n/a.</p> <p>Uher-Koch, B. D., J. A. Schmutz, and K. G. Wright. 2015. Nest visits and capture events affect breeding success of Yellow-billed and Pacific loons. Condor 117:121-129.</p> <p>Wilson, H. M., P. L. Flint, A. N. Powell, J. B. Grand, and C. L. Moran. 2012. Population ecology of breeding pacific common eiders on the Yukon-Kuskokwim Delta, Alaska. Wildlife Monographs 182:1-28.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
398.	3-91	37	Latty/FWS	Please change "increase" to "decrease".		
399.	3-92	11-12	Latty/FWS	<p>Please consider changing this sentence to, "Liebezeit et al. (2009) reported a decrease in nest survival of passerines within 3.1 mi of oilfield infrastructure."</p> <p>Although Liebezeit et al. (2009) speculates that this may be been related to differences in predator density, they state, "Contrarily to expectations, our a priori models suggested that neither subsidized nor non-subsidized predator abundance was related to nest survival." Instead, they report that passerine nest survival was related to the distance of nests to the nearest high structure feature and the gravel footprint area within 3 and 16 km of plots.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

400.	3-92	27	Latty/FWS	<p>Please consider removing, "but are unlikely to affect population sizes or nesting densities of breeding birds".</p> <p>There is relatively little statistically rigorous information to support or dispute the hypothesis of "no effect" of disturbance on breeding tundra nesting bird density. However, in other habitats several investigators have reported lower density in the vicinity of infrastructure (see Benítez-López et al. 2010 and meta-analysis the references within), while others reported higher densities. For example, Reijnen et al. (1995) found about half the bird species investigated had lower densities adjacent to roads and attributed this to noise load. Green et al. (2017) found abundance at sage-grouse lek sites was negatively related to oil and gas infrastructure density. Nenninger and Koper (2018) found sparrow abundance decreased near oil infrastructure sites. Davis (2017) reported bird density was greater in disturbed compared to undisturbed areas near oil and gas infrastructure in south Texas.</p> <p>Davis, K. R. 2017. Impacts of Oil-and-Gas Development in the Eagle Ford Shale on Quail and Other Birds. Texas A&amp;M University-Kingsville.</p> <p>Green, A. W., C. L. Aldridge, and M. S. O'donnell. 2017. Investigating impacts of oil and gas development on greater sage-grouse. The Journal of Wildlife Management 81:46-57.</p> <p>Nenninger, H. R., and N. Koper. 2018. Effects of conventional oil wells on grassland songbird abundance are caused by presence of infrastructure, not noise. Biological Conservation 218:124-133.</p> <p>Reijnen, R., R. Foppen, C. T. Braak, and J. Thissen. 1995. The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads. Journal of Applied Ecology 32:187-202.</p>		
401.	3-92	28-42	Latty/FWS	Please considering adding a sentence regarding boat traffic not related to screeding and barging to this paragraph.		

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Although it's mentioned elsewhere, it seems most applicable in this paragraph. For example, please consider adding: "Boat operations for other activities may also occur across the duration of the project." after, "visual disturbance." in line 31 and "Displacement and disturbance to birds from other boating activities may also be short in duration, but may occur over a broad area and across the duration of the project." in line 42 after, "small area."		
402.	3-92	31	Latty/FWS	<p>A variety of waterfowl and sea birds use the program area lagoons during summer and fall. For example, Lysne et al. (2004) found up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Refuge coast.</p> <p>Please consider adding: "Many seabird species use the nearshore waters of the Beaufort Sea. Lysne et al. (2004) recorded over 23,000 long-tailed ducks along the Refuge coast during a survey in late summer 2003. They also reported a substantial portion of yellow-billed loons, red-throated loons, scaup, and pacific loons counted during the entire Alaska North Slope survey occurred along the Refuge coast during some years." after, "visual disturbance." In line 31.</p> <p>Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
403.	3-92	34	Latty/FWS	Additional references are available for how marine birds documented in the program area lagoons might respond to disturbance. Please consider adding the sentences: "Johnson (1982) reported displacement of long-tailed ducks in response to aircraft, boats, and human disturbance. Schwemmer et al. (2011) reported ship traffic affected flight reactions in sea ducks and the distribution of loons." after "from wind and waves (Flint et al. 2004)."  Johnson, S. R. 1982. Continuing investigations of Oldsquaws (Clangula hyemalis L.) during the molt period in the Alaskan Beaufort Sea. Final Report To Outer Continental Shelf Environmental Assessment Program Research Unit 467. Schwemmer, P., B. Mendel, N. Sonntag, V. Dierschke, and S. Garthe. 2011. Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications 21:1851-1860.		
404.	3-92	34	Latty-Swem/FWS	Please consider adding the timing of long-tailed duck molt and other seabirds lagoon use to better qualify when the lagoons are predominantly used by seabirds.		
405.	3-92	3-4	Latty/FWS	Please consider moving this sentence to the section describing habitat loss. Although I do not have access to the full Troy and Carpenter citation, it appears to specifically address the redistribution of nesting birds after pad construction (i.e. habitat loss).		
406.	3-92	37-40	Latty/FWS	The sentence as written may not adequately represent the finding in Flint et al. 2003 or Fisher et al. 2002. Please considering changing the sentence to, "Site fidelity was not clearly impacted by seismic surveys (Flint et al. 2003) and aerial surveys did not find a difference in density of long-tailed ducks between industrial and control sites (Fisher et al. 2002)."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
407.	3-93	24-25	Latty/FWS	Although snow geese occur in substantial numbers during the post-breeding period, so do many of species of birds. Please consider changing this sentence to, "All types of air traffic also have the potential to cause disturbance and displacement of birds outside of the breeding season."		
408.	3-93	26	Latty/FWS	Please consider changing "as many as 300,000" to "For example, over 300,000" as 325,760 snow geese were estimated in 1978 (Kendall 2006).  Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service		
409.	3-93	9-16	Latty-Swem/FWS	Although this section provides background on the type of flights that may occur in support of development and some estimates of timing, it does not currently describe the magnitude. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates or the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different unimproved sites. Depending on the type of activity associated with these take-offs and landings and it's duration, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information).		
410.	3-94	23	Crane/FWS	Small spills still pose a risk to birds and other wildlife regardless if they reach the tundra or not. Recommend rewording this statement to address this potential effect.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
411.	3-97	38-39	Latty-Swem/FWS	In NPR-A, residents of nearby villages may be allowed access to roads which may increase harvest. Please consider updating this sentence to reflect if and how changes in access may impact harvest.		
412.	3-98	13	Latty-Swem/FWS	Please change "sooner" to "earlier".		
413.	3-98	32	Latty-Swem/FWS	Please change "nest sites" to "resources".		
414.	3-99	12	Crane/FWS	While polar bears are marine mammals, polar bears in the SBS population do spend a fair amount of time on land. Recommend rewording the statement that "None of the terrestrial mammals..." are listed..." to account for this. This would then be consistent with language on page 3-113 where polar bears are referenced and protections of polar bear dens is addressed in Alternative D and elsewhere in this section.		
415.	3-99	26-27	R. Wilson/FWS	Recommend changing the sentence to read '... and are an important subsistence resource for Inupiaq and Gwich'in hunters.' The line shouldn't be specific to the refuge, because these animals travel beyond the refuge, and whatever impacts they experience from development in the refuge could be felt beyond it.		
416.	A2-6, A2-8	Map 2-6 and 2-8	Kaye/FWS	Individual stip for Alt DI, show the Wilderness boundary stip 10 from the west up to the Lease stip 7 area, but not beyond. Show that this is providing the boundary in both a stip 7 & a stip 10 area. Doing so would more visually show the area's importance.		

Deleted: Line should

Deleted: Why not s

Deleted: Recommend

Deleted: ?

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
417.	A3-12	Map 3-12	Randy Brown USFWS	Dolly Varden also overwinter in the Canning River in the reach upstream (south) of the braided delta on the western edge of the 1002 Area (see Brown et al. 2018).  Perhaps it is best that the EIS reflect the anadromous waters catalog entries, but I think the portrayal of upstream distribution of Dolly Varden in the minor streams between the Canning and Hulahula rivers and between the Hulahula and Aichilik rivers makes it appear that Dolly Varden are more abundant and broadly distributed in freshwater systems than they really are. All the sampling studies I've read on these systems suggests that juveniles are very rarely encountered and almost always in the lower reaches.		
418.	A3-13	Map 3-13	Randy Brown USFWS	Sadlerochit Spring was not identified in this map as essential fish habitat (EFH) and several streams that do not support fish during winter were included as EFH. Recommend revising as appropriate.		
419.	A3-2	Map 3-2	Kaye/FWS	Map 3-2 shows mines, prospects & mineral occurrences. I don't know about those. I am not aware of prospects & occurrences in the program area, but there are no mines in the program area identified with <u>triangles</u> , so Mines should be deleted from the title, as it's misleading		
420.	A3-3	Map 3-3	Kaye/FWS	Map 3-3: Are all these wells depicted here "existing"? or are some previous well sites? If that's the case, the map should differentiate between existing & previous well sites		
421.	A3-44	Map 3-44	Kaye/FWS	Special Designations. Although it's outside the program area, could recommend this map show the adjacent designated Wilderness, since it's a significant factor in our proposed boundary stip.		
422.	App A	Map 3-3	O'Dell/FWS	The map does not <u>and</u> should include the KIC #1 exploration well.		

Deleted: triangles..

Deleted: m

Deleted: the latter,

Deleted: P

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
423.	App. A	Map 3-44	S. Arthur/FWS	Not all of the coastal plain is a Marine Protected Area. Recommend revising <a href="#">the</a> shading to indicate the correct area.		
424.	Appendix 2		Jorgenson/FWS	In appendix 2, 'visual resources photos' has only 2 photos, neither from the program area. It is not clear what the purpose of this appendix is. Recommend providing additional detail.		
425.	Appendix A	Map 3-18	Loya/FWS	Colors in legend do not fit maps; see Map 3-20 for correct colors by category		

Deleted: Revise

Deleted: What is

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
426.	Appendix D			<p>Missing pertinent laws and policy –the USFWS does implements a variety of statutes beyond ESA/MMPA/FWCA</p> <p>Marine Mammals Protection Act</p> <p>National Wildlife Refuge System Administration Act, amended through the National Wildlife Refuge Improvement Act (including BIDEH policy – Service Manual 601 FW 3, dated 16 Apr 2001)</p> <p>Migratory Bird Treaty Act</p> <p>Bald Eagle and Golden Eagle Protection Act</p> <p>US Fish and Wildlife Service Mitigation Policy dated 23 Jan 1981 (reinstated via 2016 policy withdrawal effective 30 Jul 2018: FWS 2018))</p> <p>The Wilderness Act</p> <p>Wild and Scenic Rivers Act</p> <p>National Historic Preservation Act</p> <p>Native American Graves Protection and Repatriation Act</p>		
427.	Appendix E		JohnT/FWS	Please includeInclude additional Table for Water Use/Requirements by activity. Similar to tables in GMT2 DEIS		
428.	Appendix G		JohnT/FWS	Tables # in text 3.2.10 do not match actual table #s in Appendix G.		
429.	Appendix G	Table G-2 G-3	JohnT/FWS	Table title: add "Annual"		

Deleted: more than

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
430.	Appendix G 3-46	Table G-6 19	JohnT/FWS	Referenced as Table G-5 in text. Titles are not necessarily representative of the data; peak spring breakup was not captured during most years. Include column with dates of start and end of record for each year. USGS has more recent data for the Canning River, Tamayariak River and is currently gaging the Hulahula River. This information should also be presented		
431.	Appendix G 3-48	Table G-7 12	JohnT/FWS	Change G-6 to G-7		
432.	Appendix G	Tables G-4, G-5	JohnT/FWS	Combine Tables. Remove Atigun, Kongakut and Sagavanirtoq Rivers, add Canning, Hulahula, Okpilak, Jago, Aichilik and Saderochit Sprg. Creek to current Table G-5		
433.	Appendix G, 3-45	Table G-1 11-14	JohnT/FWS	Table title: please add "Annual" to Average Monthly Air Temp., the lack of Barter Island and Toolik data and the difference in years do not allow for a comparison as stated in text. Kugaruk data is good- just fix title please.		
434.	D-1	5	Conn / FWS	The name of the treaty being discussed in this section is the "Agreement on the Conservation of Polar Bears" but it is often referred to as the Range States Agreement. I suggest changing the section heading to include this more commonly known nomenclature.		
435.	D3		JohnT/FWS	Bald and Golden Eagle Protection Act, referenced in p. 3-86, l. 35-36, not included in Appendix D.		
436.	D3	21-26	Campbell	Add: ANILCA Section 1431, Arctic Slope Regional Corporation Lands. Specifically Sections 1431(a), (g) and (o)		
437.	D3	21-26	Campbell	Add: Agreement Between Arctic Slope Regional Corporation and the United States of America, August 9, 1983 Specifically Including Appendices 1 and 2		
438.	D3	21-26	Campbell	Add: ANILCA Sections 301, 303(2) and 304.		

Deleted: Please include

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
439.	D3	21-26	Campbell	Add: Public Land Order 2214 Establishing the Arctic National Wildlife Range, December 6, 1960		
440.	D3	21-26	Campbell	Revised Arctic National Wildlife Refuge Comprehensive Conservation Plan, January 2015		
441.	D-3	21	Carl/FWS	The USFWS has the following additional authority: 1. It is the administering agency under the Federal Advisory Committee Act for all of the Federal Subsistence Regional Advisory Councils established under Title VIII of ANILCA, which includes the North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils. 2. It still possesses authority under Section 1002 of ANILCA to administer elements of an oil and gas exploration program in the Coastal Plain. That provision was not modified or deleted by the Tax Act.		
442.	D-3	21-26	S. Arthur/FWS	There is no mention of the various laws and policies that establish management purposes and govern the administration of a NWR (e.g., National Wildlife Refuge System Improvement Act) and specifically the Arctic Refuge (e.g., PLO 2214, ANILCA). The Arctic Refuge has additional legally mandated purposes that must be balanced with the Oil & Gas program, and the FWS has additional responsibilities here besides Endangered Species consultations.		
443.	D-3	21-26	R. Wilson/FWS	This should also list the Marine Mammal Protection Act. And also the appendix should include a section for NOAA and their mandates under MMPA and ESA?		
444.	D-3	21-26	Campbell	Add: Terms and Conditions for Land Exchanges and Resolution of Conveyancing Issues in Arctic Slope Region Between the Department of the Interior and Arctic Slope Regional Corporation. June 29, 1979		

**Commented [CD23]:** Check on this

**Deleted:** Why is t

**Deleted:** ?

**Commented [CD24]:** Comment reflected above

**Deleted:** Shouldn't t

**Deleted:** ?

**Deleted:** T

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
445.	D-3	22	Conn/FWS	Suggest rewriting the section describing ESA. Possible language: The USFWS, along with NMFS, is responsible for administering the Endangered Species Act. Federal action agencies will consult with the USFWS to ensure the effects of the actions they are authorizing are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat. The results of this consultation will be provided in a Biological Opinion and may include Terms and Conditions to reduce any incidental take of a listed species.		
446.	D-3	24	Conn/FWS	Keep language describing FWCA (maybe as a separate bullet to be consistent with other agencies authorities in the document).		
447.	D-3	26	Conn/FWS	Add another <sup>an</sup> additional bullet for the MMPA. Suggest the following language: All marine mammals are protected under the Marine Mammal Protection Act. Jurisdiction of the Act is shared by NMFS and USFWS depending upon the species being considered. Using specific criteria, and on application, the USFWS may authorize the take of marine mammals.		
448.	D-3	26	Conn/FWS	Suggest the following language: The Bald and Golden Eagle Protection Act prohibits the taking of eagles including their parts, nests, or eggs. If a project may result in take, and after avoidance and minimization measures are established, the USFWS may issue an eagle take permit.		
449.	D-4	17	Carl/FWS	The Alaska Department of Natural Resources possesses another regulatory authority relevant to the Coastal Plain oil and gas leasing program: the obligation to adjudicate instream flow reservations and other applications for reserved water rights. Recommend revising as appropriate.		
450.	D-7	USFWS Section	Conn/FWS	Re-word the MMPA permit to read "Issue incidental and/or intentional take authorization under the Marine Mammal Protection Act.		
451.	D-7	USFWS Section	Conn/FWS	Add a line "Issue take permits as appropriate pursuant to the Bald and Golden Eagle Protection Act.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

Deleted: If

Deleted: is added



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
452.	E-1	10	O'Dell/FWS	"Reserves" are proven and economically producible, so term is inaccurately used until you get into the RFD assumptions. Change "reserves" to "undiscovered resources"		
453.	E-1	29-31	Leonard/FWS	Sentence beginning with 'Proposed plans...' is inscrutable. I cannot make a suggestion because multiple grammatical errors in the sentence make it difficult to interpret.		
454.	E-1	Row 17	O'Dell/FWS	There are definitely known plays. There arebut no "proven" plays. Suggest changing "known" to "proven".		
455.	E-1, 3-32	23-25 13-18	JohnT/FWS	The \$42 per barrel (2009 dollars) needs to be converted to today's value to make reasonable comparison to the current price of \$65. Chapter 3 leaves out that \$42 is in 2009 dollars.		
456.	E-14	19	Berendzen/ FWS	Add "All roads are removed and gravel from them is placed back in the gravel pit it was originally extracted from"		
457.	E-16	25	Leonard/FWS	Subject-verb: Change 'is' to 'are'		
458.	E-17	1-3	Berendzen/ FWS	These gravel pits will destroy the habitat and clearly compromise Refuge purposes. While the gravel pits may not be considered part of the 2,000 acre surface disturbance cap, they will still have short long term effects on the habitat and potentially the other 4 purposes of the refuge. Please provide additional detail as to how BLM concluded they do not contribute to the surface disturbance cap..		
459.	E-4	13	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
460.	E-4	16	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
461.	E-5	17	O'Dell/FWS	Add at the end: "Drilled in 1986 on village of Kaktovik land, the KIC-1 well is the only well drilled in the Arctic NWR. Data from the well has remained confidential."		
462.	E-5	2	Matz/FWS	Define "play" in footnotes, here or at the first mention of it in this section, as was done with other technical terms in Chapter 3.		
463.	E-5	21	O'Dell/FWS	Change "reserves" to "undiscovered resources"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

Deleted: Recommend changing

Commented [LS25]: Not sure what this correction is?

Deleted: todays

Deleted: .

Deleted: even if they aren't



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
464.	E-5	22	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
465.	E-5	4	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
466.	E-7	5	Berendzen/ FWS	I've seen little mention of seismic activity and resulting impacts. Does this document thoroughly evaluate seismic impacts? Short time frames for permitting of seismic and lease sale might complicate this assumption		
467.	E-8	Table E-3	O'Dell/FWS	3D Seismic is projected to take 2 winter seasons (2018/19 & 2019/20). Presumably, the first season would focus on high-potential area of the western part of Coastal Plain. Should the assumption be that 3D will be completed over the highest potential areas? Please clarify.		
468.	E-8	Table E-3	O'Dell/FWS	Additional Seismic Exploration on lease blocks. A more reasonable assumption would be that initial 3D is so designed as to enable targeting of specific exploration AND delineation wells – and would be available for sale to lease holders. Suggest re-evaluation of this progression. (Now noting the description doesn't include a second round of 3D seismic. Should probably be removed from the table.)		
469.	e-8	Table E-3	JohnT/FWS	Add Abandonment and Reclamation to Table E-3.		
470.	E-9	10	JRose/FWS	Please provide clarity on how the estimate of 990 mi <sup>2</sup> was developed. Under alternative D approximately 1600 mi <sup>2</sup> would be available for lease. Is this based upon the maximum amount of area that wells under the development scenario could reach or based upon the 2-D seismic work and the area overlying high and medium plays?		
471.	E-9	16-17	JRose/FWS	Should clarify how far out the nodes are placed. A 3-mile wide layout is considerably different than a .5 mile layout. There is not enough information provided to convey a sense of scale.		

Commented [CD26]: Comment captured in earlier comments.

Deleted: to provide

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
472.	E-9	16-20	Loya/FWS	<p>The description of seismic lines spacing for post-leasing seismic exploration, which would presumably refine existing information, seems like it should be similar to or smaller than that proposed for the area <a href="#">area wide</a> seismic being evaluated in concurrent Seismic EA. Please see Marsh Creek Plan of Operations V.8.1 page 9, which states:</p> <p>Vibrator source points will be located along source lines every 41.25 feet. Geophone receiver lines will run perpendicular to source lines, and both source and receiver lines are spaced approximately 660 feet apart. Geophones will be located along source lines every 165 feet. Up to 20 receiver lines could be placed on the ground at one time. Wireless nodes and geophones will be laid out by crews on foot and through the use of rubber tracked tundra travel approved vehicles.</p>		
473.	E-9	5	Crane/FWS	Recommend clarifying if the statements made regarding assumptions made about leasing refer to the Tax Cuts and Jobs Act or to assumptions made by BLM in preparation of this EIS. For example, "It is also assumed that 3d seismic studies..." appears to be an assumption made by the BLM, but it is not clear with current wording.		
474.	ES-3	37	Loya/FWS	Revise to state known variation in this high uncertainty data: "The program area is estimated to contain between 4.3 and 11.8 billion barrels of technically recoverable oil (BBO), with a mean of 7.7 BBO. Non-associated gas resources are estimated to be between 0 and 10.0 Trillion Cubic Feet (TCF), with a mean of 3.5 TCF." Directly from last paragraph, page AO-14 in USGS assessment. Unable to find the value of 7.041 TCF in gas in USGS assessment.		
475.	ES-3	39	Loya/FWS	Arctic, not arctic.		

Deleted: wideareawide

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
476.	ES-4	24-25	Loya/FWS	Revise: Potential impact on marine mammals, including human-polar bear interactions; vehicle, aircraft and boat traffic and noise disturbance; and accidental, unplanned take by vessel strikes or oil spills		
477.	ES-4	26-27	Loya/FWS	Revise: Impacts on terrestrial mammals, including disturbance from vehicle and aircraft noise, human presence and habitat fragmentation and loss		
478.	ES-4	31	Reed/FWS	Change to "Loss or reduced quality of some recreational opportunities around areas leased for energy infrastructure"		
479.	ES-4	35	JFox/FWS	Wording is unclear. Change to "Residents of Kaktovik are the primary users of..."		
480.	ES-4	36	JFox/FWS	Wording is unclear. Change to "The community of Nuiqsut has the potential to..."		
481.	ES-4	Insert after 31	Reed/FWS	Insert below line 31 and above line 32 the following bulleted item: "Loss of some recreational access around areas leased for energy infrastructure" (see Section 3.4.9, Transportation)		
482.	ES-4	Insert after 39	Reed/FWS	Suggested language: The majority of visitors to Arctic Refuge come specifically to the project area. With expected increases in recreational use coupled with decreased access to recreation in areas users of the Coastal Plain would be likely to experience direct and indirect impacts."		
483.						
484.						
485.						
486.						
487.						
488.						

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
489.	H-I	I		<p>Appendix H does not list taxa specific conservation listings. The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a> .</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		
490.	H-I	5	Latty/FWS	<p>This line introduces the listings of birds occurring on the Coastal Plain of Arctic Refuge and a citation for the Refuge CCP is listed. The CCP provided data for the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters. "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" should be substituted for "Coastal Plain of the Arctic NWR" as the aforementioned area includes lands outside the Coastal Plain.</p>		
491.	I-I	17	Matz/FWS	Add size range for Arctic grayling.		
492.	I-I	18	Matz/FWS	Replace "large" with size range of burbot.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
493.	I-1	24	Matz/FWS	Replace "small" with size range of ninespine stickleback.		
494.	I-1	8	Matz/FWS	Replace "relatively small" with size range of round whitefish.		
495.	I-2	20	Matz/FWS	Replace "relatively small" with size range of least cisco.		
496.	I-2	26	Matz/FWS	Replace "relatively large" with size range of broad whitefish.		
497.	I-2	30	Matz/FWS	Replace "relatively small" with size range of Arctic cisco.		
498.	I-2	37	Matz/FWS	Replace "small" with size range of rainbow smelt.		
499.	I-3	16	Randy Brown USFWS	Typo: should read "...fishes may use coastal and lagoon..."		
500.	I-3	24	Matz/FWS	Replace "They are typically a small to medium sized species" with size range of Arctic cod.		
501.	I-3	32	Matz/FWS	Replace "medium to large in size" with size range of saffron cod.		
502.	I-3	36	Matz/FWS	Provide size range of fourhorn sculpin.		
503.	I-3	39	Matz/FWS	Replace "They are a medium sized species" with size range of Arctic flounder.		
504.	I-3	7,8	Matz/FWS	Provide size ranges of resident and anadromous Dolly Varden.		
505.	I-5	22, 23, 32 and 33	Carl/FWS	Regulations are laws, they are merely laws issued by the Executive branch, as opposed to the Legislative branch (which are statutes). To use the phrase "laws, regulations" suggests that they are not, in fact, laws. Recommend deleting "regulations" which would be included in federal laws.		
506.	M-1	10	Matz/FWS	Remove "growth-inducing effects" as it is an unclear example, and examples are not needed for this general and cited description of indirect effects		
507.	M-10	2 through 4	FWS – BAWR (Allen and Collins)	There are established methodologies for evaluating air quality impacts. This statement should be removed.		
508.	M-10	5 through 7	FWS – BAWR (Allen and Collins)	Mitigation and stipulations can change the overall surface and well development. This statement should be removed.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
509.	M-10	8	FWS – BAWR (Allen and Collins)	Please add "air quality" . . . "BLM approval would require further 'air quality' NEPA analysis. . ."		
510.	M-10	M.3.3 Impacts/ Indicators Table	Matz/FWS	Change last bullet in "Action" column to read, "Noise generated in the construction and operation of roads, well pads, and other ancillary support activities"		
511.	M-13	11	JRose/FWS	Is 200 Acres a typo? Should this read "Up to 2,000 acres of gravel...."		
512.	M-14, M-15	10	JohnT/FWS	<p>Impacts and Indicators Water Resources: Actions Impacting Resource list is incomplete and/or very general: add Seismic Surveys: Use of rolligons or other orv's; add Water withdrawal from lakes for ice roads, pads, airstrips, dust abatement, camp/facilitie support and other uses; add Construction, placement and use of gravel pads, roads, airstrips.; add construction and use of barge docks; add construction and operation of seawater treatment plant; add placement and use of ice roads, bridges, pads, airstrips; add spills;</p> <p>This table could be modeled similar to the M-table for Wetlands and Vegetation. The actions may be different but the construction phase and operation phase are addressed separately.</p> <p>Types of Impact: update impact to match action.</p> <p>Impact Indicators: no units have been identified.</p>		

Deleted: It seems that this should

Deleted: maybe

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
513.	M-16	19	Jorgenson/FWS	In M.3.12, this phrase (or similar) is used repeatedly: 'no indicator available to assess possible plant community changes'. Given the information that is available, please explain why no indicators cannot be developed. Some sources of information: I see that some assumptions about development footprint are made on page M-19. The area that would be covered by 3-D seismic exploration in one winter by 2 crews can also be estimated, based on past surveys in NPRA. Also information on vegetation changes in Reynolds 2014.		
514.	M-16	M.3.11 Impacts/Ind Table	Matz/FWS	Change first line under "Action" column to read, "Introduction of contaminants including petroleum products and heavy metals caused by"		
515.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Gravel Mining for road and pad construction," change middle bullet to read, "Changes in water quality, including turbidity and mobilization of contaminants."		
516.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "New gravel roads, pads, culverts, and bridges," change middle bullet to read, "Temporary and periodic turbidity, sedimentation, and contaminant mobilization during gravel placement, compaction, and grading."		
517.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Vehicle traffic on ice or gravel infrastructure," change second bullet to read, "Habitat and water quality alterations, including contaminant mobilization, due to dust, gravel spray, or sediment runoff from gravel roads."		
518.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Off-road vehicle activity on tundra," change bullet to read, "Habitat alteration due to compression or damage to vegetation resulting in soil exposure, sediment runoff, and contaminant mobilization."		
519.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Potential spills...", change first bullet to read, "Habitat alteration or loss due to spills or leaks."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
520.	M-22	M.3.14 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		
521.	M-23	M.3.14 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
522.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
523.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
524.	M-25	4 (last row of table for M.3.15)	Reed/FWS	Carry through resolution of following comment, which seeks clarification in Analysis Assumptions whether/how sport hunting and other recreation access is intended, to specify type of impact for roads and pads (e.g.: change to "Increased/alterd access for subsistence hunter, sport hunters, and other recreationists."		
525.	M-25	7	Reed/FWS	Clarify in Analysis Assumptions the extent to which sport hunting and other recreation access is intended to be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
526.	M-25	Section M3.16, last point in first row of second column	R. Wilson/FWS	Type of impact should also include 'Possible den abandonment and loss of cubs'		
527.	M-25	Section M3.16, second row, second column	R. Wilson/FWS	Should also include 'Behavioral disturbance to polar bears onshore related to landings of marine vessels'		
528.	M-26	12-14	R. Wilson/FWS	This assumption needs to be modified because we know that not all dens will be detected, and could be lower than 60% based on data in Amstrup et al. 2004. Recommend modifying the assumption such that it assumes that upwards of 60% of dens are initially detected.		

Deleted: I would suggested

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
529.	M-26	7	R. Wilson/FWS	Need to include a bullet under assumptions that 'Offshore oil spills will be sufficiently rare to ignore their potential impacts to polar bears and other marine mammals'. This may not be an appropriate assumption, but it follows from what is considered in the Affected Environments section  Also, should modify the third bullet point to state that it is unlikely that all dens will be identified during den surveys, and that some percent dens are likely to be missed during surveys (>40%; Amstrup et al. 2004)		
530.	M-28	9	DeCleva/USF VS	Previous NRHP eligibility status may prove insufficient due to the passage of time or changes in integrity since the evaluation. It is recommended that the bullet read as: "Cultural resource sites are treated as eligible for the NRHP until they are sufficiently evaluated as determined by BLM."		
531.	M-29	M.3.19 Impact/Ind Table	Matz/FWS	Under "Action Impacting Resource" column for "Contamination," add a bullet: "Release, discharge, or insecure containment of hazardous materials or hazardous wastes." Same line, under "Type of Impact" column, change last bullet to read, "Reduced user access because of perceived or actual increases in subsistence food contamination"		
532.	M-31	M.3.20 Impact/Ind Table	Matz/FWS	For "Action Impacting Resource" column "Disruptions to subsistence activities and uses," add a bullet under Type of Impact: "Reduced social, economic, and nutritional benefits resulting from reduced use of subsistence foods due to actual or perceived increases in subsistence food contamination"		
533.	M-33	12 (table M.3.23 column 3)	Reed/FWS	Delete duplicate second bulleted item		
534.	M-36	10	Matz/FWS	Replace "casual" with more precise terminology, for example, "occasional."		

Deleted: I'm not sure I necessarily agree with this

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
535.	M-36	I6 whole Section M.3.26 Economy	Reed/FWS	Section should be revised to address effects on local tourism enterprise which is employing numerous residents who serve 53 percent of visitors to the project area.		
536.	M-37	M.3.26 Impact/Ind Table	Matz/FWS	Add under "Type of Impacts" column: "Effects on incomes from alterations in subsistence activities" And, provide examples of relevant/selected economic sectors (e.g., tourism, hunting guides, air taxis)		
537.	M-38	M.3.27 Impact/Ind Table	Matz/FWS	For Oil-and-gas development, add an additional impact: " Increase in subsistence food contamination" with an Impact Indicator of "Change in contaminants in subsistence foods"		
538.	M-4	Category Rec and Tourism, Column two (Area)	Reed/FWS	Add: North American Arctic (because context of recreation – particularly polar bear viewing opportunity – extends beyond the region of the North American Arctic)		
539.	M-4	Table M-I	Matz/FWS	For Category Transportation, under Description, add after the first sentence, "Marine transportation in particular is projected to increase with decreases in sea ice associated with climate change."		
540.	M-4	Table M-I	Matz/FWS	For Category Recreation and Tourism, under Description, delete sentence beginning "Air traffic related..." as it is too specific given the general tone of the other Descriptions. Alternatively, add a similar sentence about the effects on wildlife for other Categories, including Oil and Gas Exploration, Development, and Production; Transportation; Subsistence Activities; and Community Development, as all of these have the potential to "impact wildlife species."		
541.	M-5	I9	Jorgenson/FWS	Recommend adding Add information on the cat trains, camp and fuel vehicles. Eg, I2 – I5 rubber tracked vibrators plus the number of camp vehicles?		

Deleted: to needs

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
542.	M-6	43	Reed/FWS	Change to "...occur between Fairbanks and each of the communities within the Arctic Refuge..." (because there are no passenger or air cargo commercial flights between Arctic Village and Kaktovik)		
543.	M-7	I	Reed/FWS	Change to "Government agencies, researchers, and recreationists often charter aircraft for research and travel purposes."		
544.	M-7	II	Reed/FWS	Begin first sentence with " <i>Until recently</i> , recreation...program area." And follow with this sentence: "While a very small number of local residents have historically participated in recreational guiding and tourism, since 2010 residents have developed tourism around polar bear viewing, and in 2017 over 50 percent of the visitors to the program area are served by locally-owned tourism businesses."		
545.	M-8	I	Matz/FWS	Delete sentence beginning with, "Alaskan officials..." While true, it is not relevant nor explanatory within the paragraph.		
546.	M-8	I	Reed/FWS	Delete first full sentence, beginning with "Alaskan officials..." (or include counter perspective to maintain objectivity)		

**Commented [CD27]:** Addressed in previous comment

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
547.	Map 3-1. Physiographic provinces, Appendix A.		Jorgenson/FWS	This map should not be used. Recommend using more recent data to delineate the boundary between coastal plain and foothills in the program area. It appears that the hand-drawn paper map that was created in the days before GIS, was used to inform the map depicted here, at a very broad scale of 1:2,500,000. Given the scale, it is inappropriate to zoom into a small area of the state and use that map to show divisions. The line work on the original map was not done at a scale to justify that. The division between coastal plain and foothills provinces is roughly drawn and follows no discernable topographical breaks on the landscape. Newer and better maps exist. All recent documents produced by the FWS (such as the Arctic NWR CCP 2015) use the Nowacki et al. digital map of ecological regions (2001). It is available at <a href="https://agdc.usgs.gov/data/usgs/erosafo/ecoreg/">https://agdc.usgs.gov/data/usgs/erosafo/ecoreg/</a> . That map is also used by many different agencies in Alaska, for example ADFG: <a href="http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions">http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions</a> . The descriptions of the project area should be rewritten using the newer map. The two maps differ greatly in the program area.		
548.	Map 3-18		R. Wilson/FWS	Recommend including winter, spring migration, and fall migration on the map.		
549.	Map 3-20		R. Wilson/FWS	What is the turquoise line in the maps for Alt C and Alt D, running at the bottom?		
550.	Map 3-21		R. Wilson/FWS	Under lease stipulation 5 (p. 2-7) it states that the coastline buffer goes inland 5 miles and encompasses the drainages that are specified. However, in the map, the coastal buffer goes offshore 5 miles and not inland. The map needs to have the coastal buffer go inland 5 miles and encompass the drainages listed on p. 2-7 for Alt-D.		

Deleted: The

Deleted: .

Deleted: Why are

Deleted: not depicted?

Deleted: s

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
551.	Referen- ces-7	27	JRose/FWS	Jorgensen et al. 2018. Jorgenson et al. was published 8 June 2015. Also check format. Should it be "Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C., & Michaelson, G." or something similar?		
552.	2-19	ROP 4	Burkart/FWS	The scarcity and purposes of the Arctic Refuge warrant greater setback distances for fueling stations and fueling activities. 2,000 feet should be a minimum distance in alternatives D1 and D2. 1,000 feet should be a minimum setback in alternatives B and C.		Note from Wendy: Comments 552-617 have not been reviewed by POCs for inclusion, tone or contradiction to other comments. We will do this Thursday morning.
553.	2-19	Not applicable	Burkart/FWS	Something similar to NPR-A 2013 A-4 ROP should be included. In addition to the A-4 requirements, also include the following: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing 150% of the stored volume when considering terrain and weather conditions, 3) "Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed 210 gallons shall be stored within an impermeable lined and diked area or within approved bear-proof alternate storage containers" and 4) All temporary and permanent Fueling Stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		
554.	2-22	ROP 9, objective	Burkart/FWS	The objective for streams and rivers should be more specific and parallel that for lakes and ponds (e.g. ROP 10). Change the following objective: "Maintain populations of, and adequate habitat for, fish and invertebrates." TO THE FOLLOWING: Maintain natural hydrologic regimes and populations of, and adequate habitat for, fish, and aquatic invertebrates,		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
555.	2-22	ROP 9	Burkart/FWS	Change the ROP to the following: "Withdrawal of unfrozen water or ice aggregates from rivers, streams, and springs during winter is prohibited. If it has been shown that no impacts to hydrology (including hydrologic flow paths) at breakup, channel morphology, and/or impacts to fish and invertebrates and their habitat will occur, withdrawal of up to 20% of ice aggregate from a grounded area ≤4-feet deep may be authorized on a site-specific basis. Monitoring of hydrology and channel morphology prior to and after removal may be required."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

556.	2-22	ROP 10	Burkart/FWS	<p>Rationale for different withdraw volumes compared to NPR-A EIS: 1) impacts on species and habitat are unquantified (NRC 2003), especially impacts of removal of entire permitted volume; 2) lakes are relatively rare in the Arctic Refuge thus a much larger proportion of lakes will be impacted by water withdraw which would have more significant impacts to fish and wildlife in the area; 3) because lakes are rare, companies would be more likely to withdraw fully permitted volume; 4) the original and primary ANILCA purpose of the Refuge is to maintain adequate water quality and quantity to support fish and wildlife and their habitat. Furthermore, impacts of water withdrawal on soils, shorebird habitat (wet meadow zones, and invertebrates in the NPR-A have never been assessed. Studies indicate that dissolved oxygen in untapped lakes is typically close to dissolved oxygen thresholds that, if crossed, would have severe impacts on fish and wildlife habitat. These findings suggest that additional declines in oxygen due to water withdrawal could have a severe negative impact on fish and wildlife habitat. Based on these studies and the Refuge's primary purpose to maintain adequate water quality and quantity, more conservative guidelines need to be in place. Change requirements a-d TO THE FOLLOWING FOR ALL ALTERNATIVES: "</p> <p>a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 10% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.</p> <p>b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 20% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.</p> <p>c. Lakes with no fish present, regardless of depth: water available for use is limited to 20% of total lake volume.</p>		
------	------	--------	-------------	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 10%, 20%, or 20% volume calculations.		
557.	2-22	ROP 10	Burkart/FWS	There are no requirements for determining fish presence prior to activities that could impact fish. Add the following requirement: Sensitive and nonsensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.		
558.	2-22	ROP 10g	Burkart/FWS	Compaction or removal of snow cover can have dramatic impacts on invertebrate communities and can alter the timing of hydrologic events. Allowing compaction of or removal of snow on any waterbody without fish CHANGE REQUIREMENT G TO THE FOLLOWING: g. Compaction of snow cover or snow removal from waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice. All areas of compaction and removal must be recorded and reported to the USFWS.		
559.	2-22	ROP 10h	Burkart/FWS	Change H to the following: h. Additional modeling and monitoring of lake recharge shall be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds and macroinvertebrates is maintained. Data from these efforts shall be stored in a geodatabase with appropriate metadata and be accessible to the USFWS and the general public.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
560.	2-22	ROP 10.5?	Burkart/FWS	Because water withdrawal from ice-covered lakes can have severe negative impacts on a wide range of species and habitats there is a need for a BMP that puts a cap on the percentage of lakes in each area that can be impacted by water withdrawals. Add the following requirement for alternative B: a) Up to 20% of lakes in each class (1. deep isolated, 2. deep connected, 3. shallow isolated, and 4. shallow connected) in each major ecoregion and watershed (HUC8) can be tapped annually, b) Up to 30% of lakes in each class in major ecoregion and watershed (HUC8) can ever be tapped unless statistically valid studies with the appropriate level of inference indicate there will be no impacts to hydrology, fish and wildlife, and their habitat.		
561.	2-23	ROP C-2	Burkart/FWS	Change last sentence of requirement for alternative B(a) to the following: Snow depth and density measurements would reflect conditions at the time and location of planned operations.		
562.				ROP C-2 for alternative D should also be applicable to Alternatives B and C.		
563.	2-23	C-2 ROP a, d, and f	Burkart/FWS	a. Add the following to the end of the last sentence: "and the US Fish and Wildlife Service." Change the last sentence to the following: Snow depth and density measurements would reflect conditions at the time and location of planned operations.  d. Add "as approved by the authorized officer" to the end of the first sentence.  f. Add the following to the end of the last sentence "...in consultation with the US Fish and Wildlife Service."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
564.	2-28	ROP 24	Burkart/FWS	Add the following to requirements: d) 5 years of data on stream flow, seasonal patterns in lake connectivity, and sheet flow shall be collected prior to planning bridges and culverts. These data will be stored in a centralized database and available to the general public.		
565.	2-29	ROP 26	Burkart/FWS	ROP 26 Alternative D requirements should be applicable to alternatives B and C as well.		
566.	2-29	ROP 26	Burkart/FWS	There is a need for mining restoration plans. Add the following requirement to each alternative: Each proposed mine site shall have a USFWS-approved restoration plan and effectiveness monitoring plan prior to site approval and construction. Restoration effectiveness monitoring shall continue for ten years following completion of restoration.		
567.	2-26	ROP17, Alt B-D	Burkart/FWS	This measure is not protective of non-fish bearing waters as the objective implies. Furthermore, purposes of the Refuge warrant greater protections than in the NPR-A. Change requirement to the following for all alternatives: Exploratory drilling is prohibited upon or within 100-year flood plain of streams and rivers, on or within 2,000 feet of the ordinary high water mark of potential fish-bearing lakes, and 1,000 feet as measured from the ordinary high watermark of non-fish-bearing waterbodies unless further setbacks are stipulated under Lease Stipulation I.		
568.	2-4, 2-5	Lease Stip I	Burkart/FWS	Aichillik may be misspelled. Angun River may be misspelled.		
569.	2-4	Alternative B/C/D	Burkart/FWS	Spring-fed rivers are the most unique and productive habitats in the Refuge. In Alternative D1 and D2, the following spring-fed rivers should have 2-mile setbacks: Itkilyariak Creek (and associated forks) and Tamayariak (and associated Forks), Katakturuk, Nularvik, and Okerokovik rivers. In alternative B and C, they should have 1-mile setbacks.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
570.	2-5	Lease Stipulation 3, Alternative B/C/D	Burkart/FWS	Protections associated with stipulation 3 need to be applicable to all alternatives (B, C, and D). Spring-fed river systems are the most important, productive and unique aquatic habitats in the Refuge. In addition, they provide benefits to terrestrial wildlife and subsistence users.		
571.	3-47	16-17	Burkart/FWS	Remove the last sentence. Bowling was referenced previously and here it is not cited correctly (precipitation does not make the additional portion of snowmelt)		
572.	3-51	3-5	Burkart/FWS	Are there stipulations requiring designs that prevent degradation of permafrost? If not, it really can't be assumed that they would be followed. If this sentence is to remain in the document, it should be clear that minimizing impacts only applies to minimizing impacts of thermal degradation.		
573.	3-51	11-12	Burkart/FWS	Is this clearly stated in the stipulation? If it will be referenced here as potential mitigation it should be clearly stated in stipulations. If it is not clearly stated in the stipulation, consider incorporating it into stipulations.		
574.	3-51	19-21	Burkart/FWS	This sentence is unclear. Does protecting the structural integrity of the road and pipeline somehow minimize impacts ice-jams, scours, etc. If so, consider revising for clarity.		
575.	3-49 – 3-54	General comment on section	Burkart/FWS	Tiering the impacts on water resources to BLM's documents (NPR-A 2013, NPRA 2004a, BLM 2018) is inappropriate in many cases as impacts in the Arctic Refuge 1002 Area will be different due to the many differences between the 1002 Area and the developed areas in the NPR-A. For example, in the Arctic Refuge 1002 Area, water is relatively scarce, the terrain is steeper, and major groundwater-fed springs are extremely important.		
576.	3-52	17-18	Burkart/FWS	Reference to BLM 2012 – not relevant to the 1002 area. Even in the NPR-A, the long-term impacts of water withdrawal are unknown, especially for isolated lakes that may not fully recharge at snowmelt.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
577.	3-52	30-33	Burkart/FWS	It should be noted that erosion and thermokarst related to development activities will have long-term impacts on surface water quality.		
578.	3-52	33-35	Burkart/FWS	Is there a reference or anecdotal evidence that suggests fugitive dust during winter construction is significant?		
579.	3-52	36-39	Burkart/FWS	Consider moving this paragraph to the previous section on water withdrawals. Also, note that water is not always recharged during snowmelt. Adequate recharge depends on several factors including watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not be fully recharged during snowmelt after water removal, especially during low snow years.		
580.	3-52	11 general comments	Burkart/FWS	It is important to note that contamination related to injection of hazardous wastes in subsurface areas and fracking could have major irreversible impacts to the water quantity and quality of major spring-fed systems that are important for wildlife and subsistence users. The BLM has noted that in the NPR-A groundwater contamination during injection of hazardous materials is not a concern unless it results in drinking water contamination. In the Arctic Refuge, however, the USFWS asserts that contamination of any ground or surface water is a negative impact of concern, especially if major groundwater springs are impacted. Because of these issues, a groundwater expert who can spend a substantial portion of time working on this EIS should conduct the impacts analysis for groundwater.		
581.	2-34	G-I ROP	Burkart/FWS	The requirements under alternative D should also be applicable to B and C.		
582.	E-1 – E17		Burkart/FWS	General comment: It is misleading to call the 2,000-acre cap a surface disturbance cap if the BLM interpretation is that the cap does not include all types of surface disturbance related oil development. Use more appropriate terminology that is not misleading.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
583.	EI-E17		Burkart/FWS	Be explicit about what offshore actions are planned so that these can be considered in the range of effects. Otherwise, these analyses are grossly incomplete.		
584.	E-10	31-32	Burkart/FWS	Substituting ice chips from lakes does not reduce freshwater use it only changes the form of water use (ice versus water). Both forms of use can impact aquatic ecosystems.		
585.	EI	35-36	Burkart/FWS	This line insinuates that surface disturbance will be covered under the development scenarios. The development scenarios, however, do not include destruction of tundra and permafrost related to winter travel. This should be noted.		
586.	EI-17		Burkart/FWS	There is a need for a more rigorous analyses that include a much better assessment of the feasibility of using freshwater resources versus using groundwater versus using an STP. The findings of these analyses are necessary to develop an appropriate analysis of the impacts of development on water resources, fish, other aquatic species, etc. Without this information, the analyses cannot adequately address impacts under different alternatives.		
587.	EI-17		Burkart/FWS	Total projected water use should be presented under development scenarios. It is expected that water use could increase greatly under alternative B. It is not possible to adequately conduct analyses of the impacts of development on water resources, fish, other aquatic species, and birds without detailed projections of water use under all alternatives.		
588.	EI-17		Burkart/FWS	Total projected ice road use should be presented under development scenarios. It is expected that ice road use could increase greatly under alternative B. Without assessments of ice road use under all alternatives, it is not possible to adequately conduct analyses of the impacts of development on vegetation, fish, other aquatic species, birds, soils, and water.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
589.	EI-E17	Table E-5 and other text.	Burkart/FWS	It seems unreasonable to assume that road is only expected to vary by a maximum of 7 acres under all alternatives unless ice roads are used instead of gravel roads. Due to the scarcity of water, use of ice roads may be limited. If leasing occurs in remote areas that are not protected (e.g. alternative B), the ratio of road acres to satellite facilities would decrease. If not, water use for ice roads would have to increase substantially under alternative B.		
590.	M-4	Table M-1	Burkart/FWS	In the scientific field it is widely accepted that climate change is ongoing and has widespread impacts across the North Slope of Alaska. There are numerous scientific reports on the impacts of climate change. These reports include current impacts and future projections. Climate change must be considered as a cumulative stressor if analyses are to be considered scientifically credible.		
591.	M-14	Table M.3.10	Burkart/FWS	Water withdraws should be listed as an action impacting resource. The type of impacts include impacts to surface and ground water quality, water quantity.		
592.	M-15	8	Burkart/FWS	It cannot be assumed that impacts would be similar to those described in Greater Moose's Tooth 2 and other North Slope EIS'. The 1002 area of the Arctic Refuge is very different than developed areas of the NPR-A where the extent and volume of water is much greater and the terrain is not as steep. If the Arctic Refuge were to have the same stipulations and the NPR-A, it is expected that water withdraw would have a much greater impact as the proportion of sources tapped would be much higher in the Refuge and oil companies would use the fully permitted volume (In the NPR-A oil companies only tend to use a small fraction of the permitted volume).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
593.	M-14-15	Table M.3.10	Burkart/FWS	Injection of hazardous wastes should be listed as an action impacting water resources. The type of impact would be potential contamination of ground and surface waters. The impact indicators would be surface water quality/contamination and groundwater quality/contamination. When conducting the analysis, consider that the potential for impacts to groundwater would be reduced under alternatives with stipulations that provide a protective buffer around major spring-fed rivers.		
594.	M-15	II	Burkart/FWS	What does this mean? Does it mean that water needs for specific development scenarios/infrastructure needs have been identified? And/Or the specific locations and orientation of infrastructure have not been identified; thus, it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives.		
595.	M-14-15 general	4	Burkart/FWS	Since the development scenarios for the alternatives did not address a range of development/infrastructure needs at the level necessary to assess impacts on water resources (e.g. water withdrawal needs, ice road length, gravel mine locations and type), it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives. More information is necessary to complete an adequate analysis. This information should include water needs, ice road lengths, etc. When there are a range of possibilities for a given scenario, the range should be given. This type of analysis needs to happen so that document authors can adequately assess impacts for water resources, vegetation, etc.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
596.	M-19-22	Table M.3.13	Burkart/FWS	Since the development scenarios for the alternatives did not address a range of development/infrastructure needs at the level necessary to assess impacts on fish and aquatic species (e.g. water withdrawal needs, ice road length, gravel mine locations and type), it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives. More information is necessary to complete an adequate analysis. This information should include water needs, ice road lengths, etc. When there are a range of possibilities for a given scenario, the range should be given. This type of analysis needs to happen so that document authors can adequately assess impacts for water resources, vegetation, etc. Until this information is available, an adequate analysis cannot be done.		
597.	M-22	12-13	Burkart/FWS	Currently there are no alternatives that include use of STP versus use of freshwater.		
598.	M-22	Table M.3.13, Row 2	Burkart/FWS	Declines in dissolved oxygen and increases in solutes should be mentioned specifically under type of impact. I am not sure turbidity is an impact of water withdrawal. Other types of impacts include the following: loss of littoral habitat and wet meadow zones due to shallowing, increased freeze-down of substrate used by some aquatic invertebrates to avoid freezing during winter. See Cott et al 2008 for more information on impacts of water withdrawal on fish and other species in ice-covered lakes in Canada. Studies have been done on the North Slope, but many were on deep gravel pits, inconclusive due to broken instruments, had little spatial inference, no quantified ability to detect change and never attempted to look at biological resources, such as invertebrates and wet meadow zones important to water birds. Also National Research Council 2003 -- cumulative impacts of oil on the North Slope.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
599.	M-22	Table M.3.13, Row 2	Burkart/FWS	For impact indicators, consider comparing the total volume of water needed for development (1 billion gallons???) to the estimated volume of liquid water available in in lakes and rivers at the end of the winter season in the I002 area (about 1 billion gallons, Trawicki et al 1991 or Lyons and Trawicki 1994).		
600.	M-20	Table M.3.13,	Burkart/FWS	Culverts can impact fish passage, hydrologic regimes, ice damming, etc.		
601.	M-20	Table M.3.13,	Burkart/FWS	One of the bigger effects of vehicle traffic on ice and gravel roads might be the erosion and thermokarst associated with heavy vehicle traffic, especially on ice roads.		
602.	M-20	Table M.3.13,	Burkart/FWS	Barging of materials – impact indicators – I don't think there are any stipulations targeted at preventing invasive species on incoming barges.		
603.	2-I-39	Table 2-2	Burkart/FWS	Restoration standards need to be set in stipulations. It should also be clearly stated if full restoration will be required for impacts, including but not limited to impacts to vegetation, water resources, permafrost/soils, etc.		
604.	3-240	4 & 5	JWMartin FWS	Add "transportation" as major activity phase of the oil and gas industry (exploration, development, production, transportation, and abandonment/restoration), i.e., the moving of oil and gas from field to product to market		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
605.	3-240 3-241	4ff 9ff	JWMartin FWS	NEPA [Section 101(c)(ii) & (v)] clearly states that agency reporting and/or recommendations for major federal actions affecting the quality of the human environment include a detailed statement on unavoidable adverse effects and irreversible and irretrievable commitments of resources. Sections 3.5 and 3.7 inadequately address the context and intensity (40 CFR 1508.27) or the DEIS self-described context, duration and/or intensity (Pp M-1). See also 40 CFR 1502.14(b).  Critically review and upgrade DEIS Section 3.5 Unavoidable Adverse Effects and 3.7 Irreversible and Irretrievable Commitments of Resources, proportionate to the significance of the impacts and the overall Refuge oil and gas program.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

606.	3-240	21-29	JVMartin FWS	<p>Bonding has nothing to do with unavoidable adverse effects.</p> <p>Focus discussion on unavoidable adverse effects under the context and intensity of past, present, and reasonably foreseeable future actions, e.g., the anticipated lifespan of oil and gas leasing activities – TAPS has just been reauthorized to 2032, Prudhoe Bay oilfield development and expansion now has a documented lifespan of 65 years and reasonably may be projected to 100 years (Clement et al. 2013).</p> <p>Please provide a more meaningful, rigorous and [scientifically and legally] defensible narrative in compliance with the statutory NEPA tenets of unavoidable adverse effects and irreversible and irretrievable commitments of resources. This should be as stand-alone treatment based on information in this DEIS and not incorporated by reference</p> <p>To the effect ...</p> <p>Past, Present or Reasonably Foreseeable Actions. The coastal plain 1002 area had not experienced a notable human presence up to the establishment of the Arctic Refuge (1960), and since its establishment the coastal plain has been managed for its wilderness values and with minimal management (FWS 2015a, 2015b). However, in the context of the larger landscape, the Beaufort Sea coastal plain from Point Barrow to Point Demarcation is increasingly developed. This is especially true of the western half with the NPR-A, Prudhoe Bay and adjoining oilfields along with associated infrastructure. At present, seismic exploration is conducted concurrently with oilfield development and production. Based on the existing history of oil and gas in coastal plain -</p>		
------	-------	-------	-----------------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>exploration, development, production and transportation; the potential lifespan of the proposed program coastal plain 1002 area well-beyond 65 years. This estimation is based upon the initial North Slope oil and gas development in the mid- to late-1960s. The Trans-Alaska Pipeline System (TAPS) began moving oil in 1977 and is approved to operate via DOE permit through development and the biota, J.C. Truett and S.R. Johnson (eds.), San Diego, CA; Academic Press.</p> <p>Batten, J. 2004. When good animals love bad habitats: ecological traps and the conservation of animal populations. <i>Conservation Biology</i> 18(6):1482-1491.</p> <p>Beale, C.M. 2007. The behavioral ecology of disturbance responses. <i>International Journal of Comparative Psychology</i> 20:111-120.</p> <p>Bergerud, A.T. 2000. Caribou. Pp. 658-693 in S. Demarias and P.R. Krausman (eds.), <i>Ecology and management of large mammals in North America</i>. Upper Saddle River, NJ; Prentice Hall.</p> <p>Blix, A.S. and J.W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and developmental activities. <i>Arctic</i> 45(1):20-24.</p> <p>BLM (Bureau of Land Management). 2012. National Petroleum Reserve-Alaska: final integrated activity plan/environmental impact statement (7 vols.). Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.</p> <p>BLM (Bureau of Land Management). 2014. Supplemental environmental impact statement for the Alpine Satellite Development Plan for the Greater Moose's Tooth I Development Project. Anchorage, AK: Bureau of Land Management.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>BLM (Bureau of Land Management). 2016a. Environmental assessment DOI-BLM-AKF01000-2107-001-EA [Greater Mooses Tooth Unit NPR-A]. Anchorage, AK: ConocoPhillips Alaska.</p> <p>BLM (Bureau of Land Management). 2016b. North Slope rapid ecological assessment: manager's summary. Fairbanks, AK: U.S. Department of the Interior, Bureau of Land Management.</p> <p>BLM (Bureau of Land Management). 2018. Greater Moose's Tooth II Development Project Draft Environmental Impact Statement. Anchorage, AK: Bureau of Land Management.</p> <p>BOEM (Bureau of Ocean Energy Management). 2017. Liberty Development Project: development and production plan in the Beaufort Sea, Alaska, draft environmental impact statement. Anchorage, AK: U.S. Department of the Interior, Bureau of Ocean Energy Management OCS EIS/EA BOEM 2016-010.</p> <p>Brodo, I. M., S.D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven and London.</p> <p>Brown, S., J. Bart, R.B. Lanctot, J.A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the Arctic National Wildlife Refuge. Condor 109:1-14.</p> <p>CAFF (Conservation of Arctic Flora and Fauna). 2010. Arctic biodiversity trends 2010: selected indicators of change. Akureyri, Iceland: Arctic Council, Conservation of Arctic Flora and Fauna International Secretariat.</p>		
--	--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>CAFF (Conservation of Arctic Flora and Fauna). 2013a. Arctic biodiversity assessment: report for policy makers. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>CAFF (Conservation of Arctic Flora and Fauna). 2013b. Arctic biodiversity assessment: status and trends in Arctic biodiversity. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>Cameron, R.D., D.J. Reed, J.R. Dau, and W.T. Smith. 1992. Redistribution of calving caribou in response to oil field development on the Arctic Slope of Alaska. Arctic 45(4):338-342.</p> <p>Cameron, R.D., E.A. Lenart., D.J. Reed, K.R. Whitten, and W.T. Smith. 1995. Abundance and movements of caribou in the oil field complex near Prudhoe Bay, Alaska. Rangifer 15:3-7.</p> <p>Cameron, R.D., W.T. Smith, R.G. White, and B. Griffith. 2005. Central Arctic caribou and petroleum development: distributional, nutritional, and reproductive implications. Arctic 58(1):1-9.</p> <p>Cameron, R.D., K.R. Whitten, W.T. Smith, and D.D. Roby. 1979. Caribou distribution and group composition associated with construction of the Trans-Alaska Pipeline. Canadian Field-Naturalist 93(2):155-162.</p> <p>Cameron, R.D., K.R. Whitten, and W.T. Smith. 1983. Responses of caribou to petroleum-related development on Alaska's Arctic slope. Juneau, AK: Alaska Department of Fish and Game, Progress Report Federal Aid in Wildlife Restoration Project W-21-2 and W-22-1, Job 3.18R.</p> <p>Clement, J.P., J.L. Bengtson, and B.P. Kelly. 2013. Managing for the future in a rapidly changing Arctic: a report to the President. Washington, D.C.: Interagency Working Group</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>on Coordination of Domestic Energy Development and Permitting in Alaska.</p> <p>Clough, N.K., P.C. Patton, and A.C. Christiansen. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resources assessment: report and recommendation to the Congress of the United States and final legislative environmental impact statement (2 Volumes). Washington, D.C.: U.S. Department of the Interior, Geologic Survey and Bureau of Land Management.</p> <p>Cronin, M.A., H.A. Whitlaw, and W.B. Ballard. 2000. Northern Alaska oil fields and caribou. Wildlife Society Bulletin 28(4):919-922.</p> <p>Dau, J., and R.D. Cameron. 1992. Effects of a road system on caribou distribution during calving. Rangifer Special Issue 1:95-101.</p> <p>Day, R.H., J.R. Rose, A.K. Prichard, and B. Streever. 2015. Effects of gas flaring on the behavior of night-migrating birds at an artificial oil-production island, Arctic Alaska. Arctic 69(3):367-379.</p> <p>Felix, N.A. and M.K. Reynolds. 1989. The effects of winter seismic trails on tundra vegetation in northeastern Alaska, U.S.A. Arctic and Alpine Research 21 (2):188-202.</p> <p>Franklin, A.B., B.R. Noon, and T.L. George. 2002. What is habitat fragmentation? Studies in Avian Biology 25:20-29.</p> <p>Fuller, T., D.P. Morton, and S. Sarkar. 2008. Incorporating uncertainty about species' potential distributions under climate change into the selection of conservation areas with a case study from the Arctic coastal plain of Alaska. Biological Conservation 141(6):1547-1559.</p> <p>FWS (Fish and Wildlife Service). 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan,</p>		
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>final environmental impact statement, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>FWS (Fish and Wildlife Service). 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>Gliders, M.A., and M.A. Cronin. 2000. North Slope oil field development. Pp. 15-33 in The natural history of an arctic oil field: development and the biota, J.C. Truett and S.R. Johnson (eds.). San Diego, CA: Academic Press.</p> <p>Gunn, A., C.J. Johnson, J.S. Nishi, C.J. Daniel, D.E., Russell, M. Carlson, and J.Z. Adamczewski. 2011. Understanding the cumulative effects of human activities on barren-ground caribou. Pp. 113-133 in P.R. Krausman and L.K. Harris (eds.), Cumulative effects in wildlife management: impact mitigation. Boca Raton, FL: CRC Press.</p> <p>Gutzwiller, K.J. 2002. Applying landscape ecology in biological conservation. New York, NY: Springer-Verlag.</p> <p>IPCC (Intergovernmental Panel on Climate Change). 2007. Climate change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC (M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.) Cambridge, U.K., Cambridge University Press.</p> <p>Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The effects of linear developments on wildlife: a review of selected scientific literature. Calgary, Alberta: Canadian Association of Petroleum Producers, ARC Wildlife Services.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>Jorgenson, J.C., J.M. Ver Hoef, and M.T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. <i>Ecological Applications</i> 20(1):205-221.</p> <p>Kemper, J.T. and S. Ellen MacDonald. 2009. Effects of contemporary winter seismic exploration on low Arctic plant communities and permafrost. <i>Arctic, Antarctic, and Alpine Research</i> 41(2):228-237.</p> <p>Krausman, P.R., and L.K. Harris. 2011. Cumulative effects in wildlife management: impact mitigation. Boca Raton, FL: CRC Press.</p> <p>Krebs, C.J. 2001. Ecology: the experimental analysis of distribution and abundance. San Francisco, CA: Benjamin Cummings.</p> <p>Liebezeit, J., E. Rowland, M. Cross, and S. Zack. 2012. Assessing climate change vulnerability of breeding birds in Arctic Alaska. A report prepared for the Arctic Landscape Conservation Cooperative. Bozeman, MT: Wildlife Conservation Society.</p> <p>Lindenmayer, D.B., and J. Fischer. 2006. Habitat fragmentation and landscape change: an ecological and conservation synthesis. Washington, D.C.: Island Press.</p> <p>Linnell, J.D., J.E. Swenson, R. Andersen, and B. Barnes. 2000. How vulnerable are denning bears to disturbance? <i>Wildlife Society Bulletin</i> 28(2):400-413.</p> <p>Martin, P.D., J.L. Jenkins, F.J. Adams, M.T. Jorgenson, A.C. Matz, D.C. Payer, P.E. Reynolds, A.C. Tidwell, and J.R. Zelenak. 2009. Wildlife response to environmental Arctic change: predicting future habitats of Arctic Alaska. Report of the Wildlife Response to Environmental Arctic Change (WildREACH): Predicting Future Habitats of Arctic</p>		
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Alaska Workshop; 17-18 November 2008. Fairbanks, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>Mattoli, S. 2011. Family Cervidae (Deer). Pp. 350-443 in D.E. Wilson and R.A. Mittermeier (eds.), Handbook of the mammals of the world. Vol. 2: Hoofed mammals. Barcelona, Spain; Lynx Edicions.</p> <p>Mattson, D.J. 1990. Human impacts of bear habitat use. Bears: their biology and management 8:33-56.</p> <p>McCarter, S.S., A. Rudy, and S.F. Lamoureux. 2017. Long-term landscape impact of petroleum exploration, Melville Island, Canadian High Arctic. Arctic Science 3(4):730-744.</p> <p>McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behaviour, habitat use and demography. Journal of Applied Ecology 25(2):451-460.</p> <p>McLellan, B.N., and D.M. Shackleton. 1989. Immediate reactions of grizzly bears to human activities. Wildlife Society Bulletin 17(3):269-274.</p> <p>Miller, F.L. 2003. Caribou Rangifer tarandus. Pp. 965-997 in G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (eds.), Wild mammals of North America: biology, management, and conservation. Baltimore, MD: John Hopkins University Press.</p> <p>Mitchell, C., and S. Pihl. 2005. Steller's Eider Polysticta stelleri. Pp. 689-692 in J. Kear (ed.), Ducks, geese, and swans (2 Vols.). New York, NY; Oxford University Press.</p> <p>Morrison, M.L., B.G. Marcot, and R.W. Mannan. 2006. Wildlife-habitat relationships: concepts and applications. Washington, D.C.: Island Press.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Murphy, S.M., and B.E. Lawhead. 2000. Caribou. Pp. 59-84 in The natural history of an arctic oil field: development and the biota, J.C. Truett and S.R. Johnson (eds.). San Diego, CA; Academic Press.</p> <p>Myers-Smith, I.H., B.K. Arnesen, R.M. Thompson, and F.S. Chapin, III. 2006. Cumulative impacts on Alaskan arctic tundra of a quarter century of road dust. <i>Ecoscience</i> 13(4):503-510.</p> <p>Nelleman, C., and R.D. Cameron. 1996. Effects of petroleum development on terrain preferences of calving caribou. <i>Arctic</i> 49(1):23-28.</p> <p>North Slope Borough. 2009. Impacts and benefits of oil and gas development to Barrow, Nuiqsut, Wainwright, and Atkasuk harvesters. Barrow, AK: North Slope Borough, Department of Wildlife by S.R. Bruand and Associates.</p> <p>NRC (National Research Council). 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. Washington, D.C.: National Academies Press.</p> <p>NRC (National Research Council). 2008. Ecological impacts of climate change. Washington, D.C.: National Academy Press.</p> <p>NRC (National Research Council). 2014. The Arctic in the Anthropocene: emerging research questions. Washington, D.C.; National Academy Press.</p> <p>NRC (National Research Council, Polar Research Board; Division on Earth and Life Studies). 2015. Arctic matters: the global connection to changes in the Arctic. Washington, D.C.; National Academy Press.</p>		
--	--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Pepper, C.B., M.A. Nascarella, R.J. Kendall. 2003. A review of the effects of aircraft noise on wildlife and humans, current control mechanisms, and the need for further study. <i>Environmental Management</i> 32(4):418-432.</p> <p>Pickett, S.T.A., and P.S. White. 1985. The ecology of natural disturbance and patch dynamics. San Diego, CA; Academic Press.</p> <p>Pulliam, H.R. 1988. Sources, sinks, and population regulation. <i>American Naturalist</i> 132:652-661.</p> <p>Pulliam, H.R., and B.J. Danielson. 1991. Sources, sinks, and habitat selection - a landscape perspective on population-dynamics. <i>American Naturalist</i> 137 Supplement:S50-S66.</p> <p>Reimers, E., and J.E. Colman. 2006. Reindeer and caribou (<i>Rangifer tarandus</i>) response towards human activities. <i>Rangifer</i> 26(2):55-71.</p> <p>Reynolds, P.E., H.V. Reynolds, and E.H. Follmann. 1986. Responses of grizzly bears to seismic surveys in northern Alaska. <i>International Conference on Bear Research and Management</i> 6:169-175.</p> <p>Romero, L.M., and J.C. Wingfield. 2015. Tempests, poxes and people: stress in wild animals and how they cope. New York, NY; Oxford University Press.</p> <p>Rudnik, D.A., S.J. Ryan, P. Beier, S.A. Cushman, F. Dieffenbach, C.W. Epps, L.R. Gerber, J. Hartter, J.S. Jenness, J. Kintsch, A.M. Merenlender, R.M. Perkl, D.V. Preziosi, and S.C. Trombulak. 2012. The role of landscape connectivity in planning and implementing conservation and restoration priorities. <i>Issues in Ecology Report</i> 16.</p> <p>Thomas, D.S., G.E. Fogg, P. Convey, C.H. Fristen, J-M. Gili, R. Gradinger, J. Laybourn-Parry, K.Reid, and D.W.H.</p>	
--	--	--	--	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>Walton. 2008. The biology of polar regions. New York, NY: Oxford University Press.</p> <p>Trammell, E.J., M.L. Carlson, N. Fresco, T. Gotthardt, M.L. McTeague, and D. Vadapalli. 2015. North Slope rapid ecological assessment. Report prepared for the Bureau of Land Management. Fairbanks, AK: University of Alaska, Alaska Center for Conservation Science, Institute of Social and Economic Research, and Scenarios Network for Alaska and Arctic Planning.</p> <p>Trombulak, S.C., and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. <i>Conservation Biology</i> 14(1):18-24.</p> <p>Truett, J.C., and S.R. Johnson. 2000. The natural history of an arctic oil field: development and the biota. San Diego, CA: Academic Press.</p> <p>Truett, J.C., M.E. Miller, and K. Kertell. 1997. Effects of Arctic Alaska oil development on Brant and Snow Geese. <i>Arctic</i> 50(2):138-146.</p> <p>Van Horne, B. 1983. Density as a misleading indicator of habitat quality. <i>Journal of Wildlife Management</i> 47:893-901.</p> <p>Vors, L.S., and M.S. Boyce. 2009. Global declines of caribou and reindeer. <i>Global Change Biology</i> 15:2626-2633.</p> <p>Walker, L.R. 2012. The biology of disturbed habitats. New York, NY: Oxford University Press.</p> <p>Walker, A.M., and K.R. Everett. 1987. Road dust and its environmental impact on Alaskan tundra and tundra. <i>Arctic and Alpine Research</i> 19(4):479-489.</p>		
--	--	--	---	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				<p>Walker, D. A., D. Cate, J. Brown, and C. Racine. 1987. Disturbance and recovery of arctic Alaskan tundra terrain: A review of recent investigations. CRREL Report 87-11. U.S. Army Cold Regions Research and Engineering Laboratories, Hanover, New Hampshire, USA. Walker, D.A., D. Cate, J. Brown, and C. Racine. 1987. Disturbance and recovery of Arctic Alaskan tundra terrain: a review of recent investigations. Hanover, NH: U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratories CRREL Report 87-11.</p> <p>Wilson, R.R., J.R. Liebezeit, and Wendy M Loya. 2013. Accounting for uncertainty in oil and gas development impacts to wildlife in Alaska. Conservation Letters6(5):350-358.</p> <p>Wood, E.M., and J.L. Kellermann. 2015. Phenological synchrony and bird migration: changing climate and seasonal resources in North America. Studies in Avian Biology 47.</p> <p>Wormworth, J., and K. Mallon. 2006. Bird species and climate change. Fairlight, New South Wales, Australia: Climate Risk.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
607.	3-241	1	JWMartin FWS	<p>... "natural environmental balances" is undefinable or unattainable as an agency or industry restoration goal</p> <p>Replace with "ecosystem functions and processes" which is definable, attainable and measureable; and further, implies a potential of substitution rather than replication of the pre-development state - alternately "ecosystem services" which is broader yet and includes social/subsistence considerations).</p>		
608.	3-241	6-7	JWMartin FWS	<p>"Section 4.9 of the NPR-A EIS (BLM 2012)" described discussion of short-term uses of industry development and production and long-term resource productivity in the 1002 Area is not possible due to extreme environmental differences between the NPR-A and 1002 Area: topographic relief; precipitation and snow cover: hydrology; among others as described in existing environmental of this DEIS.</p> <p>Illogical/confusing and multiple definitions of "product" and "resource" within sentence - Replace with better narrative, likely multiple sentences.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
609.	3-241	23	JWMartin FWS	<p>Loss or change in subsistence use is not dependent upon just abandonment plans but intervening direct, indirect and cumulative effects of oil and gas leasing activities (exploration, development, production, transportation and restoration) over the lifetime of impacts with the implicit statutory and case law understanding that federal agencies are held to a higher standard (lower threshold of significance) under ANILCA 810 than that of NEPA for subsistence availability, access and abundance (Naiman 1996).</p> <p>NEPA significance (40 CFR 1508.27) is not equal or equivalent to ANILCA Title VIII (Section 810) "significance," i.e., significant restriction of subsistence uses (access, abundance, availability). ANILCA (Section 804 Preference for Subsistence Uses) sets a much higher standard (lower threshold) for significant impacts than NEPA (see Naiman 1996 for review of case law).</p> <p>Citation: Naiman, J. 1996. ANILCA section 810: an undervalued protection for Alaskan villagers' subsistence. Fordham Environmental Law Journal 7:211-350.</p> <p>The ANILCA 810 Evaluation is needed to draft any meaningful narrative on this subject</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
610.	M-5	12-13	JWMartin FWS	<p>"Both onshore and offshore reasonably foreseeable future oil and gas ..." There is no acknowledgement of Canadian projects, present or pending, in the following listing, as implied in Table M-1 (see Canadian Arctic under Effects Analysis Area). These would be additive to the existing marine sea and air traffic as well as background noise, and likely to increase under RFFA.</p> <p>Identify Canadian projects and pending expansion or new development; add increase in noise levels related to surface, air and sea traffic; oil and gas development; and, infrastructure development to Table M-1.</p>		
611.	M-5 – M-6	12ff	JWMartin FWS	<p>Special Alaska Lease Sale Areas (SALSA), including Harrison Bay, Gwydyr Bay and Storms areas of the North Slope are not acknowledged under Oil and Gas Exploration, Development and Production (line 1) (see Anchorage Daily News dated 9 Aug 2018 under title Alaska Puts Chunks of North Slope Up for Single Bids in Unprecedented Lease Sale <a href="https://www.adn.com/business-economy/energy/2018/08/09/alaska-promotes-large-chunks-of-north-slope-in-single-bid-lease-sale">https://www.adn.com/business-economy/energy/2018/08/09/alaska-promotes-large-chunks-of-north-slope-in-single-bid-lease-sale</a>).</p> <p>add to listing of reasonably foreseeable future actions (RFFAs)</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

612.	Chapter 3	all	JWMartin FWS	<p>There are repeated references, incorporation by reference (per 40 CFR 1502.21) in Chapter 3 - the combined affected or existing environment and environmental consequences, to the NPR-A (BLM 2012) or Greater Moose's Tooth 2 (GMT2) (BLM 2018) or other NEPA compliance in the greater NPR-A/North Slope area.</p> <p>(1) there is no reference of where that information may be located among the multiple volumes and documents of the BLM Alaska ePlanning website, to facilitate the average reader reviewing the information;</p> <p>(2) the GMT2 is a DRAFT document, therefore plastic, subject to change without notice and likely change before finalization; therefore, the reader is referencing a moving target – which is not acceptable as an incorporation by reference under NEPA;</p> <p>(3) comparisons between the NPR-A and the 1002 are problematic at multiple levels and scales – they are not similar and environmental effects in the NPR-A does not imply any comparable consequence in the 1002 Area; and,</p> <p>(4) if incorporation by reference and comparisons are to be made with NPR-A as to oil and gas BMPs/ROPs or other aspects of NEPA compliance, it is strongly recommended that comparison table (matrix) be generated to indicate where in those integrated references the relevant information across multiple disciplines may be located by the average reader. For example –</p> <table><tr><td></td><td>DEIS Leasing</td><td>BLM EIS-B</td><td>BLM EIS-C</td></tr><tr><td>Subject 1</td><td>Pp x-y</td><td>Pp x-y</td><td>Pp x-z</td></tr><tr><td>Subject 2</td><td>Pp x-w</td><td>Pp x-a</td><td>Pp x-v</td></tr></table>		DEIS Leasing	BLM EIS-B	BLM EIS-C	Subject 1	Pp x-y	Pp x-y	Pp x-z	Subject 2	Pp x-w	Pp x-a	Pp x-v		
	DEIS Leasing	BLM EIS-B	BLM EIS-C															
Subject 1	Pp x-y	Pp x-y	Pp x-z															
Subject 2	Pp x-w	Pp x-a	Pp x-v															

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
613.	3-1 and through chap	11 ff	JWMartin FWS	<p>"Direct and indirect effects to each resource are analyzed in this chapter [3]. Cumulative effects and reasonably foreseeable future actions are analyzed in Chapter 4, Cumulative Effects."</p> <p>Note that the cumulative impact analysis and cumulative effects narrative discussion of the BLM NPR-A IAP Final EIS required 322 pages, including 26 pages devoted to unavoidable adverse effects (Volume 4 in its entirety, BLM 2012). The depth and detail of discussion, and proportionality of unavoidable adverse effects found in the BLM NPR-A IAP EIS, is lacking in the subject DEIS.</p> <p>As a compounding factor for attempting to make comparisons between the NPR-A and 1002 area, the NPR-A does not have establishing origins in wildlife, wilderness and recreational values (PLO 2214), nor statutory purposes based in natural resource conservation (ANILCA Section 302(2)(B) as the 1002 area of Arctic National Wildlife Refuge. These considerations bear on the impact analysis and potential mitigation measures. As presented in the subject DEIS, this is largely glossed over as opposed to taking a hard look at cause and effects of proposed action [see BLM National Environmental Policy Act Handbook H-1790-1 (2008) 6.8.1.2 Analyzing Effects – a "hard look" is a reasoned analysis containing quantitative or detailed qualitative information].</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
614.				<p>Additionally, the following are not addressed under statutory and regulatory compliance (D-3).</p> <p>Marine Mammals Protection Act</p> <p>National Wildlife Refuge System Administration Act, amended through the National Wildlife Refuge Improvement Act (including BIDEH policy – Service Manual 601 FVW 3, dated 16 Apr 2001)</p> <p>Migratory Bird Treaty Act</p> <p>Bald Eagle and Golden Eagle Protection Act</p> <p>US Fish and Wildlife Service Mitigation Policy dated 23 Jan 1981 (reinstated via 2016 policy withdrawal effective 30 Jul 2018: FWS 2018))</p> <p>The Wilderness Act</p> <p>Wild and Scenic Rivers Act</p> <p>National Historic Preservation Act</p> <p>Native American Graves Protection and Repatriation Act</p> <p>FWS (Fish and Wildlife Service). 2018. U.S. Fish and Wildlife Service mitigation policy. Federal Register 83(146):36472-36475.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
615.	Chapter 3 & Appendix H, M		JWMartin FWS	<p>Multiple BLM NEPA compliances to date mention the phases of oil and gas activity, specifically: exploration, development, production, transportation and abandonment/restoration. However, when abandonment/restoration is discussed, if at all, there is no consideration as an active, ongoing process. This would facilitate the Refuge in meeting a primary ANILCA purpose of "in their natural diversity."</p> <p>There is no mention of developing adaptive management approaches to rehabilitate and restoration impacts in a sequentially phased manner as industry explores, develops, produces, and transports oil and gas so that everything does not occur at some distant end point in time and space. Further, there is no investment in technologies that may be adaptive to variable climates that will differ from those at present. In spite of improved industry standards, some impacts are still measureable 60 years after the activity (Walker et al. 1987; Felix and Reynolds 1989; Gliders and Cronin 2000; Kemper and MacDonald 2009; Jorgenson et al. 2010; McCarter et al. 2017).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

616.	2-39  3-61  Appendix H	M-ROPs  12ff	JWMartin FWS	<p>As stated in the DEIS, a canvas of the North Slope shows no invasive alien vascular plants present now. However, there is no mention of predictive modeling to identify what species may pose a real or potential risk for pioneering: where to look, when to look, how to look for potential invasive alien species – in order to develop preventative monitoring. There are significant risks associated with increased development in the program area either through human-subsidized movement through personnel or material, but also through surface disturbances that create conditions conducive to species pioneering and establishment. ROPs may not be sufficient to offset this risk and may require a concerted effort by all cooperators and academia (Taylor et al. 2017).</p> <p>Citation.</p> <p>Taylor, J., M. Storzer, C. Coon, S. Davis, G. Harrington, B. Anderson, J. Martin, B. Merrill. 2017. DOI Arctic Cumulative Impacts Workshop Final Report. Anchorage, AK: Bureau of Land Management, US Geological Survey, Bureau of Ocean Energy Management and National Oceanic and Atmospheric Administration.</p> <p>References – for consideration in reworking this discussion</p> <p>Bella, E.M. 2009. Predicting invasive plant range expansion in Alaska. Davis, CA: University of California, doctoral dissertation.</p> <p>Conn, J., C. Stockdale, N. Werdin-Pfisterer, and J. Morgan. 2010. Characterizing pathways of invasive plant spread to Alaska: II. Propagules from imported hay and straw. <i>Invasive Plant Science and Management</i> 3(3):276-285.</p> <p>Crowl, T.A., T.O. Crist, R.R. Parmenter, G. Belovsky, and A.E. Lugo. 2008. The spread of invasive species and</p>		
------	------------------------------------	--------------------	-----------------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				<p>infectious disease as drivers of ecosystem change. <i>Frontiers in Ecology and the Environment</i> 6(5):238-246.</p> <p>Davis, M.A. 2009. <i>Invasion biology</i>. Oxford, U.K.: Oxford University Press.</p> <p>Elton, C. 1958. <i>The ecology of invasions by plants and animals</i>. London, U.K.: Methuen.</p> <p>Lassuy, D.R., and P.N. Lewis. 2013. Invasive species: human-induced. Pp. 559-565 in <i>Conservation of Arctic Flora and Fauna Arctic Council (eds.), Arctic biodiversity assessment: status and trends in Arctic biodiversity</i>. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>NRC (National Research Council). 2002. <i>Predicting invasions of nonindigenous plants and plant pests</i>. Washington, D.C.: National Academy of Press.</p> <p>Ricciardi, A., M.F. Hoopes, M.P. Marchetti, and J.L. Lockwood. 2013. Progress toward understanding the ecological impacts of nonnative species. <i>Ecological Monographs</i> 83(3):263-282.</p> <p>Root, T., and L. Hughes. 2005. Present and future phenological changes in wild plants and animals. Pp. 61-69 in T.E. Lovejoy and L. Hannah (eds.), <i>Climate change and biodiversity</i>. New Haven, CT: Yale University Press.</p> <p>Root, T.L., J.T. Price, K.R. Hall, S.H. Schneider, C. Rosenzw</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
617.	3-65	19	JWMartin FWS	Wetland Functions  Please correct to EPA defined Wetland Functions and Values – EPA has purview over the Clean Water Act, and hence wetlands (see <a href="https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF">https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF</a> ).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
1.	General comment		Crane/FWS	The DEIS does not fully analyze nor distinguish how the various alternatives affect the other purposes of the refuge. Recommend incorporating this analysis into the affected environment section as appropriate or clarify what assumptions are made regarding the impact of each alternatives on all six of the refuge purposes.		
2.	General comment		Loya/FWS	The DEIS does not consistently analyze nor distinguish how the various alternatives affect individual resources of the refuge. We recommend that BLM provide more specific guidance to the chapter authors on how to incorporate the Reasonably Foreseeable Development Scenario and the Approach to Environmental Analyses (Appendix M) assumptions into the Chapter 3 Environmental Consequences analyses.		
3.	General comment		Loya/FWS	Splitting Alternative D into two alternatives (D1 and D2) is confusing and we recommend that Alternative D1 be eliminated. The primary difference is related to the elements of Stipulation 6 related to timing limitations of activity when caribou use the coastal plain, which are consistent, but less restrictive, than those required under the NPRA Integrated Activity Plan. Alternative D2 allows for the Authorized Officer to waive timing restrictions if caribou are not present in significant numbers (10% of the population) during calving and insect relief periods. If development proceeds in the high resource potential area and in a manner similar to NPRA, with one major construction project occurring at a time, it would be highly likely that timing restrictions could be waived. Recommend rewording Alternative D Stipulation 6 to highlight this flexibility when warranted.		
4.	General comment		Loya/FWS	We recommend including information referred to in other NEPA documents in the appendices, especially in the case of referring to another Draft EIS (e.g. GMT2), that may change in the Record of Decision. We recommend referrals to other documents include chapter or page numbers to guide the reader.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

Deleted: does not



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

5.	General comment		Kaye/FWS	<p>The current Comprehensive Conservation Plan for the Arctic National Wildlife Refuge enacts minimal management prescriptions for the coastal plain and includes a recommendation for designating the area as Wilderness. Thus, we believe the DEIS should more thoroughly address how the addition of the oil and gas purpose to the Arctic National Wildlife Refuge coastal plain will affect wilderness values and characteristics.</p> <p>Further, wilderness provides the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists. A more complete description in the baseline conditions of all resources under Alternative A related to the wilderness context will further elucidate the impacts of the action alternatives.</p> <p>Recommend include a preface to the document, or to Wilderness section in Chapter 3.4.7, that states:</p> <p>A Note about Wilderness and Wilderness Terminology</p> <p>The Arctic Refuge was first proposed as "The Last Great Wilderness," and wilderness is an original (1960 PLO 2214) and continuing purpose of the coastal plain, which is officially recommended for Wilderness designation. As well, wilderness provides the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists. Given the significance of wilderness in Arctic Refuge issues, it is important to address confusion regarding use of the term. Wilderness can refer to characteristics, qualities, or values held by the entire Refuge, including the coastal plain, or just to areas designated as Wilderness such as the areas south and east of the 1002 area. To clarify, this document uses the non-capitalized word <i>wilderness</i> when describing wilderness-associated</p>		
----	-----------------	--	----------	---	--	--

**Commented [CMA1]:** I think this is beyond the scope of the EIS – the O&G purpose was added by Congress. What is relevant is the impact of the various alternatives on wilderness values and characteristics

**Commented [CMA2]:** Can we be more specific here? Seems pretty broad...

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
				characteristics, qualities and special values (USFWS 2015) of the coastal plain, including the qualities referenced in ANILCA section 101(b) ("wilderness resource values") and Section 304(g) ("wilderness value"). It uses capitalized <i>Wilderness</i> when referring to effects upon the adjacent designated Wilderness areas and to post-development reclamation of the coastal plain to a level where it is again qualified for Wilderness designation.		
6.	General comment		Crane/FWS	Throughout the document there are references to the construction of ice roads and ice bridges to facilitate development similar to NPRA. However, the EIS also describes how the vast majority of lakes in the program area freeze solid and only contain a small volume of unfrozen water. The analysis of the various alternatives does not fully account for what will likely be a lack of sufficient fresh water resources for development needs and what that means for other resources (e.g. gravel mining and surface disturbance). Recommend that the reasonably anticipated water needs of the RFDS be estimated and clearly stated and compared with the identified water supplies in the program area. If a deficit exists, the EIS should identify alternatives to address that shortage.		
7.	General comment		Crane/FWS	Throughout the document, readers are directed to reference documents for additional analysis of impacts. Many of these documents are for impacts associated with development in NPRA. Given the significant difference in terrain and landscape of the program area when compared to NPRA, the affected environment of NPRA is in many cases not comparable to the program area. Recommend providing analysis that reflects the differences between the two areas.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
8.	General Comment		Crane/FWS	The EIS does not really address the forthcoming area wide seismic project currently being reviewed by BLM, despite being included in the list of actions in the Cumulative Impacts section of Appendix M. Recommend addressing the effects of this action either in the baseline or in the cumulative effects sections of each resource as future activities will be additive to the effect of the area wide seismic project.		
9.	General comment		Jorgenson/FWS	Readily available documents that should be cited in the EIS, including all relevant sections of Chapter 3:  National Research Council, 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press.)  Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geocological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.		
10.	General comment		JohnT/FWS	The topography and hydrology on the coastal plain, particularly in the area of high interest are different than that of the NPRA. Arctic Refuge scenario and effects will be different and should not be addressed solely by reference to NPRA documents.		
11.	1-1	21	JohnT/FWS	The introduction should include statement of all of the purposes of the Arctic Refuge. Insert ANILCA and PLO 2214 purposes here.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
12.	2-15	LS 9, Alt D, Requirement c.i.	Reed/FWS	Change "...impacts on subsistence uses..." to "...impacts on subsistence and other public uses (because transportation infrastructure would be closed to non-subsistence public users; see Section 3.4.9, Transportation)..."		
13.	2-15	LS 9, Alt D, Requirement c.ii.	Reed/FWS	Change "...impacts on subsistence uses..." to "...impacts on subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
14.	2-16	LS 9, Alt D, Requirement d	Reed/FWS	Change "...on area resources and subsistence uses..." to "...on area resources, and subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)"		
15.	2-17	ROP 2	Swem/FWS	Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made.		
16.	2-17	ROP 2	Putnam/FWS	Recommend the use of bear resistant containers for all waste materials and classes for all Alternatives (not just for Alternative D). Bear resistant containers for all waste materials and classes is the current best practice and will reduce or prevent the majority of human-bear conflict interactions under all Leasing Alternatives.		
17.	2-17, 2-18	ROP 2, 3	Matz/FWS	Under Waste Prevention, Handling, Spills, and Public Safety, ensure that Requirement/Standards match for each ROP. Currently Requirement/Standard for ROP 3 under Alternatives B and C is identical to Requirement/Standard under ROP 2 for Alternative D.		
18.	2-18	2	Matz/FWS	Required Operating Procedure 3 under Alternative D should be duplicated under Alternatives B and C, as the activities described therein are in fact required by law.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
19.	2-19		Burkart, Greta, USFWS	Something similar to NPR-A BMP A-4 should be included. In addition to the A-4 requirements, also include the following: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing <b>150%</b> of the stored volume <b>when considering terrain and weather conditions</b> , 3) "Except during overland moves <b>and seismic operations</b> , fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed <b>210</b> gallons shall be stored within an impermeable lined and diked area or within approved <b>bear-proof</b> alternate storage containers" and 4) <b>All temporary and permanent</b> Fueling Stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		
20.	2-19	ROP 5	Putnam/FWS	The last sentence of the Requirement/Standard states: "The plans would include specific measures identified in the current USFWS Polar Bear Mitigation Plan and would be adapted as needed for grizzly bears." This ROP is good and necessary, but we recommend removing this last sentence as it may may confuse lease holders as to what is required. The USFWS approved polar bear interaction, or mitigation, plans are developed on an individual basis by and for each project or company.		
21.	2-2	25	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
22.	2-2	7	JFox/FWS	We can't predict whether or not resource trends will remain the same. Suggest eliminating this part of the sentence.		
23.	2-20	ROP 7, Paragraph b.	FWS – BAWR (Allen and Collins)	Delete "sensitive" from sentence: Class I and Class II area (as identified . . . )		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
24.	2-20	ROP 7, Paragraph d.	FWS – BAWR (Allen and Collins)	Add "mercury and other heavy metals" to the end of the sentence: ". . . including greenhouse gases, mercury and other heavy metals and fugitive dust."		
25.	2-21	ROP 7	JFox/FWS	Remove references to Greater Mooses Tooth Unit I and Nuiqsut and replace with Coastal Plain and Kaktovik.		
26.	2-21	ROP 7	JRose/FWS	Appears objective for GMTI was included by accident. If it was included intentionally modifications need to be made to make this relevant to the Refuge communities.		
27.	2-21	ROP 7, Paragraph f.	FWS – BAWR (Allen and Collins)	Replace with: If the air quality analysis shows potential future impacts on National Ambient Air Quality Standards (NAAQS) or Alaska Ambient Air Quality Standards (AAAQS) or impacts above specific levels of concern for Air Quality Related Values (AQRVs), the BLM will require air quality mitigation measures and strategies within its authority and in consultation with local, state, federal and tribal agencies with responsibility for managing air resources in addition to regulatory requirements and proponent committed emission reduction measures and for emission sources not otherwise regulation by the Alaska DEC or EPA."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
28.	2-21	ROP 7, Paragraph e.	FWS – BAWR (Allen and Collins)	For additional clarity and accuracy, replace paragraph with "For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM Authorized Officer will require air quality analysis for determining the project's direct, indirect, cumulative impacts on air quality. The BLM will evaluate the magnitude of potential air emissions from the project or activity, the durations of the proposed action, the proximity to a federally mandated Class I area and Class II area (as identified by EPA, Alaska DEC or a federal land management agency), location to a population center, location to a nonattainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude or existing development in the area, or other issues identified during the project's NEPA analysis. The BLM will determine the information required for a project-specific air quality analysis by developing a modeling protocol for each air analysis. The BLM will consult and inform the U.S. Fish and Wildlife Service and other appropriate federal, state, or local agencies regarding air quality analysis and analysis decisions to avoid duplication of effort. The air quality analysis will compare predicted impacts on all applicable local, state, and federal air quality standards and increments and impacts on air quality-related values (AQRVs), as well as other scientifically defensible significance thresholds such as incremental cancer risks."		
29.	2-21	ROP 7, Paragraph g.	FWS – BAWR (Allen and Collins)	Replace the beginning of the sentence with: "If ambient air monitoring indicates that project-related emissions cause or contribute to impacts or cause unnecessary or undue degradation of the lands, cause exceedances or NAAQS or AQRVs or fail to protect health. . ."		
30.	2-22	I	Matz/FWS	Add, "including human health or public health tribal, state, or federal agencies" after "appropriate entities."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
31.	2-22	ROP 10	Latty-Swem/FWS	Objective should read "Maintain .... and adequate habitat for fish, birds, and aquatic invertebrates." This change is intended to reflect that shorebirds and some passerines also rely on habitats and soils surrounding lakes and ponds (in addition to waterfowl, which is the only category of birds currently mentioned and associated with these habitats).		
32.	2-22	ROP 8	Carl/FWS	Makes it optional for the BLM Authorized Officer to require changes in operator processes to reduce contamination to subsistence foods ("the BLM Authorized Officer may require changes," emphasis added). This should not be optional, and should state "shall require changes."		
33.	2-23		Carl/FWS	None of the ROPs related to "Winter Overland Moves and Seismic Work" require any protection of winter subsistence activities. This is an oversight that needs to be corrected.		
34.	2-23	ROP 11	JRose/FWS	To meet refuge purposes set forth in ANILCA Requirement/Standard should be the same for all alternatives. Requirement/Standard "e" should be amended to read "... or lake of special concern to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds and terrestrial wildlife." Then requirement/Standard "h" should be removed from Alt D.		
35.	2-23	ROP 11	Swem/FWS	There seems to be an odd glitch in wording that complicates contrasting Alts B+C, item b, with Alt C, item d. They seem to be counterparts, yet were written using different language, presumably unintentionally. If they were intended to be the same, they should have identical wording. If they were intended to be different, the differences should be highlighted, not immersed in other subtle differences in wording that currently obscure the intended differences.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
36.	2-23	ROP II	Putnam/FWS	Recommend that Requirement/Standard for Alternative D be used for all Alternatives. For polar bears, the standards described in the Alternative D, ROP II, parts c and d are consistent with what will likely be required in any MMPA incidental take authorization.		
37.	2-23	ROP II for Alt D	R. Wilson/FWS	Requirements/Standard b should include a clause something like, '... by the BLM Authorized Officer and consistent with Incidental Take Regulations and Letters of Authorization issued by the USFWS as part of MMPA regulations' This issue cannot be solely addressed by the BLM, because it stems from the Service's authority under the MMPA.		
38.	2-23	ROP II, Req. a	S. Arthur/FWS	FWS is unclear if ADFG would be similarly responsible for grizzly bear den detection in the Arctic Refuge, as it appears to be in NPRA. Because grizzly dens excavated into the ground are not typically detected by FLIR used to find polar bears which den in snow, they would require additional effort to find.		
39.	2-24	ROP 12	Loya/FWS	Language in b. was found to be confusing by reviewers. Recommended revision of "note" for both alternatives:  b. Low-ground-pressure vehicles would be used for on-the-ground activities off ice roads or pads. Low-ground-pressure vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra by shearing, scraping, or excessively compacting the tundra mat. Note: Heavy equipment required for ice road construction would be allowed and required to be operated in a manner that eliminates direct impacts on the tundra.		
40.	2-24	ROP 12, Alt B & C	Leonard/FWS	Suggest adding (e): Seismic operations and winter overland travel may be monitored by agency representatives and the operator would be required to accommodate the representatives during operations.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
41.	2-24	ROP 12, Alt B and C	JRose/FWS	Requirement/Standard "a" is nebulous. What are "sufficient depths" and who determines it. Recommend amending first sentence to read "...protect the tundra as determined by the authorizing official."		
42.	2-24	ROP 12, Alt D: (a)	Leonard/FWS	Remove 'highest' and replace: 'over the tussock tops'. This will be an interpreted standard and this language will better reflect the intent of the standard. Because snow densification increases throughout the winter, the standard will become easier to meet as the winter progresses.		
43.	2-25	Alt D: (g)	Leonard/FWS	Recommended wording change: Seismic operations and winter overland travel may be monitored by agency representatives and the operator is required to accommodate the representatives during operations.		
44.	2-26	ROP 17	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt B and C.		
45.	2-26	ROP 19	Reed/FWS	Use consistent language about recreationists and subtypes. Compare to F I ROP language for "...recreationists of the area, including sport hunters and anglers." Specify transportation infrastructure would be closed to non-subsistence public users.		
46.	2-26	ROP 19	Carl/FWS	Under "Facility Design and Construction," this is the first reference to any requirement to protect subsistence use and access. It should be required throughout the entire process.		
47.	2-27	ROP 21 & 22	Reed/FWS	End both <u>objective</u> sentences with "...anadromous fish, protect subsistence use and access to subsistence hunting and fishing, and opportunities for primitive recreationists of the area, including sport hunters and anglers."		
48.	2-27	ROP 23	JRose/FWS	Requirements/Standards for all alternatives should be the same. Regardless of which alternative is selected, the Refuge must minimize the impacts to other Refuge purposes by law.		
49.	2-28	ROP 23	JFox/FWS	Consider incorporating language in Alternative D f. and g. into Alternative C to meet all Refuge purposes.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Commented [CMA3]:** The Refuge must minimize? Under what authority in this case? What obligation does BLM have?



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
50.	2-29	ROP 26	JFox/FWS	Consider replacing Requirement/Standards in Alternative C with those in Alternative D to meet all Refuge purposes.		
51.						
52.	2-29	ROP 27	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt D. The difference is under 'b.' which prohibits allowing wildlife access to human food or odor-emitting waste. Engaging in conduct that attracts bears to human food and garbage is illegal under 5 AAC 92.230(a)(1). Bears conditioned to human food and food odors would prove fatal for hunters and recreationalists.		
53.	2-29	ROP 27	Swem/FWS	ROP 27: Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made. And, Requirement/Standard b for both Alt B/C and D should include "Feeding of wildlife and allowing wildlife to access human food or odor-emitting waste is prohibited."		
54.	2-3	3	JFox/FWS	Do you mean to say "would" or "could" here? As written, this implies that all stipulations would be permanently exempted, exempted on a one-time basis, or changed.		
55.	2-31	ROP E-12	Swem/FWS	Was this accidentally called a "Required Operating Practice" rather than a "Procedure?"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
56.	2-31	ROP E-14	Randy Brown/FWS	ROPs 24b and E-14 are redundant with regards to fish passage guidelines. Recommend either removing E-14 or revising E-14 to reflect contemporary fish passage recommendations presented in ROP 24b, which would then state:  To ensure that crossings provide for fish passage, all proposed crossing designs would adhere to the best management practices outlined in Fish Passage Design Guidelines, developed by the USFWS Alaska Fish Passage Program (June 29, 2018), Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (US Forest Service 2008) and other generally accepted best management procedures prescribed by the BLM Authorized Officer and the USFWS.		
57.	2-32	ROP E-15	Loya/FWS	Cliff-nesting raptors are scarce in the program area. Recommend revising to state: a. Removing greater than 100 cubic yards of bedrock outcrops, sand, or gravel from cliffs displaying evidence of raptor nests would be prohibited.		
58.	2-32	ROP E-17	Swem/FWS	The dates for restrictions associated with this ROP can be changed to June 1 through July 31 to reflect FWS efforts to ensure consistency in the restrictions and better reflect improved information on hatching dates across the North Slope. (This change will relax the requirement/standard).		
59.	2-33	F-I Req/Std d	Reed/FWS	End sentence with "...moose hunting) <i>and when recreationists are present.</i> "		
60.	2-33	ROP F-I	Reed/FWS	Throughout: use consistent language about recreationists and subtypes throughout Stips/ROPS Requirements and Standards or specify why not consistent.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
61.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part f states that "hazing wildlife by aircraft is prohibited." The use of helicopters to haze polar bears is an approved method of hazing polar bears under certain circumstances and with appropriate training and MMPA authorization. Recommend adding something like "...unless otherwise authorized..." or something like that, to allow for the use of this method.		
62.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part g. Recommend adding "and 0.5 miles horizontal distance" after "1,500 AGL feet". This is what will likely be required in MMPA incidental take authorizations.		
63.	2-34	ROP G-I	Berendzen/ FWS	Alternatives B & C are inadequate for meeting refuge purposes – the standards in Alt D are more protective. All Alternatives should ensure that reclamation result in Wilderness eligibility.		
64.	2-34	ROP G-I	JRose/FWS	The Presidential Recommendation for Designation as Wilderness still stands. Suggest amending Requirement/Standard to read "...restoration of ecosystem function and meet minimal standards for eligibility of Wilderness designation.		
65.	2-34	ROP G-I	JRose/FWS	In Alternative D Wilderness should be capitalized		
66.	2-34	ROP G-I Req/Std b	Reed/FWS	Change "...habitat condition, and wilderness eligibility." to "...habitat condition, wild and scenic river eligibility/suitability, and wilderness eligibility."		

**Commented [CMA4]:** Is it that the Alternatives are inadequate or that the ROP in those alternatives is inadequate? As stated previously, I would expect the standards in Alt D to be more protective in all cases...

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
67.	2-34 & 35	ROP H-1, H-2	Carl/FWS	ROP H-1.a. and b. and H-2.e. for all alternatives, the DEIS references "North Slope and Eastern Interior Subsistence Advisory Panels" or "North Slope and Eastern Interior Subsistence Advisory Councils." We believe you are referring to the FACA-charted Federal Subsistence Regional Advisory Councils created under Section 805 of ANILCA, and the correct names are "North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils." These groups meet through publicly-noticed meetings. These meetings are held in February-March and August-November. As such, the timing of such coordination must take into account those schedules.		
68.	2-36	H-2	Carl/FWS	For the H-2 Required Operating Procedures, the Objective notes: "Prevent unreasonable conflicts ...". How is "unreasonable" defined, and from whose perspective. Most certainly, a subsistence user will have a very different understanding of "unreasonable" than an oil and gas service company.		
69.	2-37	H-3 ROP	Putnam/FWS	This Requirement/Standard is good, appropriate, and necessary. Recommend keeping this for all Alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
70.	2-39	General Wildlife Protection	Latty-Swem/FWS	<p>The number of helicopter take-offs and landings that may occur associated with permitted activities in the program area may be substantial, but is currently not addressed. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates from the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different sites. Depending on the type of activity and it's duration associated with these take-offs and landings, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information)</p> <p>Because the number of potential take-offs and landings at unimproved sites during summer is large and may affect the productivity of breeding birds, please consider adding a Required Operating Procedure to minimize negative impacts to productivity.</p> <p>For example, please consider adding a ROP with an Objective to minimize the disturbance to breeding birds on the Coastal Plain, and a Requirement/Standard that includes a timing restriction on aircraft take-offs and landings at unimproved sites to avoid the nesting season except when doing so would impact the purpose of the approved project.</p>		
71.	2-39	ROP M-2	JohnT/FWS	Invasive Species add additional ROP to address rodent introduction from barge traffic.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
72.	3-39	M-3 and M-4	Loya/FWS	We recommend combining ROPs M-3 and M-4 with the following text: <u>Objective:</u> Minimize loss of populations of, and habitat for, plant and animal species that are rare, sensitive or endemic to the Arctic. <u>Requirement/Standard:</u> If a development is proposed in an area that provides potential habitat for an identified rare, sensitive or endemic plant or animal species in Alaska, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats to determine if the species occurs there. The results of these surveys will be submitted to the BLM with the application for development.		
73.	2-4	Table 2-2 LS 1	JohnT/FWS	Terminology: active flood plain, bank, and ordinary high water mark are used interchangeably. This comment may apply throughout the document.		
74.	2-4	Table 2-2 and throughout document	Reed/FWS	Change spelling from Aichilak to Aichilik throughout document		
75.	2-5	LS 2	Loya/FWS	Lakes are a unique habitat within the Arctic Refuge given their scarcity, especially in comparison to NPRA. Thus, lakes may serve as irreplaceable habitat for avian and aquatic species, especially in the biological productive area around the Canning River. Requiring a 0.5 mi buffer is a common BMP in the NPRA IAP for protecting wildlife and habitat. This includes the minimum river setbacks (K-1); Brant nests (K4b); caribou approaching a road crossing (K5a, K12); Grizzly bear dens (C-1) and Raptor nests (C-2, F-1). Therefore, we recommend that the LS 2 for Alt D- Canning River Delta and Lakes be applied across all alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
76.	2-5	LS 3	Loya/FWS	<p>Springs and aufeis create unique habitats within the Arctic Refuge in both summer and winter. Therefore, we recommend that the LS 3 for Alt D Springs/Aufeis requiring studies be included under all alternatives. Recommend adding the following to Alt B and C:</p> <p>Objective: Protect the water quality, quantity, and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the Coastal Plain. River systems with springs provide year-round habitat and host the most diverse and largest populations of fish, aquatic invertebrates, and wildlife; they are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs. It helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could be disturbed by drilling or fracking, use buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.</p> <p>Requirement/Standard: a. Before drilling, the lessee/operator/permittee would conduct studies in areas containing springs to ensure subsequent drilling activities would not disrupt flow of the perennial springs, unless such studies have already been completed. Study plans would be developed in consultation with the BLM and USFWS and other agencies, as appropriate.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

77.	2-6	LS 3	Loya/FWS	<p>It was not the intent of LS 3b. to restrict leasing or have NSO below springs. The language in the DEIS suggests these restriction by the use of "Within 3 miles of or above ...." We recommend revising to state:</p> <p>i. No leasing and no new non-subsistence infrastructure will be permitted within 3 miles adjacent to or above Sadlerochit Spring (04N031E) nor within a 1 mile buffer below the spring to where it enters the Saddlerochit river and along the aufeis formation (04N031E &amp; 05N031E). This spring supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.</p> <p>ii. No leasing will be permitted within 3 miles adjacent to or above the perennial spring at Fish Hole 1 on the Hulahula River (05N032E). Further, no new non-subsistence infrastructure within 4 miles of the perennial spring at Fish Hole 1 on the Hulahula River (05N032E) per LS 1, nor within 1 mile of the aufeis field (05N032E &amp; 06N032E). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.</p> <p>iii. No leasing will be permitted within 3 miles adjacent to or above the perennial Tamayariak Spring, and no new non-subsistence infrastructure will be permitted within 1 mile of the associated aufeis field (07N026E).</p> <p>iv. No leasing will be permitted within 3 miles adjacent to or above the perennial Okerokavik Spring (04N036E), and no new non-subsistence infrastructure will be permitted within 1 mile of the associated aufeis field in the Jago River drainage (05N035E &amp; 05N036E).</p>		
-----	-----	------	----------	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
78.	2-6	LS 4	Carl/FWS	Lease Stipulation 4 for Alternative B or Alternative C does not acknowledge obligations regarding ESA designated critical habitat for polar bears. In fact, none of the ROPs acknowledge this.		
79.	2-7	First 3-4 lines of Lease stip 7, Requirement/Standard for Alt D	R. Wilson/FWS	This statement '... between May 15 and November 1 or when sea ice is within 10 miles of the coast each season, whichever is later.' should actually be '... between May 15 and November 1 or when sea ice extent (as defined by Fetterer et al. 2017) is beyond 10 miles of the coast each season, whichever is later.' As written, it would imply that when sea ice is right up on shore in December that exploration could not occur. The intent is to say that when ice has retreated from shore, and is beyond a distance that may cause physical distress for bears to swim, activity should cease because bears are likely to be on shore for the summer/autumn. Here is the citation for the sea ice extent data: Fetterer, F., K. Knowles, W. Meier, M. Savoie, and A. K. Windnagel. 2017, updated daily. Sea Ice Index, Version 3. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. doi: <a href="https://doi.org/10.7265/NSK072F8">https://doi.org/10.7265/NSK072F8</a> .		
80.	2-9	LS 6	Loya/FWS	Delete the following sentence at the end of the paragraph on this page last line of the stipulation for Alt D:  The intent of this requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of oilfields in the region.		
81.	3-1	13	Leonard/FWS	Reference to Chapter 4, Cumulative Effects. There is not a Chapter 4. It appears each section in Chapter 3 deals with all the alternatives within each subject. Remove reference to Chapter 4 and clarify reference to Cumulative Effects.		
82.	3-1	25	Leonard/FWS	Reference the 30 yr average as the definition of climate.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
83.	3-1	36	Carl/FWS	"Summer" does not last through September on the North Slope. Autumn peaks in mid-August. Additionally, this sentence only recognizes the existence of two seasons – summer and winter. It should reflect the existence of the other two (spring and autumn).		
84.	3-105	27	R. Wilson/FWS	Not a valid assumption that all grizzly dens would be detected during den surveys. I would omit ", assuming all such dens are located on those surveys" and replace with ", although complete detection of dens is unlikely (Amstrup et al. 2004)."		
85.	3-108	21	S. Arthur/FWS	Revise sentence as: "areas adjacent to the PCH calving grounds contain less high-quality forage and higher predator densities, and exhibit more topographic relief than do the current PCH calving grounds..."		
86.	3-108	3	Crane/FWS	The citation in this line is incorrect (Boulanger et al 2020).		
87.	3-110	26	Matz/FWS	Add this sentence, "Dust generated during creation of and travel on gravel roads may contaminate roadside vegetation, upon which mammals forage."		
88.	3-110	28-31	Loya/FWS	Recommend expanding the description of seismic activity, and clearly identifying and quantifying impacts.		
89.	3-110	37	S. Arthur/FWS	Citation of Wilson et al. (2012) refers to the TCH, not the PCH		
90.	3-111	25	S. Arthur/FWS	Revise as: "defines the time period as the caribou calving season" rather than "when caribou are present". As stated on line 26, caribou are present in this area well past June 15.		
91.	3-111	37	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
92.	3-112	17-20	R. Wilson/FWS	It is inconsistent to say that seismic won't be able to occur in areas off limits to leasing when it's scheduled to happen this winter, before a record of decision. This text should be modified to say something to the effect of "following area-wide seismic expected to be conducted prior to the implementation of this plan, future seismic would not occur in areas off limits to leasing."		
93.	3-112	19	Loya/FWS	'Southwestern' should be changed to 'southeastern' if referring the calving area		
94.	3-113	14	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		
95.	3-113	39	S. Arthur/FWS	Delete "activity"		
96.	3-114	1-2	S. Arthur/FWS	Sentence does not make sense. Revise as "Alternative D would also prohibit ...." (beginning on previous page)		
97.	3-114	6	S. Arthur/FWS	Revise "3 mil" as "3 miles"		
98.	3-115	40	S. Arthur/FWS	Revise "documents" as "documented"		
99.	3-116	Table 3.3.5-I	Matz/FWS	Under Potential Effects for "Gravel and Pipeline Infrastructure," add "Contamination of roadside forage due to dust."		
100.	3-117	10	S. Arthur/FWS	Citation should be "Griffith" rather than "Griffiths"		
101.	3-117	13	S. Arthur/FWS	Revise sentence beginning "Additional oil development..." as: "Infrastructure constructed to support development within the program area is likely to facilitate additional oil development west of the program area, which will increase exposure of CAH caribou to development. This could alter their behavior and movements..."		
102.	3-117	Table 3.3.5-I	S. Arthur/FWS	Effect type for Gravel Mine should be "Adverse" rather than "Low"		
103.	3-118	26	Hamilton/FWS	The worldwide population of polar bears should be updated to reflect Regerhr et al. Following is copied from IUCN Report - The total number of polar bears worldwide is estimated to be 26,000 (95% CI=22,000–31,000; Regehr et al. 2016)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
104.	3-119	23	Crane/FWS	There are more recent stock assessments for polar bears than 2010. The most recent one is from 2017 and has an estimate of ~ 900 bears. Recommend updating this section.		
105.	3-119	LI-6	R. Wilson/FWS	Need to state that only the SBS stock is being considered for this analysis. Suggest something like the following: "... thus, the program area is in the core activity area of the SBS and the below analyses only consider impacts to the SBS stock"		
106.	3-12	36	FWS – BAWR (Allen and Collins)	Cumulative Impacts Section – The FWS BAWR continues to not recommend a qualitative approach to addressing these air impact concerns. Appropriate time and resources needed to be allocated after the delivery of the Reasonably Foreseeable Development (RFD) documentation for quantitative analysis (project and cumulative level) to be conducted.		
107.	3-12	6	Matz/FWS	Change to: "Collect baseline ambient air data for a time period sufficient to support air quality modeling to analyze direct, indirect, and cumulative impacts (typically, one year) prior to...."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
108.	3-120	11-18	R. Wilson/FWS	If this section is only talking about all polar bears in the US, then also need to include text about the Bilateral Agreement with Russia, the I-I (native-native agreement) between natives in the US and Canada, and a MOU between the US and Canada, signed by the Sec of the Interior. If only referring to the SBS stock, then only the later 2 need to be mentioned. For the first, updated text could be "Polar bears in the Chukchi Sea stock are managed bilaterally with Russia under the Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska—Chukotka Polar Bear Population. The Inupiat-Inuvialuit Agreement is a Native to Native Agreement between the U.S. and Canada for managing the harvest of bears in the SBS stock. It is a voluntary agreement. Finally, the Memorandum of Understanding between Environment Canada and the United States Department of the Interior Concerning the Conservation and Management of Shared Polar Bear Populations enhances the coordination between the U.S. and Canada on the conservation and management of polar bears in the SBS stock."		
109.	3-120	8	Crane/FWS	The existing ITRs for the Beaufort Sea do not cover the program area. Recommend correcting this statement to clarify that new ITRs will need to be developed to address take of polar bears in the program area.		
110.	3-121	12	R. Wilson/FWS	I would change this sentence to read as follows because all age/sex classes are represented on shore: "... besides denning females, adult females with and without cubs, sub adults, and adult males all come ashore."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
111.	3-121, 3-122	39; 1	R. Wilson/FWS	Herreman and Peacock 2013 did not study the Kaktovik Bone pile, or estimate the number of bears using it. It was the bone pile at Point Barrow. They also didn't claim that at least 15% of the SBS used it, but that it could represent 15% of the SBS stock if they all were from the SBS stock, which is unlikely given the large overlap in that area between the CS and SBS stocks. The dissertation by Lillie (2018), however, does provide an estimate of bone pile use in Kaktovik. So, you could include the following text: "As many as 146 (SE=21) bears from the SBS stock were estimated to have used the bone pile in Kaktovik in 2012 based on hair-snare data." Here is the link to the dissertation <a href="https://digitalcommons.usu.edu/etd/7252">https://digitalcommons.usu.edu/etd/7252</a>		
112.	3-123	18-19	R. Wilson/FWS	This citation (Amstrup 2003a) is too outdated to make this statement. Should probably cite Atwood et al. (2016) and statement something like "Up to 37% of adult females have been estimated to use land in the summer, spending an average of 56 days on shore. Given that adult males and sub-adult animals are not able to be collared to track their movements, it's unclear what proportion of those bears use land. However, it is clear that they also use land in the summer and autumn (Miller et al. 2015)"		
113.	3-127	L2-4	R. Wilson/FWS	While it might be true that the amount of critical barrier island habitat present in the 1002 area is only a small proportion available to bears, it does receive a disproportionate amount of use compared to most of the other barrier islands. Thus, the statement is misleading. Add an additional sentence at the end stating that, "Even though the overall proportion of critical barrier island habitat potentially affected is not large in the 1002 area, it does receive a disproportionately high level of use (Wilson et al. 2017) and thus if it were to be affected by program-related activities, it could have a larger impact on bears than indicated based on the proportion of the total amount it represents"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
114.	3-128	32-33	R. Wilson/FWS	It is inaccurate to say that all three alternatives would lead to similar levels of disturbance and displacement. Alt D provides protection for a significant proportion of important denning habitat, which would lead to significantly less potential for disturbance than Alt B, for instance.		
115.	3-13 to 3-14	42& 43 1 & 2	FWS – BAWR (Allen and Collins)	The conclusion that these air impacts are cumulative and are not project is incorrect. Suggested language: "Cumulative visibility impacts and deposition levels for all sources included in the BOEM analysis were above thresholds, and warrant additional quantitative (project and cumulative level) analysis." - Delete the rest of the sentence from "often" to "... of all sources."		
116.	3-130	41	Crane/FWS	While the current statement is correct regarding population level effects to polar bears, those analyses were based on activities occurring in NPRA and there being no industrial activity in Arctic National Wildlife Refuge, where the habitat is used by a greater proportion of the SBS polar bear population. Recommend clarifying this statement to reflect this detail.		
117.	3-131	26-27	R. Wilson/FWS	It is highly unlikely that the assumption that all dens will be detected by pre-construction den surveys. Under a best-case scenario, where FLIR was used to attempt to detect known dens, Amstrup et al. (2004) only successfully detected 62% of dens after a single FLIR survey. It is likely that this value would be considerably lower when den locations are not previously know. This assumption is not valid.		
118.	3-134	35	Crane/FWS	According to NMFS, past exploration activities have resulted in the death of at least one seal due to a lair being crushed. Recommend coordinating with NMFS for additional details and updating this section as appropriate.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
119.	3-134	4-6	R. Wilson/FWS	It is inaccurate to state that the only type of marine program-related spill that could occur is related to marine vessels. It appears that Alternatives B and C would allow for some development on coastal islands or waters and, if that is the case, we recommend that the potential for an underwater pipeline release should be considered.		
120.	3-136	L	R. Wilson/FWS	Should be changed to '... and as maternal females search for den locations in autumn and leave dens with dependent young in late winter'		
121.	3-14	21-28	Loya/FWS/FWS	It is insufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents and search for information. If DEIS is used, then provide further information such as Chapter and/or page numbers.		
122.	3-140	24	Crane/FWS	There are no current ITRs that cover the program area. Recommend correcting this statement to reflect this detail.		
123.	3-141	30	Crane/FWS	Recommend deleting the sentence that begins "Compared with climate change..." as the effects analysis should not discount nor attempt to justify the adverse effects of the action on natural resources by comparing it to other adverse actions or activities that may occur in the area.		
124.	3-143	10-11	Berendzen/ FWS	Unclear what "Of the remaining surface area, 99 percent (138,700 acres) is water" is referring to? Suggests that it would be lagoon waters, but those inside the refuge are administered by FWS. KIC lands are not 99% water??		
125.	3-143	21	Berendzen/ FWS	Only aware of one airport. Old Air Force runway is no longer used		
126.	3-145	13-15	Berendzen/ FWS	Inaccurate statement - Kaktovik is bordered on south by KIC lands		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
127.	3-147	36	LaKowski/ FWS	After the sentence ending with "...a 20-mile tractor trail.", I recommend either adding the following sentence (or add as a footnote): "The RS 2477 trails have been identified and asserted by the State of Alaska, but the validity of all RS 2477 trails must be determined either via a determination of perfection prior to FLPMA or through appropriate judicial proceedings."		
128.	3-153	24	DeCleva/USF WS	Insert "documented" before "cultural resources"		
129.	3-154	6	DeCleva/USF WS	Insert "documented" before "cultural resources"		
130.	3-155	11	Carl/FWS	Change "are transported" to "migrate." The use of the word "transported" suggests that they are carried through in shipments. This is not accurate.		
131.	3-155	12-13	Carl/FWS	The Federal Subsistence Board has legally recognized the customary and traditional uses of Dall sheep and moose for the communities of Point Hope and Anaktuvuk Pass in Unit 26C. See 50 C.F.R. §100.24(a)(1). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of Dall sheep for the communities of Chalkyitsik and Fort Yukon in Unit 26C. See id. The Draft EIS needs to analyze the potential impacts to the communities based on activities in the program area.		
132.	3-155	13	Carl/FWS	In reference to the term "contemporary uses." The correct standard under Title VIII is whether the community has an established customary and traditional use. This should be changed to reflect the correct standard.		
133.	3-156	28	JReam/FWS	It would be helpful to know the actual number of respondents as "all respondents" could indicated a single household.		
134.	3-156	3	JReam/FWS	ANILCA lists one additional element of subsistence that should be included in this line – traditional. It may be inherently part of "cultural" but I would suggest that the sentence be consistent with the legislation.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
135.	3-156	32-33	Carl/FWS	List of terrestrial mammals for residents of Kaktovik should include musk ox. See 50 C.F.R. §100.24(a)(1).		
136.	3-156	33	Carl/FWS	Change "grizzly bear" to "brown bear" for correct term used under applicable State and Federal regulations. Make change throughout document.		
137.	3-156	4/5	JReam/FWS	I would restructure the sentence a bit and mention explicitly that, concerning the harvest of fish and wildlife, corporation owned land is managed by the State.		
138.	3-156	7	Carl/FWS	This sentence asserts that private lands within the program area are subject to federal subsistence regulations. This is not correct. See 50 C.F.R. §100.4 (definition of "public lands").		
139.	3-157	26/27	JReam/FWS	Define a "core species"		
140.	3-158	1-2	JReam/FWS	The use of the terms "material" and "cultural" in this sentence and the associated table (J-6) to be awkward. Perhaps "Harvest Contribution (Usable Weigh)" could replace "Material Importance." I do not think it is appropriate to measure "cultural importance" simply by analyzing % of households trying to harvest and those receiving a given resource. Sure, these can be indicators, but what happens when a resource is scarce, regulations hinder harvest attempts, and sharing is minimal due to unforeseen challenges? Suggest changing the reference to something like "Effort and Sharing Indices." Same in each community section. Alternatively, we could qualify "importance" as "nutritional importance."		
141.	3-158	17	JReam/FWS	This should read "for the most recent period [in which information is available]"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
142.	3-162	11	Carl/FWS	Two general comments on this section. First, the analysis does not include communities in Canada that rely on the PCH for customary and traditional uses. The analysis must include those communities in order to "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd by ... in Yukon and Northwest Territories, Native users as defined ..." Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd, Section 2(b)(2). See also id. at Section 3(b) ("The Parties will ensure that the Porcupine Caribou Herd, its habitat and the interests of users of Porcupine Caribou are given effective consideration in evaluating proposed activities within the range of the Herd.") and Section 3(g) ("When evaluating the environmental consequences of a proposed activity, the Parties will consider and analyze potential impacts, including cumulative impacts, to the Porcupine Caribou Herd, its habitat and affected users of Porcupine Caribou.").		
				Additionally, the Federal Subsistence Board has recognized the customary and traditional use of caribou in Unit 26C by the residents of Point Hope, see 50 C.F.R. §100.24(a)(1), who are omitted from this analysis.		
143.	3-163	13-14	Carl/FWS	It is not sufficient to defer analysis because "project details are uncertain or unknown." The locations and types of activities are known well enough, as well as the location and uses of fish and wildlife resources. This, along with known impacts of other similar activities on the North Slope, can inform a more thorough analysis.		
144.	3-163	26	Carl/FWS	This sections should include: (1) destruction of habitat and related impacts to subsistence resources, and (2) deflection of migratory species that are relied upon for subsistence.		
145.	3-163	32	Carl/FWS	What does the label of "short term" mean?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
146.	3-163	35	Carl/FWS	Change "have the potential" to "will," as there is enough data to know for certain that impacts will occur. The only uncertainty is the degree of impact.		
147.	3-164	17	Carl/FWS	Change "may result" to "will result," as there is enough data to know for certain that these activities will occur in connection with oil and gas exploration, leasing, development and production.		
148.	3-164	27	Carl/FWS	After reference to traditional knowledge, add that biological science shows that marine mammals are sensitive to such disturbance. That is why CAAs are required for all oil and gas offshore operations during marine mammal migratory seasons.		
149.	3-164	41	Carl/FWS	Change "could experience a decline" to "would experience a decline." Under no circumstances will the PCH not experience a decline if there is "large scale displacement from PCH calving grounds." Calf survival is crucial to the health of the PCH, or any caribou herd.		
150.	3-165	39-40	Carl/FWS	This sentence suggests that there may be times where development may not occur within harvesting areas or during harvesting times. Once the infrastructure is in place in a harvesting area, it will always occur during harvesting times – infrastructure will not be removed on a seasonal basis to accommodate subsistence activities.		
151.	3-166	2	JReam/FWS	I would posit that "simply dislike the experience" has a connotation of being "minimal". Perhaps consider "noise pollution and increased human activity may be considered to degrade the subsistence experience."		
152.	3-166	24	Carl/FWS	Change "could pose" to "will pose" – it is the only appropriate phrasing given the rest of that sentence.		
153.	3-166	39-40	Carl/FWS	How many residents of the villages you are analyzing do not have either an ATV or snowmachine? Quantify that in order to justify including this as a benefit.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
154.	3-166	4	Carl/FWS	Change "could include" to "would include." These types of infrastructure are guaranteed with oil and gas operations.		
155.	3-167	16	Carl/FWS	The assertion "infrastructure is not expected to divert caribou migration altogether" is not supported. Testimony in the transcripts for the meetings of the Western Interior Alaska Subsistence Regional Advisory Council, along with correspondence from that Council to federal agencies, indicates that the development of the Dalton Highway permanently altered caribou migration patterns. This should be considered in the analysis.		
156.	3-167	3	Crane/FWS	Impacts of increased access to the area via corridor built to support oil and gas development also include an increase in the likelihood of illegal harvest. Recommend addressing this in the effects analysis.		
157.	3-167	42	Carl/FWS	The assertion that oil spills "would be largely contained" is unsupported and fails to recognize the difference in the water regimes in the Coastal Plain compared to the Prudhoe Bay area. There are significantly more river systems in the Coastal Plain by comparison (most water in the Prudhoe Bay industrial area is ponds), and such rivers would not provide for containment of an oil spill. During break-up and associated sheetflow, spills would not be contained. Rivers with oil spills in the Lower 48 have shown challenges with containment.		
158.	3-167	5	JReam/FWS	Another important impact to consider is how project roads could facilitate increased access by non-local hunters and recreational users (resulting in increased competition), especially if project roads connect to statewide road systems, either now or in the future. This fear is commonly voiced at subsistence regional advisory council meetings.		
159.	3-168	12	Carl/FWS	Change "could result" to "will result." That there will be reduced access is guaranteed; the only issue is to what degree.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
160.	3-168	22-32	Carl/FWS	Reduced user access and resource availability means exactly what in practical terms? Less food, more food costs, changes in diet, loss of culture, etc. North Slope and Northwest Arctic communities use the term "starvation" when they discuss periods of time when caribou were not abundant.		
161.	3-168	32	Carl/FWS	Affirmatively state who will provide the "dividends" referred to, and how many residents of what communities will receive such dividends. There are no revenue projections that suggest such dividends will be issued.		
162.	3-169	11-13	Joshua Rose/USFWS	It is unclear how "an increase in employment rates or income" will impact "user access". Does this mean more individuals will have money to buy materials needed to access subsistence resources, won't be able to get in and out of the villages because more people will be using the limited flights in and out of communities, they won't have time to access subsistence resources because they will be working? Need to clarify what this means.		
163.	3-169	24-25	Joshua Rose/USFWS	Clarify "timing restrictions on human activity". Does this apply to oil and gas activity, subsistence, all human activity? If this applies to subsistence access there will be greater restrictions than just "timing" once infrastructure is in place.		
164.	3-169	24-25	Carl/FWS	There will be more than timing restrictions. Once infrastructure is in place, it will create access restrictions (likely permanent given the pervasiveness of abandoned oil and gas infrastructure in the Prudhoe Bay area) as well.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
165.	3-17; 3-18	30-40; 1-21	Loya/FWS	Noise disturbance from construction and aircraft to humans and wildlife are of great concern to communities across the Arctic. The DEIS does not adequately analyze or attempt to quantify the level of activity and how it will vary across alternatives. An estimate should be provided of annual activity and the acres or proportion of the area that would be affected by noise. Further, the DEIS largely considers Kaktovik Airport to be the hub of aircraft disturbance and does not adequately consider air traffic coming from Prudhoe Bay or other sites on the Dalton highway with airstrips. Further, the DEIS does not account for the impacts associated with support activities, such as surveys, stick-picking and research, much of which is done by helicopters which have been used only rarely under current management. The DEIS should reference the aviation data collected by BLM for landings in NPRA as an example/analog for activity (e.g. ~10,000 landings in 2018) and describe where it is likely to occur under each alternative.		
166.	3-170	15	Carl/FWS	Change "which could" to "which will" as it will be impossible for there to be no impacts to subsistence harvest opportunity or subsistence activity. The only question is degree of impact.		
167.	3-170	33	Carl/FWS	Change "would lead" to "will," as, by definition, creating an entirely new area for oil and gas activity will further expand oil and gas development in the North Slope.		
168.	3-170	38-39	Carl/FWS	Describe in detail exactly how increased income will help offset impacts to subsistence resources, both in the short term and the long term.		
169.	3-172	11	Carl/FWS	Change "1970 passage" to "1971 passage."		
170.	3-173	21	Crane/FWS	Recommend clarifying what permit authority the EIS is referring to for the FWS.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
171.	3-173	30-31	Carl/FWS	Two comments. First, quantify exactly how and which communities have shared in financial gains related to oil and gas development on the North Slope. Second, acknowledge that no similar benefits have been or will be shared with the villages of Arctic Village and Venetie.		
172.	3-174	32	Carl/FWS	Add additional sentence at the end: "As such, those communities do not receive any financial benefit associated with resource development or shares therein by ANCSA corporations."		
173.	3-175	24	Carl/FWS	The end of this sentence is highly editorial. It is a "driving force" according to whom? Do all communities of the North Slope believe that their economies are driven by oil and gas development?		
174.	3-176	21	Carl/FWS	Change "may make these" to "will make these," as there is no question as to the impact; the only question is degree.		
175.	3-176	22	Carl/FWS	Change "wherewithal" to "capacity" or "ability."		
176.	3-178	34-35	Carl/FWS	Change "has the potential to" to "will likely," as there is no question that it will affect sociocultural systems – this analysis clearly states that. The only question is degree.		
177.	3-179	15	Carl/FWS	This is a general comment on the section starting on this line, this page. There is no indication as to the amount or quality of local employment resulting from oil and gas development in this area. Consider both the short-term and long-term effects (e.g. James, A. 2016. The long-run viability of Prudhoe Bay. Resources Policy 50: 270-275.		
178.	3-179	36	Carl/FWS	Specify by percentage how many super-harvester households also have high income, in order to weigh the merits of this statement.		
179.	3-18 to 3-20		Jorgenson/FWS	The descriptions of the program area should be rewritten using the map in Nowacki et al. 2001. It is a newer, more detailed map than the one used. The two maps differ greatly in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
180.	3-180	29	Carl/FWS	Given they do not enjoy revenue-sharing, what "limited" economic benefit will Arctic Village and Venetie enjoy as the result of oil and gas development in the program area?		
181.	3-180	3	Carl/FWS	Previously, text indicates that "many" super-harvesters are high income earners, and here it asserts that they are "often." Be consistent with terminology, as one word indicates number, the other frequency.		
182.	3-181	31	JReam/FWS	Decreased use of certain traditional areas may be influenced by more than resource availability and user access changes – consider how noise, human activity, and competition effect a meaningful subsistence "experience."		
183.	3-184	14	Carl/FWS	This section fails to analyze or consider "historical patterns of exposure to environmental hazards" (or the fact that these communities have not been so exposed, except for Nuiqsut) as required by the 1997 CEQ guidance on Environmental Justice analyses.		
184.	3-185	5-6	Carl/FWS	The Federal Subsistence Board has legally recognized the customary and traditional uses of Dall sheep and moose for the communities of Point Hope and Anaktuvuk Pass in Unit 26C. See 50 C.F.R. §100.24(a)(1). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of Dall sheep for the communities of Chalkyitsik and Fort Yukon in Unit 26C. See id. The entire Environmental Justice section needs to consider the impacts to these additional communities. This is in addition to including discussion of all communities that rely upon caribou for subsistence, as noted in comments on 3-162, line 11.		
185.	3-186	15	JReam/FWS	I would add "subsistence resources [and their uses]" to encapsulate that subsistence values are broader than the availability of resources for nutritional purposes.		
186.	3-188	16	Carl/FWS	Change "could" to "will" as it is not a question of if, but to what degree.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
187.	3-188	27	Carl/FWS	Insert the word "adverse" in between "lasting" and "effects."		
188.	3-188	42	Carl/FWS	Quantify the expected revenue that will accrue, and the basis for the estimate. The estimate provided during the discussion of the Tax Act was not in accord with recent comparable oil and gas lease sales in the NPR-A.		
189.	3-188	8-9	Carl/FWS	Suggest rewording "Potential adverse economic impacts are identified, and potential localized beneficial...." The loss of subsistence resources, and thus increased reliance upon store-bought foods and a cash economy would be a significant adverse economic impact.		
190.	3-189	10-11	Carl/FWS	The history of oil and gas operations reflects that there are potential contamination sources for subsistence foods beyond just oil spills. This should be thoroughly acknowledged and detailed.		
191.	3-189	11	Matz/FWS	Change sentence to read, "...with the possible exception of contamination through an oil spill or through contaminants mobilized through erosion or permafrost degradation."		
192.	3-189	18-19	Carl/FWS	"Until site-specific development activities are proposed, the extent of this effect is not possible to determine." We suggest that analysis can be done of the likely effects if activities were to occur near those areas, given known impacts of such activities elsewhere in the North Slope area. Recommend completing analysis of likely effects should development occur near the areas listed in line 17 using known impacts of such activities in the North Slope area.		
193.	3-189	28	Carl/FWS	Rationale needed for how and why there is going to be an increased level of recreation use in the program area under all alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
194.	3-189	7-9	Carl/FWS	The history of oil and gas operations on the North Slope shows that best practices, regulation and monitoring does not prevent numerous and significant oil spills related to operation. This sentence should be significantly altered to reflect this reality or simply be stricken as inaccurate.		
195.	3-19	18-36	Loya/FWS	Recommend revising permafrost text to reflect updated information available in Jorgenson et al. 2015. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		
196.	3-19	34 - 36	Jorgenson/FWS	Delete last sentence in this paragraph. The systematic field sample described in Jorgenson et al. 1994 (and a number of other data sets) shows that low-centered polygons are in the minority in the program area; polygons with centers that are drier than the edges (flat centered polygons) are much more common. Low-centered polygons occur in very wet tundra, which is more common west of the refuge than in the refuge.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
197.	3-19	9-17	Loya/FWS	<p>This section is largely duplicated in Section 3.2.8 and could be combined. Text references language (Teshekpuk (1a) and White Hills (1b)) not depicted in Map 3-1 and inconsistent with section 3.2.8 Soil Resources. Map 3-1 uses Coastal Plain, Foothills and Arctic Mountains, as does 3.2.8. Recommended revising this section to be more concise and updated. According to the map included in the DEIS, the majority of the program area is considered to be coastal plain physiography (Map3-1), characterized by relatively flat lowlands with scattered lakes. However, due to the proximity of the Brooks Range to the coast in the eastern end of the Alaskan Arctic, large alluvial fans extend into the program area creating upland terrain with moderate slopes which can extend to the coast, especially south of Camden Bay (Jorgenson et al. 2015). It is misleading to suggest all of the area show in Map3-1 is similar to the coastal plain described as Teshekpuk by Wahrhaftig 1965.</p> <p>Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a>.</p>		
198.	3-190	12-13	Carl/FWS	We appreciate the acknowledgement of potential impacts on the belief systems, cultural identity, and sacred site of calving grounds. Please explain how these impacts are measured and how they vary across the alternatives.		
199.	3-190	25	Carl/FWS	Strike "potentially" from this line. Reduction in harvest will result in this shift. The only question is degree.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
200.	3-192	12	Joshua Rose/ USFWS	Strike the words "perceived as" from this line. There is significant documentation of climate driven changes in northern Alaska and that these changes have affected subsistence activities (Hinzman et al. 2005, "Evidence and Implications fo recent climate change in northern Alaska and other arctic regions". DOI: 10.1007/~10584-005-5352-2).		
201.	3-192	27	Carl/FWS	Change "could" to "will" at the beginning of this line. The question is not whether, but to what degree.		
202.	3-192	38	Carl/FWS	The line references "increased TAPS throughput." The impact of increased oil throughput from a Coastal Plain oil and gas program on the TAPS, which has far exceeded its originally planned lifespan, needs to be considered in the cumulative impacts analysis. When the TAPS ROW was renewed in the early 2000s, the possibility of oil from the Coastal Plain was not likely analyzed in that EIS document.		
203.	3-192	40-42	Carl/FWS	Quantitative data is lacking as to the extent of enhanced government revenues and increased job opportunities for Alaskans. How much will be provided for both areas?		
204.	3-193	32-33	Carl/FWS	This sentence indicates that hunting and fishing for federally qualified subsistence users is a "primary recreation opportunity." This assertion should be deleted, as it will be inflammatory to federally qualified subsistence users for their customary and traditional activities to be equated with recreational activities.		
205.	3-193	33	Reed/FWS	Correct sentence to read "...to non-Federally qualified..." (recreational hunting, or general hunting, as the SOA refers to it, does not include federally-qualified subsistence users)		
206.	3-193	37-38	Reed/FWS	Replace beginning of second sentence in last paragraph with: "Until recently, most..."; and add this sentence after: "Increasingly, visitors come later in the fall season, experiencing rapid decreases in average daily daylight and increased opportunity to view the Northern Lights."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
207.	3-194	10	Reed/FWS	Begin paragraph with: "Visitor use in the project area has increased in recent years with the emergence of polar bear viewing on waters immediately surrounding Kaktovik."		
208.	3-194	10	Reed/FWS	Change sentence beginning with: "More than 90 percent..." to "Prior to the emergence of polar bear viewing, more than 90 percent..."		
209.	3-194	11-15	Reed/FWS	Change following two sentences (beginning with "Other visitors..." and "During the summer...") to past-tense.		
210.	3-194	15	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace paragraph content beginning with "In 2017..." with "In 2017, guided polar bear viewing accounted for approximately 54 percent of all reported guided recreation activities in the program area. Polar bear viewing occurs on waters immediately adjacent to Kaktovik. Of the remaining 46 percent of visitors to the project area, use was more dispersed, and river floaters accounted for the majority (60 percent), while backpackers, base campers, and hunters each made up a portion of the minority of activity types (40 percent). Visitors conducting each of these four recreational activity types depend predominantly on use of river corridors during all or a portion of their visits.		
211.	3-194	23	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace "In 2017, approximately 8 percent..." with "In 2017, approximately 4 percent..." and add the following sentence. Of the visitors to the project area whose use was focused on river corridors (i.e.: not polar bear viewers), approximately 8 percent were hunters. "		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
212.	3-194	6-7	Reed/FWS	End sentence with "...arrive by chartered aircraft." Strike "..., which is part of their special use permit."		
213.	3-194	7	Reed/FWS	Replace sentence beginning with "They..." with "Air operators providing transportation services to visitors are regulated through a special use permit system, which conditions their operations. There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land where surface conditions permit it."		
214.	3-194	8	Reed/FWS	Replace first part of sentence beginning with "Individual hikers..." with "Visitors enter the program area directly via chartered aircraft, from the north via Kaktovik, or to a lesser extent..."		
215.	3-195	25	Reed/FWS	Replace "...unique primitive recreation experiences..." with "...primitive recreation experiences that are unique on a world scale (such as expedition-length float hunts and polar bear viewing)..."		
216.	3-198	11	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		
217.	3-198	39-40	Reed/FWS	Change to read: "This would also <i>minimize impacts</i> to the viability of specially-permitted..."		
218.	3-199	1-2	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

219.	3-2	17-26	Loya/FWS	<p>Weather data, especially wind and precipitation, from Kaktovik is insufficient to describe conditions across the program area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.</p> <p>Katabatic winds from the mountains have a significant effect on snow distribution in the area.</p> <p>Recommend adding this info after line 26: Inland near the Brooks Range, monthly mean wind speeds are slightly lower (4.2ms<sup>-1</sup>; Olsson and others, 2002), but strong winds from the south, readily exceeding exceed 20ms<sup>-1</sup>, can originate as katabatic flows down the many north-oriented valleys of the Brooks Range (Sturm and Stuefer 2013). In general, snow depth and snow water equivalent (SWE) decrease from inland to the coast (SWE values of 15–20cm near the foothills to 6–12 cm near the coast; Liston and Sturm, 1998), while bulk snow density and the prevalence of wind slabs increase (Sturm and Liston, 2003).</p> <p>Liston GE and Sturm M (1998) A snow-transport model for complex terrain. J. Glaciol., 44(148), 498–516</p> <p>Olsson PQ, Hinzman LD, Sturm M, Liston GE and Kane DL (2002) Surface climate and snow–weather relationships of the Kuparuk Basin on Alaska's Arctic Slope. ERDC/CRREL Tech. Rep. TR-02-10)</p> <p>Sturm M and Liston GE (2003) The snow cover on lakes of the Arctic Coastal Plain of Alaska, USA. J. Glaciol., 49(166), 370–380 (doi: 10.3189/172756503781830539)</p>		
------	-----	-------	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
				Sturm, M & Stuefer, S (2013). Wind-blown flux rates derived from drifts at arctic snow fences. <i>Journal of Glaciology</i> . 59. 21-34. doi:10.3189/2013jog12j110		
220.	3-2	21-22	Reed/FWS	No wind rose appears in figure referenced		
221.	3-2	9-22	Leonard/FWS	Meteorology from Kaktovik is unlikely to be representative of large portions of the study area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.		
222.	3-200	11	Reed/FWS	Change to read: "...four additional purposes..."		
223.	3-200	Table 3.4.7-1	Kaye- FWS	Table 3.4.7-1 ANWR Purposes lists only EIS sections relevant to ANILCA purposes but does not include the still applicable PLO 2214 purposes. While ANILCA purpose (i) includes the PLO wildlife purpose, the PLO wilderness and recreational purposes are not referenced. They should be.		
224.	3-201	1-3	Reed/FWS	Change to read: "...opportunity to prioritize using existing management authorities and better understand..."		
225.	3-201	20	Reed/FWS	Break first sentence into two. End first sentence of paragraph with "... (NVSRS)." Second sentence should read: "Federal managers of recommended rivers are obligated to use existing management authorities to protect the characteristics of rivers for the conditions under which they were found eligible and suitable (in this instance, as described in the Wild and Scenic River Review)." .		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

226.	3-202	2	Kaye/FWS	<p>Recommend expanding description of the Wilderness Characteristics, Qualities and Values section to include the following:</p> <p>Arctic Refuge Coastal plain wilderness characteristics and values</p> <p>The Arctic Range, including the coastal plain, was initially proposed by the National Park Service as "The Last Great Wilderness" (Kaye 2006) and Public Land Order 2214 (1960) which established the Range identified preservation of wilderness values as one of the area's three purposes. So to clarify, the wilderness characteristics and values described herein are not based on designated (big W) Wilderness, but on the still applicable 1960 wilderness purpose of the original Arctic Range and the wilderness values referenced in ANILCA sections 101(b) and 304(g). Consistent with this wilderness purpose, the Refuge's 2015 Comprehensive Conservation Plan (CCP) declared that "The Arctic Refuge serves a distinctive role in the National Wildlife Refuge System—exemplifying the qualities of natural condition, wild character, and ecological wholeness." The Refuge's CCP went on to recommend the 1002 area for Wilderness designation because it exemplifies these qualities. Studies of Refuge visitors (Christensen and others 2009) and the broader national public's values and interests related to the Refuge (Bengston and others 2010) show that these wilderness qualities are highly prominent in the public's perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge's Special Values (FWS 2015) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain's wilderness purpose and its function within the larger Refuge. It includes the experiential values of those who visit, and vicarious values for those who find satisfaction just knowing the area exists. Wilderness associated values include ecological,</p>		
------	-------	---	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>scientific, wildlife, aesthetic, recreational, and symbolic values, and are summarized as follows: Underpinning the coastal plain's ecological value is its wildness, the characteristic most at risk to development. Wildness is the landscape's freedom from human intent to alter, control, or manipulate its components and ecological and evolutionary processes. This freedom is integral to the area's high degree of biological integrity and natural diversity. It is also integral to the area's scientific value, as a natural laboratory of international significance. Investigations here have and can continue to provide insights into how arctic ecosystems function, transition, and respond to anthropogenic change such as climate change when left alone. Wildlife of the coastal plain remain wild to an unsurpassed degree here, their behavior, interactions, cycles and ecological roles continuing. Caribou, widely recognized as a symbol of the area's wildness, continue their migratory patterns, their ancient memory of unbounded movements to and within their calving grounds, unimpeded by developments. This wild quality of caribou and several of the Refuge's other species led to the research finding that "the national public's interest in the refuge's wildlife would be best served by maintaining the natural roles, interactions, and population dynamics of all species (Bengston and others 2010). Recreational visitors come to the coastal plain seeking a "wilderness experience," enhanced by all the aforementioned values. A 2009 study of Refuge visitors found that wilderness and wildness values were highly important as both motivations for visiting and as conditions that were experienced. As was intended by the Arctic Range's founders, the Arctic Refuge has become a symbolic landscape (Kaye 2006). Since the first efforts to establish a "Last Great Wilderness" here, most people who value this landscape have been less interested in how it can be used than in what its continued preservation represents. Millions who will never set foot in the area find satisfaction, inspiration,</p>		
--	--	--	--	---	--	--

Deleted:

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>and even hope in just knowing it exists. Bequest value is a component of the area's symbolism. For many people, the Refuge represents the hope of a past generation that one of the finest remnants of our natural inheritance will be passed on to future generations, undiminished. For many, the question of the coastal plain's future has come to symbolize daunting questions the nation faces regarding energy policy, sustainability, and our effect upon the larger biosphere we jointly inhabit.</p> <p>The intangible, ineffable yet foundational symbolic value of the area is well summarized by Refuge founder Lowell Sumner (1985) who compared the Refuge to the statue of liberty. In the far north, he wrote, is another American symbol:</p> <p>... and this one too symbolizes freedom . . . freedom to continue, unhindered and forever if we are willing, the particular story of Planet Earth unfolding here—freedom for us as well who need to come to the few out-of-the-way places still remaining . . . but also where we can learn to appreciate and respect the intricate and inscrutable unfolding of the Earth's destiny—when free from meddling human concerns and the urge to take possession of and use up what we so imperfectly understand.</p> <p>Literature Cited</p> <p>Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. <i>International Journal of Wilderness</i>. 16: 13-20.</p> <p>Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.</p> <p>Kaye, R. 2006. Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge. University of Alaska Press, Fairbanks, Alaska.</p>		
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Sumner, L. 1985. Arctic National Wildlife Refuge address, 25 <sup>th</sup> anniversary. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska. U. S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.		
227.	3-202	17	Brady/FWS	When citing the Wilderness Act, please use the language from the Act as follows – 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation an use in an unimpaired condition and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.		
228.	3-202	8	Kaye/FWS	Change to "a natural and wild condition"		
229.	3-203	36	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
230.	3-205	15-16	Reed/FWS	Maintain water quality using Bureau of Land Management's (BLM's) policy and program direction for management of eligible and suitable wild and scenic rivers (WSRs) which directs its plans to "protect and, where feasible, enhance the free-flowing condition, water quality"—through baseline data on quality of water at time of eligibility not by using State water quality standards.		
231.	3-207	17-18	Kaye/FWS	Change to "... measured by the overall visual quality and naturalness and wildness of an area that may be affected by changes to the types and levels of recreational activities, management actions, and surrounding land use."		
232.	3-207	31	Kaye/FWS	Change "could" impact to "would" impact		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
233.	3-207	36	Kaye/FWS	Change "natural appearance" to naturalness		
234.	3-208	18	Kaye/FWS	Change "no impacts" top "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
235.	3-208	25	Kaye/FWS	Delete "apparent"		
236.	3-208	29	Brady/FWS	Need a more robust analysis of the direct/indirect and cumulative effects that each of the alternative oil and gas programs would have on designated wilderness on Arctic Refuge and how an oil and gas program would affect each element of the wilderness; untrammeled; natural, undeveloped, outstanding opportunity for solitude		
237.	3-208	3	Kaye/FWS	Change "could" diminish to "would" diminish		
238.	3-208	9	Kaye/FWS	Change "no impacts" to "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
239.	3-209	23-24	Leonard/FWS	Replace 'on' with 'to' in 2 places since there is no demarcation mentioned between east and west sections.		
240.	3-21	10	Crane/FWS	Impacts from gravel infrastructure will likely persist in the form of no vegetation, compaction, and thermos-karsting even if infrastructure is removed. Recommend clarifying the statement made on page 3-21.		
241.	3-210	30-31	Leonard/FWS	Replace 'Buildings' with 'Human-built structures' AND 'modify' with 'modified'. Begin next sentence by replacing 'Buildings' with 'These structures'		
242.	3-211	14	Leonard/FWS	'dominate' needs explanation. Suggest removing entire sentence unless quantified differences between air and surface.		
243.	3-211	32-34	Leonard/FWS	But the outcome of such an analysis would not be tied to the lease itself (i.e., Stip) but only to a ROP for that action. This should be made very clear. Suggest adding 'and will inform ROPs on such actions, such as the APD phase'.		
244.	3-213	10	Leonard/FWS	Remove 's' from 'surfaces'		
245.	3-213	12	Leonard/FWS	Subject-verb: Change 'is' to 'are'		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
246.	3-215	16	Leonard/FWS	Change 'result' to 'resulting'		
247.	3-215	2-22	Leonard/FWS	Cumulative Impacts, and most of the visual resource section, are purely descriptive. One way to quickly produce quantitative information is to include a viewshed analysis based on different alternatives.		
248.	3-215	24-40+	Berendzen/ FWS	Affected Environment section is repeated on following page		
249.	3-215	32	Berendzen/ FWS	Several short airstrips are used by small fixed-wing aircraft for landing on wheels to transport recreationalists and researchers.		
250.	3-215	32	Reed/FWS	Change sentence to read: "...snow or <i>land</i> ..." See Reed comment for 3-194, line 7--There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land		
251.	3-215	4-8	Berendzen/ FWS	Please identify the anticipated miles of disturbed trail expected from the proposed action, which would be expected to far exceed the 125 miles of disturbance left after damage that occurred 25 years prior. Please identify the effect of this disturbed trail on the ability to achieve refuge purpose #1 -- "to conserve fish and wildlife populations and their habitats in their natural diversity."		
252.	3-216	28	Berendzen/ FWS	The message in these paragraphs is unclear, but suggests that enhancement of public and subsistence transportation would be a benefit. Please identify and analyze the impact of additional transportation infrastructure on the achievement of all of the purposes of the Refuge.		
253.	3-216	3-4	Reed/FWS	Commercial snowmachine use for recreation has not been authorized to my knowledge; recommend striking word "commercial" from sentence beginning in Line 3.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
254.	3-217	5	Loya/FWS	The FWS recommends that roads be closed to motorized use by the public. Subsistence access would be determined under LS 11. Recommended revision:  New transportation infrastructure, such as seasonal or year-round roads, airstrips, or other facilities, would not be available for public use using motorized vehicles. Thus, new infrastructure may enhance only non-motorized public access.		
255.	3-217	6-7	Berendzen/FWS	Industry developed infrastructure is not intended or expected to enhance public access opportunities. Sentence not needed.		
256.	3-22	1-24	Loya/FWS	Estimate of gravel footprint is not an adequate analysis of impacts to the physiography or how physiography would affect infrastructure placement. The info presented in this section belongs in the RFDS section.		
257.	3-233	6	Matz/FWS	Change sentence to read, "...completed (ADEC 2018), although cleanup thresholds may have changed since the date of closure (e.g., ADEC 2017)."  ADEC 2017 is Draft Cleanup Levels Guidance for Methods Two and Three, available at: <a href="http://dec.alaska.gov/spar/csp/guidance-forms/">http://dec.alaska.gov/spar/csp/guidance-forms/</a> . There are other documents describing changes in cleanup guidance and levels on there as well.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
258.	3-24	6; 16	Loya/FWS	No geologic map is present. Recommend using Jorgenson et al. 2015 Figure 11. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalog/Maps/mapping/ows/5a0ae567e4b09a898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		
259.	3-240	10-20	Berendzen/ FWS	These adverse impacts are likely to occur and conflict with other refuge purposes. Need to evaluate the extent of these impacts under each of the alternatives and the associated impact on the ability to meet all of the refuge purposes.		
260.	3-240	38-40	Berendzen/ FWS	Proposed activities would likely result in chronic impacts as stated and conflict with refuge purposes. Need to evaluate the extent of these impacts under each of the alternatives and the associated impact on the ability to meet all of the refuge purposes.		
261.	3-241	23	Berendzen/ FWS	Add " Loss of genetic diversity of wildlife species displaced by development activities"		
262.	3-25	17	Reed/FWS	After the paragraph's first sentence, add this sentence: "The August 12, 2018, M6.4 earthquake with epicenter near Kaktovik changes the level of earthquake activity understood to be foreseeable in the Coastal Plain."		
263.	3-25	17-25	FWS	Earthquake analysis is outdated. A 6.4 magnitude quake struck the area along and adjacent to the Sadlerochit mountains, and potential impacts to infrastructure in the shake zone should be analyzed.		

**Commented [CMA5]:** I would suggest deleting this conclusion -- but will leave it to Mitch to decide.

**Commented [CMA6]:** Ibid

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
264.	3-29	10	Crane/FWS	Recommend expanding the discussion and analysis on the effects of subsidence and permafrost thaw as a result of oil and gas development and on development itself. In 2017, a well failed in NPRA and was attributed to thawing permafrost. With increasing temperatures, it is expected that permafrost thawing will also increase and potentially result in similar incidents.		
265.	3-3	14-15	Leonard/FWS	There are weather stations with data from inside and around the project area that are far closer than Barrow. See <a href="#">GTN-P</a> sites as well former NRCS run <a href="#">SNOTEL</a> sites		
266.	3-3	21-22	Leonard/FWS	Statement about discernable trends is not fully accurate. Most of the precip is driven by inter-annual variability and there are numerous studies that predict an increasing trend for the arctic and some that show a decreasing trend ( e.g., Stafford, J. M., Wendler, G., & Curtis, J. (2000). Temperature and precipitation of Alaska: 50 year trend analysis. Theoretical and Applied Climatology, 67(1-2), 33-44.) However, Nearly all models agree that with increasing temps, we will see increasing precip. The current problem is that we don't have enough weather stations to properly monitor these changes. More importantly though: Total precipitation (assuming authors are excluding snow per 3-2 lines 10-11) is not the salient measurement for change as it relates to temperature above. Changes in the timing of precipitation are important here (e.g., rain on snow events). See: Bieniek, P., Bhatt, U., Walsh, J., Lader, R., Griffith B., Roach, J., Thoman, R. 2018. Assessment of Alaska Rain-on-Snow Events Using Dynamical Downscaling. American Meteorological Society. 57.1847-1863. <a href="https://doi.org/10.1175/JAMC-D-17-0276.1">https://doi.org/10.1175/JAMC-D-17-0276.1</a>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
267.	3-31	20	O'Dell/FWS	The KIC#1 well is the only well that has been drilled in what is now termed the "Coastal Plain". Suggest changing to "Data from most wells drilled near or in the Coastal Plain are held confidential..."		
268.	3-31	8	LaKowski/FWS	Recommend changing "... (previously known as the 1002 Area)..." to "(also known as the 1002 Area)"		
269.	3-31	9	Crane/FWS	Recommend stating that while the Coastal Plain was not designated wilderness, it was recently recommended for designation in the CCP and executive letter to congress and has been managed as such.		
270.	3-33	Line 18	O'Dell/FWS	Area 1002 has not been "poorly studied" but studied extensively with low volume and quality of data. Suggest just saying: "Given the uncertainty involved in defining undiscovered resources within the Coastal Plain, attempting to define variances in production by alternative is too speculative to provide value in the analysis."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
271.	3-35	1-5	Loya/FWS	<p>Because of the USGS assessment is being used as the basis for oil recovery, and it assumes that oil is not evenly distributed across the program area, recommend the following revision. It is not clear where the "medium" oil potential zone comes from, it does not appear to be described in the USGS assessment. Figures AO6 – AO15 suggest that only the "Thin-skinned Thrust Belt Play" may have indicators of oil bearing sand, otherwise the area is assumed to be more favorable for gas than oil. Using the two zones described in the current USGS assessment seems to be the "best available science". The USGS describes two zones: undeformed (high potential) and deformed (low potential). Appendix E summarizes the oil potential as 6.420 BBO for high and 1.267 for low areas. Thus, the text in this section should be revised to reflect the estimated unequal distribution of oil.</p> <p>Further, there is quantified uncertainty which should be preserved in the text. The amount of oil that may not be recovered is difficult to determine as directional drilling may make oil accessible even where no leasing occurs. To quantify the amount that may be "unrecovered" divide the value of total oil in Table E-1 (7.668 BBO (range 4.254 to 11.8) by the value for the deformed part in Table E-2 (1.267 (range 0 to 3.185)) and account for the variation reported by USGS which is 0 BBO to:</p> <p>This closure represents approximately 30 percent of the program area; however the area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
272.	3-35	17-19	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
273.	3-35	29-31	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
274.	3-36	17-22	Loya/FWS	Recommend moving this section on contribution to greenhouse gases to Page 3-4 Section beginning on line 15L Impacts of the proposed action on climate change		
275.	3-36	22	Trawicki/FWS	Is the 9.32 bbo and 4.01 bmt consistent with 3.2.1-2. Use similar units.		
276.	3-39	36	Jorgenson/FWS	Soils are described for lowlands but not for uplands		
277.	3-39	8-16	Loya/FWS	Due to NSO and No leasing, the impacts would not be the same across all alternatives, recommend revising text to reflect at least what percentages of the surface would be undisturbed by development and relate to table 3.2.7-1 PFYC Values of Program Area.		
278.	3-4	24	Leonard/FWS	Add 'and' after 'drilling production'		
279.	3-4	26-30	Hopkins/FWS	Statement about amount of available oil/gas by this project does not cite a study or an analysis and is thus 100% speculation, not factual and should be deleted. Statistics on anticipated oil and gas production are cited later in the EIS – could move those forward to this spot.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
280.	3-4	29	Crane/FWS	The statement regarding no additive effects of combustion of fuels from the program area is based on flawed assumption that development of the program area will preclude the need to develop the same amount of resources elsewhere and vice versa. There does not appear to be a basis for that assumption and is inconsistent with the cumulative impacts language on page 3-36 regarding how production and consumption of fuels from the program area would contribute to climate change. Recommend removing this statement.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
281.	3-4	3-10	Loya/FWS	<p>It is does not seem sufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents. If DEIS is used, then provide further information such as Chapter and/or page numbers. Further, rather than taking an entire paragraph to send the reader to the DEIS for GMT2, it is worth copying that info into this important, programmatic document without taking up too much space. Recommend deleting lines 3-10 and replacing:</p> <p>The North Slope experiences the same climate trends as the Arctic as a whole, including increased average temperatures, thawing of permafrost, expanded growing season and decreases in sea ice and snow cover extent (Walsh et al. 2014). Tundra travel open season on the North Slope decreased from approximately 200 days in 1969 to approximately 120 days in 2004 as a result of regulatory changes, a warming climate and methods for measuring frost depth (North Slope Borough Oil and Gas Technical Report 2014). Tundra travel season is likely to continue to shorten in response to rising average temperatures and changes in precipitation patterns on the North Slope. Precipitation on the North Slope is projected to increase in both summer and winter, while snow cover duration is expected to drop (BLM 2014). Projections for snowfall include a later date of first snowfall and an earlier snowmelt (BLM 2014).</p>		
282.	3-4	31-32	Leonard/FWS	This is conjecture without regard to market timing or any of the various complex factors involved with making an equivalency. Remove sentence. Begin following sentence by removing 'However' and combine with previous section.		
283.	3-4	5-10		Provide links to DEIS and GMT2		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
284.	3-40	2	JRose/FWS	Check citation. Jorgenson et al. was published 8 June 2015.		
285.	3-40	24	JRose/FWS	seems to be a typo "...ground surface and, which is..." should read "...ground surface and is ..." or "...ground surface, which is..."		
286.	3-40	4 - 6	Jorgenson/FWS	Clarify when soils are frozen vs. unfrozen, summer vs. winter. Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
287.	3-40	6	JRose/FWS	Clarify, not sure where "usually unfrozen on south-facing slopes" came from. If there is a source please cite. If it is from Jorgenson et al. 2015, it is miss represented. Jorgenson et al. state "Unusually unfrozen on south-facing slopes in the boreal zone" for upland Loess in Table 3 of that document. No portion of the 1002 is in the boreal zone. Also, Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
288.	3-41	1	JRose/FWS	Need to consider impacts from seismic activities associated with leasing. Various levels of impact have been recorded and last from 2 to greater than 40 years. Impacts include subsidence, thickening of the active layer, and changes in soil moisture (Kemper and Macdonald 2009, Jorgenson et al. 2010, Siobhan et al. 2017,		
289.	3-41	25 – 28	Jorgenson/FWS	Citation to add for this paragraph: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.		

Commented [RJ7]: Added from comment 327

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
290.	3-41	31-32	JRose/FWS	Need to better explain mechanism "This can increase thermal conductivity... (USACE, 2018)". Decreased albedo in and of itself does not change thermal conductivity. I do not have access to the reference but I am assuming they are indicating that the decrease in albedo results in a warmer denser snowpack with increased thermal conductivity. If this is the case, it may be better to say "This can lead to a denser snowpack with increased thermal conductivity, leading to permafrost thaw (USACE 2018)." Or reword in another way to better reflect the mechanism the original reference is referring to.		
291.	3-42	11-26	Loya/FWS	Impacts by alternative are not specific to the soil resources, which vary considerably across the program area. Alt B should consider if there are particular soil types more susceptible to impacts from gravel fill placement across the program area, while surface restrictions under Alt D would likely concentrate impacts in the western third of the program area, requiring consideration on impacts to the soil types occurring there.		
292.	3-42	29	JRose/FWS	Does not provide context of historic impacts. Recommend "Previous seismic surveys covered 2,500 miles of trail of which 125 miles remained disturbed in 2009. Disturbance from seismic survey exploration and an exploratory test well in the program area included disruption of surface vegetation and increased thaw of permafrost, changes...(Jorgenson et al. 2010, USFWS, 2018)." (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
293.	3-42	29 - 31	Jorgenson/FWS	Add text in red: Previous seismic survey explorations and an exploratory test well in the program area have resulted in disturbance to the surface vegetation and impacted the thaw of permafrost, changes in drainage patterns, and changes in vegetation growth for 25 years after disturbance (Jorgenson et al. 2010, USFWS 2018). (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		
294.	3-42	31	JRose/FWS	Cumulative effects do not consider currently proposed seismic or future seismic work. Recommend "...Vegetation growth (USFWS, 2018). Additional seismic surveys over the program area are required at significantly higher density. While improvements have been made to avoid impacts, new seismic surveys may have similar impacts as previous seismic activity."  Under the currently proposed seismic work, I estimate a minimum of 200 miles of camp move, 800 miles of seismic lines run by vibroseis equipment, and 30,000 miles of layout lines run by tucker and snowmachines. This estimate does not include daily trips to and from camp or scouting operations. Any additional seismic activity conducted after the initial surveys will increase the total miles of seismic trails. Recommend using current plans and data from NPR-A to develop more realistic estimates of miles of trails for seismic activities.		
295.	3-44	36	JRose/FWS	Change "...cumulative impacts for soils and permafrost is..." to "...cumulative impacts for sand and gravel resources is..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
296.	3-45	3.2.10	JohnT/FWS	The fourth purpose of the refuge is (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.  Ensuring water quality and quantity (i) to conserve fish and wildlife populations and habitats in their natural diversity including..... is an explicit purpose of the refuge.  All alternatives, at a minimum, need to address and meet all purposes of the refuge.		
297.	3-46	19	JohnT/FWS	Edit: ...snowmelt or rain on snow events have produced flood events.		
298.	3-46	19-21	Randy Brown USFWS	"Table G-5 provides historic data of measured discharge..." However, Table G-5 presents stream lengths of major streams in the Coastal Plain. Other references to specific table contents in this section are also incorrect. All should be checked and resolved.		
299.	3-46	35	JohnT/FWS	Add sub heading for lakes and wetlands		
300.	3-47	14-16	JohnT/FWS	Move this statement to 3-50, Changes in Surface Water Flow		
301.	3-47	23	JRose/FWS	Amend to read "...summer season and represent at least one third of the cumulative annual base flow (Yoshikawa et al. 2007); some spring-fed..." "Spring and aufeis (icing) hydrology in Brooks Range, Alaska"		
302.	3-47	5-6	JohnT/FWS	Not sure what was sampled. Trawicki et al., 1991 conducted bathymetry, but did not conduct water quality sampling. Bayha 1996 also characterized the wet meadow zones associated with most lakes across the coastal plain.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
303.	3-48	17	JohnT/FWS	360 may be the number of reservations ADNR has on file? USFWS has filed 202 reservations with ADNR since 1994, of which 1 reservation has been adjudicated.		
304.	3-48	36-38	JohnT/FWS	Trawicki et al. 1991 is not the appropriate reference for this statement.		
305.	3-48	4-8	JohnT/FWS	The spring break-up flows also play an important role in the break-up, temperature, and salinity of near marine and lagoon environments. (check with Randy for language to match fisheries near shore marine habitat)		
306.	3-49	2	JohnT/FWS	Add to list and impacts common to all alternatives: reduction in water quality, reduction in water availability, permafrost degradation, alteration of aquatic habitats (rivers, streams, lakes, and wetlands)		
307.	3-49	20	JohnT/FWS	Add to list and impacts common to all alternatives: Saltwater treatment plant, construction and operation of barge facility, road use (dust), aerial deposition of contaminants,		
308.	3-49	26	JohnT/FWS	Delete "avoidance", water will be used.		
309.	3-50	17-18	JohnT/FWS	Permits will require reclamation plans to be implemented when pit is decommissioned.		
310.	3-50	19	JRose/FWS	Include "ground surface subsidence under some seismic trails" with examples of exploration activities.		
311.	3-50	2	JohnT/FWS	Based on 3-47 lines 14-17; surface disturbance can lead to the development of thaw lakes. Development of additional thaw lakes are likely due to surface disturbance should be added to page 3-50, line 2 Changes in Surface Water Flow		
312.	3-50	5	JRose/FWS	Include "Changes in surface runoff processes and drainage networks" with examples of potential impacts. On steeper slopes especially these changes could result in gullying, thermokarst features, and surface detachment		
313.	3-51	11-15	JohnT/FWS	Please reference ROP 24 and alter language to be consistent with ROP 24		

Deleted: .

Commented [CMA8]: Need to clean up before sending to BLM

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
314.	3-51	32-36	JohnT/FWS	This section should acknowledge that impacts to natural drainage patterns on tundra are permanent and irreversible- reclamation has not been proven for gravel removal in an Arctic environment. [This would also apply to vegetation...impacts would be for period of operation]		
315.	3-51	3-5	JohnT/FWS	Objective is to design to minimize permafrost degradation, please reference the ROP # this refers to.		
316.	3-51	37-38	JohnT/FWS	Reference ROP 13, for consistent language. Waterway crossing that have been reinforced will be removed, breached or slotted prior to breakup.		
317.	3-51	7	Matz/FWS	Change sentence to read, "...have higher suspended solids concentrations, greater turbidity, and contaminant concentrations (dependent on the underlying geology)."		
318.	3-51	7-12	JohnT/FWS	How much water per activity for conceptual lay out E-1? Analyze water availability (volume by source and distribution)?		
319.	3-52	13	Crane/FWS	Fresh water resources are limited within the program area (see pages 3-73 and 3-74). Recommend providing estimated water withdrawal amounts associated with the RFD scenario, if water resources are adequate to meet those needs, and then analyzing what the effects may actually be. The referenced IAP does not provide an analysis for an area comparable to the program area and the limited fresh water resources found within.		
320.	3-52	34	Crane/FWS	Dust deposition on ice and snow can accelerate melt rates. Recommend addressing this effect in the water quality section.		
321.	3-52	35	Matz/FWS	Change sentence to read, "increasing turbidity and contaminant concentrations (dependent on the underlying geology)."		

Deleted: I

**Commented [CMA9]:** Not clear what this is referring to – are we suggesting adding text that states that impacts to vegetation would be permanent and irreversible?

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
322.	3-52	36-39	JohnT/FWS	Logic is flawed: Section should state that if water is withdrawn from lakes during summer, then the lakes will have less water going into winter, resulting in the loss of available water, winter habitat, and lower water quality. Full recharge may or may not occur in some lakes. Surface water hydrology is not the same on coastal plain as the NPRA (2%/22%)		
323.	3-52	38	Crane/FWS	The statement "water would be recharged in the spring when snow and ice melt increases..." assumes withdrawal rates will not exceed recharge rates. Recommend discussing how this assumption will be met for the various alternatives (i.e. do ROPs ensure this, will water use permits...) given the lower snow totals that occur in the program area vs NPRA.		
324.	3-53	1-2	JohnT/FWS	At a minimum, identify/list the water quality/contaminants discussed in BLM 2004.		
325.	3-54	19-20	JohnT/FWS	Delete lines 19-20		
326.	3-57	Table 3.2.11-4	Matz/FWS	Add a column with the material that was spilled.		
327.	3-58	10	Matz/FWS	Delete "promptly," as this is a values statement (i.e., definition could vary depending on one's values).		
328.	3-58	23	Matz/FWS	Add at end of sentence, "...or at the surface, except where permafrost thaw is exacerbated by climate change and anthropogenic earth-disturbing activities."		
329.	3-6	10	Crane/FWS	The statement regarding summer sea ice extent recovering slightly from the past decade fails to acknowledge that there is still a downward trend in sea ice extent from for the last several decades. Recommend clarifying the existing statement to reflect this.		
330.	3-6	10	Hamilton/FWS	"recovered" in this sentence implies responding to new action, suggest replacing with the word risen		
331.	3-6	20	Leonard/FWS	Add a space between 'program' and 'area'		

Deleted: W

Deleted: will be

Deleted: . L

Deleted: therefore

**Commented [CMA10]:** I tried to make it clearer what changes we are asking for – please verify I did not change the substance

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
332.	3-6	29-35	Leonard/FWS	The Cumulative Impacts here are not even summarized (much less calculated) but simply explained away by the tragedy of the commons. Just because global emissions increase with increasing human development does not mean they cannot be calculated. This needs to be evaluated inside the framework of this project. There is better detail on page 3-36 Lines 17-22. This can be used with Appendix E details to actually provide a quantitative assessment.		
333.	3-6	30	Leonard/FWS	Remove word 'provided' after 'projection'		
334.	3-60	1	Matz/FWS	Define location of, or give examples of, "offsite," such as, "in the permitted Kaktovik municipal landfill."		
335.	3-61	20	Jorgenson/FWS	The vegetation mapping available to quantify..... Change to: the vegetation mapping chosen to quantify.... Justification: There are 5 other vegetation maps covering the area in question, all made from Landsat satellite data.		
336.	3-61	23 - 24	Jorgenson/FWS	"The primary data source used was a low resolution map prepared by Ducks Unlimited, Inc. (2013). " That is not actually correct for the program area. DU did not map the program area. The data source for the program area was a land cover map published in 1986 (Markon 1986), made from classified Landsat-MSS satellite imagery from 1981. The map was more recently improved by Torre Jorgenson by applying topographic modelling to the existing map. However, it is still low resolution and a satellite image from 37 years ago. There are at least 5 newer Landsat maps covering the program area, some produced from newer Landsat-TM data, which is higher resolution than Landsat-MSS.		
337.	3-61	8	Matz/FWS	Change, "...detected spills are promptly contained..." to "...detected spills would be contained..."		

Commented [CMA11]: Suggest deleting

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
338.	3-66	34 - 36	Jorgenson/FWS	<p>Comment on direct and Indirect Impacts subsection: This section uses a Landsat-MSS land cover map to calculate percentages of different vegetation types affected by different development alternatives. Landsat maps available for the area, including the one chosen, are all adequate for making general statements about the vegetation of the area but are not accurate enough to provide good estimates of the percentages of areas covered by each mapped vegetation type. They tend to overestimate prevalence of some vegetation types, such as tussock tundra, and underestimate prevalence of others, such as other moist sedge-shrub types. The document cited below provides better estimates of percentages, based on field data rather than classified satellite imagery. The data set includes 756 systematically-located field-visited plots spanning the whole coastal plain in a grid, visited in 1989 – 1990. 540 of the plots are in the 1002 area. The mapped classes are all readily cross-walked to Vierecks Alaska vegetation classification. Although the data are from ~28 years ago, they are more recent than imagery for the map that was chosen (37 years ago). The data set is described in this document and is available from FWS:</p> <p>Jorgenson, J. C., P. E. Joria, T. R. McCabe, B. E. Reitz, M. K. Reynolds, M. Emers, and M. A. Willms. 1994. User's guide for the land-cover map of the coastal plain of the Arctic National Wildlife Refuge. U. S. Fish and Wildlife Service, Anchorage, AK. 46 p.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
339.	3-67	12 - 25	Jorgenson/FWS	Rewrite of this paragraph: Seismic exploration is proposed to occur during winter with direct surface impacts occurring by passage of camp trains on skis pulled by a tracked dozer directly over the snow-covered tundra surface (Appendix E, RFD Scenario). Impacts to vegetation and wetlands typically includes changes in plant community composition caused by altered hydrology or direct damage to above ground structures such as tussocks or woody stems and branches. Long term studies have shown that the overall impact of seismic vehicle traffic on tundra is low, but impacts can still be measured up to 25 years after exploration (Jorgenson et al. 2010). Seismic vibrator lines and camp train trails on the North Slope were found to be generally visible in summer vegetation for about 5 years after disturbance, and the longer-term impacts involved limited ground subsidence where the trail became a wetter trough (Jorgenson et al. 2003; Jorgenson et al. 2010; Yokel and Ver Hoef 2014). Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree than wetter types dominated by sedges. Studies on best management....		
340.	3-67	23	Crane/FWS	Seismic trails have persisted for much longer than 5 years after disturbance in NPRA. Recommend clarifying the statement made here.		
341.	3-67	23-28	Berendzen/FWS	Habitat destruction and subsidence conflict with refuge purposes. Protective measures including more snow and frozen soil depth should be <del>discussed</del> <u>to ensure all of the purposes of the Refuge are achieved under all alternatives.</u>		

Deleted: utilized

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
342.	3-68	14 - 16	Jorgenson/FWS	Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to 15 the footprint edge. Thermokarst results in ponded areas extending into the tundra and altering the vegetation and wetland plant community structure. Change to: Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to the footprint edge, with ponded areas extending into the tundra and altering the vegetation and wetland plant community structure (Raynolds et al. 2014). Citation: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224. (Note to FWS: this paper should be cited in the EIS, at least here for thermokarst around pads and roads, on page 3-41 and probably other places in document too.		
343.	3-70	26-33	Berendzen/FWS	In addition to loss of vegetation to placement of fill, there will be vegetation loss to tundra scarring from equipment travel such as seismic or other. This conflicts with refuge purpose. <u>Need to evaluate the impact of the alternatives on all of the refuge purposes.</u>		

Deleted: .

Deleted: conflict with other refuge purposes 11

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
344.	3-73	3.2.10	John T/FWS	The entire impact analysis is qualitative and references BLM 2004 and BLM 2018. The coastal plain hydrology is significantly different (22% vs 2% of surface area is water) and cannot be evaluated based on different hydrologic conditions or without water use by season, year, and activity. Information on water availability has been identified, but there is no information on water needs by industry (please add table in Appendix E- Water Use and Requirements). How much water is required for ice road construction and exploration? Development? Dust abatement?... How does this compare to water availability and distribution across the coastal plain? Trawicki et al. 1991 identified winter water was limited in quantity and distribution. How will this be addressed?		
345.	3-73	Table 3.3.3-I	Randy Brown USFWS	Spelling issue, correct spelling is: Katakaturuk; I've never heard of a West Canning River. Note c indicates that the Marsh Fork is included with the Canning River entry four down from the top so that isn't what is referred to here as West Canning. Sadlerochit River is not included in this list even though it supports resident dwarf Dolly Varden and Arctic Grayling within the program area during summer and winter.		
346.	3-74	Lines 5-7	Randy Brown USFWS	I would rephrase the sentences here to read: "...however, by late fall the lagoons become saline again as freshwater input declines. As ice forms on the lagoons the water below becomes hypersaline and very cold, the result of ion exclusion during ice formation, restricted flow between the lagoons and the open sea beyond, and freezing point depression with greater salinity. These cold, hypersaline lagoon environments become unsuitable habitats for both anadromous and marine fishes during winter."		
347.	3-75	23-29	Randy Brown USFWS	This paragraph is very awkward and aside from the first sentence (lines 23-24), which would be a suitable concluding sentence on an earlier paragraph, should be deleted.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
348.	3-75	5-6	Randy Brown USFWS	The statement that "...only the Dolly Varden, ninespine stickleback and arctic grayling overwinter in freshwater habitats in the program area..." is not correct. The lower Canning River is in the program area and there are burbot and round whitefish in that drainage including the lower reaches. This point is brought up in the next paragraph on line 12, but the original sentence should be modified so it becomes a true statement.		
349.	3-76	7-8	JohnT/FWS	2 Acts are identified, but are not included in Appendix D. Sustainable Fisheries Act, Magnuson-Stevens Fishery.....		
350.	3-76	Table 3.3.3-2	Randy Brown USFWS	Spelling errors: Gadidae is misspelled; scientific name for ninespine stickleback is Pungitius pungitius; as of 2013, the American Fisheries Society (AFS) classifies Arctic Flounder as Pleuronectes glacialis, Fishbase.org currently uses Liopsetta glacialis but we should probably follow AFS;		
351.	3-76	Table 3.3.3-2	Randy Brown USFWS	I would delete sheefish from the table; they are present in the Mackenzie River but rarely go west of Shingle Point, which is far to the east of Herschel Island, which is east of the border between the US and Canada. I have seen no documents suggesting they have ever been encountered at Herschel Island. They should not be in this list.  In a related manner, Slimy Sculpin should also be removed from this list. Appropriate habitats in the Canning River have been sampled many times since the 1970s and nobody has found them. They are very apparent when present. They are present in the Sagavanirktok River drainage and have been found in a small stream to the west of the Canning River but it would require a marine migration to get to the Canning River. They should be removed from the list.		
352.	3-78	15	Matz/FWS	Add to end of sentence, "...decreasing habitat quality, including through mobilization of contaminants specific to the underlying geology."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
353.	3-79	17	Matz/FWS	Change sentence to read, "...can increase sediment runoff, turbidity, and contaminant concentrations in streams."		
354.	3-79	5	Randy Brown USFWS	Edit: should read "...of fish in the program area."		
355.	3-80	27	Matz/FWS	Missing from this section (and from throughout the document) is discussion of how erosion, either from climate change or anthropogenic earth-disturbing activities can mobilize contaminants – elements and minerals found in the underlying geology (e.g., uranium). Also missing is a discussion of contaminant mobilization from melting permafrost (e.g., methyl mercury). These sources have ramifications for Water Quality, Fish and Aquatic Invertebrates, Birds, Marine Mammals and Subsistence. A suggested edit to the paragraph starting on line 28 is: "...hazardous materials, potential spills from wells, pipelines, or other infrastructure, and mobilization of contaminants into aquatic or terrestrial systems from erosion, fugitive dust, and permafrost degradation."		
356.	3-81	20	Crane/FWS	The statement regarding long-term survival and distribution of freshwater fish in the program area being negatively affected implies that this alternative is not consistent with the other 4 purposes of the refuge. This is an example of my general comment above. It is not clear if and how (to what extent) each of the alternatives affect each and all of the 6 purposes of the refuge. Recommend discussing this aspect further and more clearly in the document and in a manner that facilitates comparison across alternatives.		

**Commented [CMA12]:** As stated previously, need to be consistent in the number of purposes of the Refuge

**Deleted:** the other 4

**Deleted:** and if they do, to what extent

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
357.	3-81	21	Loya/FWS	An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt C on fish, aquatic species and habitat. Recommend adding:  Due to lack of protection of fish habitat and water resources in areas where fish are mostly present, Alternative C would have similar impacts to Alternative B, which include adversely affecting the long-term survival and distribution of freshwater fish in the program area. Lack of protection of springs and auefs could result in the loss of fish overwintering habitat.		
358.	3-81	31	Loya/FWS	An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt D on fish, aquatic species and habitat. Recommend adding:  Impacts to fish and aquatic species would be limited under Alt D and occur mostly in the western portion of the program area. Impacts would be predominantly be indirect effects of changes in hydrology associated with infrastructure outside river and lake buffers or where infrastructure crosses river corridors. Protection of springs through studies and NL and NSO would reduce likelihood of disruption of groundwater that supports fish habitat.		
359.	3-81	32	Loya/FWS	Cumulative Impacts does not address the potential for any of the other actions to affect fish resources, including those that may pose the risk of an offshore oil spill. Recommend considering actions in Table M-I.		
360.	3-81	37	Loya/FWS	Recommend adding sentence to cumulative impacts section that addresses seismic impacts: Impacts from areawide seismic may result in changes in hydrology and water quality, potentially affecting fish habitat, if surface damage results in thermokarst and water channel formation.		

Commented [CMA13]: Limited or reduced?

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
361.	3-82	14-15	Latty/FWS	<p>The sentence states that small-bodied birds dominate the ARCP, with shorebirds the guild with the largest population size and provides the Pearce et al. (2018) citation. It doesn't appear that citation states this Arctic Refuge area, but rather for the whole of the Arctic Coastal Plain and originates from Liebezeit et al. (2009). Please consider removing that statement, as there is likely not adequate information to support the conclusion of the predominance of any species group in the program area. Outside of a few species, the lack of data is even greater for the number of birds that stopover or stage in the Refuge foothills, coastal plain, and lagoons.</p> <p>Liebezeit, J. R., S. J. Kendall, S. Brown, C. B. Johnson, P. Martin, T. L. McDonald, D. C. Payer, C. L. Rea, B. Streever, A. M. Wildman, and S. Zack. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications 19:1628-1644.</p>		
362.	3-82	14-16	Latty/FWS	Please define species groups here as it's currently unclear if they align with definitions described later in this section.		
363.	3-82	29-30	Latty/FWS	Please consider changing: "most of the current information on bird abundance and distribution for the program was" to, "detailed distribution and abundance data for the program area are lacking for many, and contemporary data is lacking for most bird species. In addition, much of the contemporary data was ..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
364.	3-82	9	Latty/FWS	<p>This line introduces the number of bird species known to occur in the Arctic Refuge Coastal Plain. It appears this information comes from the Arctic NWR CCP. If that is correct, than the description of the area this encompasses is not clearly defined here. The CCP states, "In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded". Please consider replacing, "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" for "Arctic Refuge Coastal Plain" as the aforementioned area includes lands outside the Coastal Plain. A citation for the Arctic Refuge CCP should also be provided it this is the source.</p> <p>This line also states, "as of 2015, 156 bird species have been recorded...". I was unable to find specific language in the Refuge CCP that states this list was updated in 2015 (the year the CCP was adopted). Please consider removing, "As of 2015".</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
365.	3-83	2-3	Latty/FWS	<p>The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a>.</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		
366.	3-83	25-31	Latty/FWS	<p>Spectacled eider have been documented breeding in the program area with the most recent known nest occurring at the Canning River Delta in 2017. Please consider adding a sentence stating that spectacled eider have been documented breeding in the program area in recent years citing USFWS, unpublished data. Contact Chris Latty <a href="mailto:Christopher_latty@fws.gov">Christopher_latty@fws.gov</a> for more details. Spectacled eider are an uncommon breeder in the program area.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
367.	3-84	13-16	Latty/FWS	Please consider changing this sentence to: "Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, prior to 2018 only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution across the program area relatively unreliable."		
368.	3-85	40	Swem-Latty/FWS	Please consider changing "diversity in abundance" to "differences in distribution among".		
369.	3-86	32	Swem-Latty/FWS	Please consider adding the sentence, "Northern harrier are an uncommon summer resident and both northern harrier and merlin may breed in the program area (U.S. Fish and Wildlife Service 2015)."  U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. US Fish and Wildlife Service.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
370.	3-88	11	Latty/FWS	<p>In addition to changes in predator behavior, impacts may include changes in predator abundance and distribution. Development on Alaska's North Slope, near oilfields and villages, has been demonstrated to lead to increased predator densities, mainly due to anthropogenic food sources, and possibly to a changing composition of predators (Eberhardt et al. 1982, Truett et al. 1997, Burgess 2000, Stickney et al. 2014). Please consider adding, "and changes in predator abundance" after "facilities."</p> <p>(Burgess, R. 2000. Arctic fox. The natural history of an arctic oil field: development and the biota. Academic Press, San Diego, California, USA:159-178. Eberhardt, L. E., W. C. Hanson, J. L. Bengtson, R. A. Garrott, and E. E. Hanson. 1982. Arctic fox home range characteristics in an oil-development area. The Journal of Wildlife Management:183-190. Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. Arctic 67:196-202. Truett, J. C., M. E. Miller, and K. Kertell. 1997. Effects of Arctic Alaska Oil development on brant and snow geese. Arctic 50:138-146.)</p>		
371.	3-88	19-21	Latty/FWS	An additional indirect impact could occur if habitat quality is impacted from water removal on which many birds rely. Please consider adding, "and impacts to habitat quality from water removal" after "...and terrain surfaces"		
372.	3-89	30	Crane/FWS	The statement "use of ice roads is extensive under all action alternatives..." is an example of how this resource need requires further analysis within the document given the limited amount of freshwater resources in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
373.	3-89	37-38	Latty/FWS	<p>Landbirds occur in similar number to waterbirds (e.g., shorebirds, loons, waterfowl, larids) during the breeding season in the program area. For example, Bart et al. (2013) estimated ~ 400,000 waterbirds and Bart et al. (2012) estimated ~300,000 passerines and ptarmigan occur on the Refuge coastal plain (i.e. excluding foothills which was calculated separately) during the breeding season. Because landbirds are also abundant in the program area, they should be considered in this section. Please consider adding a sentence regarding the potential impacts to landbirds which occur at similar or higher densities in moist areas and uplands of the on the Arctic Refuge coastal plain, compared to wetlands (varies by species). Suggest, removing, "which support lower densities of waterbirds" and changing to, "which support higher densities of passerines, ptarmigan, and some shorebirds like whimbrel and American golden-plover".</p> <p>Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. Arctic shorebirds in north america: a decade of monitoring. University of California Press.</p> <p>Bart, J., R. M. Platte, B. Andres, S. Brown, J. A. Johnson, and W. Larned. 2013. Importance of the National Petroleum Reserve-Alaska for Aquatic Birds. Conservation Biology 27:1304-1312.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
374.	3-89	5-7	Swem-Latty/FWS	Please consider changing the sentence in lines 5-7 to the following.  "When estimating the incidental take of spectacled eiders that would be caused by the construction and operation of oilfield infrastructure, the USFWS considers the direct loss of habitat due to gravel fill plus indirect loss in an adjacent zone of influence (estimated to be ~ 200 m, or 656 ft wide) where disturbance could prevent spectacled eiders from nesting. Implicit in this method of estimating impacts is the assumption that displaced pairs will not move and nest successfully elsewhere."		
375.	3-90	1-2	Latty/FWS	Please consider changing this sentence to, "Effects to birds from habitat alteration of ice roads is currently unknown, but it is expected to be minor compared to some other risk factors listed below."		
376.	3-90	12-13	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or add a discussion of the risks to red-throated and Pacific loons that do regularly breed in the program area.		
377.	3-90	15	Loya/FWS	Provide a reference or detail what is meant by: "Rehabilitation would follow North Slope reclamation guidelines." Ensure that paragraph on gravel is consistent with ROP 26 and differences between the B/C and D are evaluated.		
378.	3-90	17 and 21	Latty/FWS	Line 17 states that non-breeding and brood rearing waterbirds may benefit from gravel pits, but then line 21 states breeding birds may also benefit. Please clarify by adding breeding birds to line 17.		

Deleted: unproven and conservative

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
379.	3-90	17-21	Latty/FWS	The habitat alternation from gravel mining would affect different species differently; therefore, it is not advisable to consider all birds together. These sentences would be more accurate if it stated some species may be harmed, while other species may benefit from habitat alterations associated with gravel extraction.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
380.	3-90	2	Latty/FWS	<p>Jorgenson et al. (2010) reported that severe impacts to tundra vegetation persisted for two decades after disturbance under some conditions in the program area. Kemper and Macdonald (2009) reported that seismic lines in low arctic tundra areas had less vascular plants and more bare ground compared to reference areas and that in upland areas, mosses and lichens also occurred less frequently. In addition, they reported that the active layer increased after seismic disturbance. Although data is not available for the program area, in areas of discontinuous permafrost linear disturbances, such as winter roads and seismic lines, have been reported to alter the hydrology, ecology, and ground thermal regime (Williams et al. 2013, Braverman and Quinton 2015).</p> <p>Given there have not been any studies to examine short- or long-term impacts to birds from ice roads, nor research on how hydrology and subsequently surrounding habitat might be impacted on the Alaska coastal plain, please consider removing, "and the extent would be limited to the immediate area covered by ice."</p> <p>Jorgenson, J. C., J. M. Ver Hoef, and M. T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. <i>Ecol Appl</i> 20:205-221.  Kemper, J. T., and S. E. Macdonald. 2009. Effects of Contemporary Winter Seismic Exploration on Low Arctic Plant Communities and Permafrost. <i>Arctic, Antarctic, and Alpine Research</i> 41:228-237.  Williams, T. J., W. L. Quinton, and J. L. Baltzer. 2013. Linear disturbances on discontinuous permafrost: implications for thaw-induced changes to land cover and drainage patterns. <i>Environmental Research Letters</i> 8:025006.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
381.	3-90	7-8	Latty/FWS	It's stated here that water withdrawal may affect water chemistry. Because changes in water chemistry may impact the aquatic invertebrate that some birds forage on, please consider adding, "and impacts to aquatic invertebrate communities" after, "in some fish mortality".		
382.	3-90	9	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or change "yellow-billed loons" to "loons".		
383.	3-90	9-13	Latty/FWS	Water-source lakes may include lakes used by a variety of birds, not just yellow-billed loons. And because yellow-billed loons are not listed as a known breeder in the program area, suggest changing to, "Water-sourced lakes may include lakes used by a variety of birds during the breeding and non-breeding seasons. Drawdowns may lead to changes in the abundance and distribution of foods on which tundra birds rely. Drawdowns may also impact shorelines, thereby degrading the quality of areas as breeding and non-breeding habitat for a variety of waterbirds including shorebirds, loons, and waterfowl."		
384.	3-91	16	Latty/FWS	This section is described as "disturbance and displacement", but the terms are not well defined. Please consider defining these terms at the beginning of this section.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

385.	3-9I	22-24	Latty/FWS	<p>Because winter is not defined here, it's unclear if this statement is accurate. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002, p. 16). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995, p. 377). Some Snowy Owls (<i>Bubo scandiacus</i>) winter on Arctic breeding grounds, but most arrive during Apr and May, with egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (<i>Falco peregrinus</i>), Rough-legged Hawks (<i>Buteo lagopus</i>), and Short-eared Owls (<i>Asio flammeus</i>), arrive to the Arctic and initiate nesting in May and early June (summarized in Pitelka et al. 1955, p. 12, Cade 1960, Bechard and Swem 2002, p. 16).</p> <p>Please define the period winter is meant to describe. If it overlaps with periods where breeding raptors occur, please update the document to reflect this.</p> <p>Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (<i>Buteo lagopus</i>). in A. F. Poole, and F. B. Gill, editors. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. <i>University of California Publications in Zoology</i> 63:151-290.</p> <p>Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (<i>Bubo scandiacus</i>). in P. G. Rodewald, editor. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (<i>Aquila chrysaetos</i>). in A. F. Poole, and F. B. Gil, editors. <i>The Birds of North America</i>. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. <i>The Condor</i> 57:3-18.</p>		
------	------	-------	-----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. <i>Journal of Field Ornithology</i> 66:373-379.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
386.	3-91	36-38	Latty/FWS	<p>No definitions are provided of the various levels of disturbance, therefore it difficult to interpret this sentence. If "low" disturbance is intended to include changes in incubation constancy (as is implied here) please consider adding, "increased predation risk" after "incubation constancy." Although this is also mentioned in "high disturbance" discussion, reduced productivity due to human disturbance by foot traffic at nest sites is the most consistently reported effect of human presence. Reduced nest survival has been demonstrated for many tundra nesting birds, including cackling and greater white-fronted geese; common, king, and spectacled eider; and pacific and yellow-billed loons (Bowman and Stehn 2003, Bentzen et al. 2008, Wilson et al. 2012, Uher-Koch et al. 2015, Meixell and Flint 2017).</p> <p>Bentzen, R. L., A. N. Powell, and R. S. Suydam. 2008. Factors influencing nesting success of king eiders on northern alaska's coastal plain. Journal of Wildlife Management 72:1781-1789.</p> <p>Bowman, T. D., and R. A. Stehn. 2003. Impact of investigator disturbance on spectacled eiders and cackling Canada geese nesting on the Yukon-Kuskokwim Delta. in Unpublished report prepared for US Fish and Wildlife Service, Anchorage, Alaska.</p> <p>Meixell, B. W., and P. L. Flint. 2017. Effects of industrial and investigator disturbance on Arctic-nesting geese. The Journal of Wildlife Management:n/a-n/a.</p> <p>Uher-Koch, B. D., J. A. Schmutz, and K. G. Wright. 2015. Nest visits and capture events affect breeding success of Yellow-billed and Pacific loons. Condor 117:121-129.</p> <p>Wilson, H. M., P. L. Flint, A. N. Powell, J. B. Grand, and C. L. Moran. 2012. Population ecology of breeding pacific common eiders on the Yukon-Kuskokwim Delta, Alaska. Wildlife Monographs 182:1-28.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
387.	3-91	37	Latty/FWS	Please change "increase" to "decrease".		
388.	3-92	11-12	Latty/FWS	<p>Please consider changing this sentence to, "Liebezeit et al. (2009) reported a decrease in nest survival of passerines within 3.1 mi of oilfield infrastructure."</p> <p>Although Liebezeit et al. (2009) speculates that this may be been related to differences in predator density, they state, "Contrarily to expectations, our a priori models suggested that neither subsidized nor non-subsidized predator abundance was related to nest survival." Instead, they report that passerine nest survival was related to the distance of nests to the nearest high structure feature and the gravel footprint area within 3 and 16 km of plots.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

389.	3-92	27	Latty/FWS	<p>Please consider removing, "but are unlikely to affect population sizes or nesting densities of breeding birds".</p> <p>There is relatively little statistically rigorous information to support or dispute the hypothesis of "no effect" of disturbance on breeding tundra nesting bird density. However, in other habitats several investigators have reported lower density in the vicinity of infrastructure (see Benítez-López et al. 2010 and meta-analysis the references within), while others reported higher densities. For example, Reijnen et al. (1995) found about half the bird species investigated had lower densities adjacent to roads and attributed this to noise load. Green et al. (2017) found abundance at sage-grouse lek sites was negatively related to oil and gas infrastructure density. Nenninger and Koper (2018) found sparrow abundance decreased near oil infrastructure sites. Davis (2017) reported bird density was greater in disturbed compared to undisturbed areas near oil and gas infrastructure in south Texas.</p> <p>Davis, K. R. 2017. Impacts of Oil-and-Gas Development in the Eagle Ford Shale on Quail and Other Birds. Texas A&amp;M University-Kingsville.</p> <p>Green, A. W., C. L. Aldridge, and M. S. O'donnell. 2017. Investigating impacts of oil and gas development on greater sage-grouse. The Journal of Wildlife Management 81:46-57.</p> <p>Nenninger, H. R., and N. Koper. 2018. Effects of conventional oil wells on grassland songbird abundance are caused by presence of infrastructure, not noise. Biological Conservation 218:124-133.</p> <p>Reijnen, R., R. Foppen, C. T. Braak, and J. Thissen. 1995. The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads. Journal of Applied Ecology 32:187-202.</p>		
390.	3-92	28-42	Latty/FWS	Please considering adding a sentence regarding boat traffic not related to screeding and barging to this paragraph.		

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Although it's mentioned elsewhere, it seems most applicable in this paragraph. For example, please consider adding: "Boat operations for other activities may also occur across the duration of the project." after, "visual disturbance." in line 31 and "Displacement and disturbance to birds from other boating activities may also be short in duration, but may occur over a broad area and across the duration of the project." in line 42 after, "small area."		
391.	3-92	31	Latty/FWS	<p>A variety of waterfowl and sea birds use the program area lagoons during summer and fall. For example, Lysne et al. (2004) found up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Refuge coast.</p> <p>Please consider adding: "Many seabird species use the nearshore waters of the Beaufort Sea. Lysne et al. (2004) recorded over 23,000 long-tailed ducks along the Refuge coast during a survey in late summer 2003. They also reported a substantial portion of yellow-billed loons, red-throated loons, scaup, and pacific loons counted during the entire Alaska North Slope survey occurred along the Refuge coast during some years." after, "visual disturbance." In line 31.</p> <p>Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
392.	3-92	34	Latty/FWS	Additional references are available for how marine birds documented in the program area lagoons might respond to disturbance. Please consider adding the sentences: "Johnson (1982) reported displacement of long-tailed ducks in response to aircraft, boats, and human disturbance. Schwemmer et al. (2011) reported ship traffic affected flight reactions in sea ducks and the distribution of loons." after "from wind and waves (Flint et al. 2004)."  Johnson, S. R. 1982. Continuing investigations of Oldsquaws (Clangula hyemalis L.) during the molt period in the Alaskan Beaufort Sea. Final Report To Outer Continental Shelf Environmental Assessment Program Research Unit 467. Schwemmer, P., B. Mendel, N. Sonntag, V. Dierschke, and S. Garthe. 2011. Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications 21:1851-1860.		
393.	3-92	34	Latty-Swem/FWS	Please consider adding the timing of long-tailed duck molt and other seabirds lagoon use to better qualify when the lagoons are predominantly used by seabirds.		
394.	3-92	3-4	Latty/FWS	Please consider moving this sentence to the section describing habitat loss. Although I do not have access to the full Troy and Carpenter citation, it appears to specifically address the redistribution of nesting birds after pad construction (i.e. habitat loss).		
395.	3-92	37-40	Latty/FWS	The sentence as written may not adequately represent the finding in Flint et al. 2003 or Fisher et al. 2002. Please considering changing the sentence to, "Site fidelity was not clearly impacted by seismic surveys (Flint et al. 2003) and aerial surveys did not find a difference in density of long-tailed ducks between industrial and control sites (Fisher et al. 2002)."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
396.	3-93	24-25	Latty/FWS	Although snow geese occur in substantial numbers during the post-breeding period, so do many of species of birds. Please consider changing this sentence to, "All types of air traffic also have the potential to cause disturbance and displacement of birds outside of the breeding season."		
397.	3-93	26	Latty/FWS	Please consider changing "as many as 300,000" to "For example, over 300,000" as 325,760 snow geese were estimated in 1978 (Kendall 2006).  Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service		
398.	3-93	9-16	Latty-Swem/FWS	Although this section provides background on the type of flights that may occur in support of development and some estimates of timing, it does not currently describe the magnitude. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates or the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different unimproved sites. Depending on the type of activity associated with these take-offs and landings and <u>their</u> duration, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information).		
399.	3-94	23	Crane/FWS	Small spills still pose a risk to birds and other wildlife regardless if they reach the tundra or not. Recommend rewording this statement to address this potential effect.		

Deleted: it's

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
400.	3-97	38-39	Latty-Swem/FWS	In NPR-A, residents of nearby villages may be allowed access to roads which may increase harvest. Please consider updating this sentence to reflect if and how changes in access may impact harvest.		
401.	3-98	13	Latty-Swem/FWS	Please change "sooner" to "earlier".		
402.	3-98	32	Latty-Swem/FWS	Please change "nest sites" to "resources".		
403.	3-99	12	Crane/FWS	While polar bears are marine mammals, polar bears in the SBS population do spend a fair amount of time on land. Recommend rewording the statement that "None of the terrestrial mammals..." are listed..." to account for this. This would then be consistent with language on page 3-113 where polar bears are referenced and protections of polar bear dens is addressed in Alternative D and elsewhere in this section.		
404.	3-99	26-27	R. Wilson/FWS	Recommend changing the sentence to read '... and are an important subsistence resource for Inupiaq and Gwich'in hunters.' The line shouldn't be specific to the refuge, because these animals travel beyond the refuge, and whatever impacts they experience from development in the refuge could be felt beyond it.		
405.	A2-6, A2-8	Map 2-6 and 2-8	Kaye/FWS	Individual stip for Alt DI, show the Wilderness boundary stip 10 from the west up to the Lease stip 7 area, but not beyond. <del>Providing the boundary in both a stip 7 &amp; a stip 10 area would more accurately reflect the area's importance.</del>		

**Deleted:** Line should

**Deleted:** Why not show that this isRecommend p

**Deleted:** :? Doing so would more visually show the

**Commented [CMA14]:** This wording was confusing. I tried to clarify it, but please verify that I did not mess it up

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
406.	A3-12	Map 3-12	Randy Brown USFWS	Dolly Varden also overwinter in the Canning River in the reach upstream (south) of the braided delta on the western edge of the 1002 Area (see Brown et al. 2018).  Perhaps it is best that the EIS reflect the anadromous waters catalog entries, but I think the portrayal of upstream distribution of Dolly Varden in the minor streams between the Canning and Hulahula rivers and between the Hulahula and Aichilik rivers makes it appear that Dolly Varden are more abundant and broadly distributed in freshwater systems than they really are. All the sampling studies I've read on these systems suggests that juveniles are very rarely encountered and almost always in the lower reaches.		
407.	A3-13	Map 3-13	Randy Brown USFWS	Sadlerochit Spring was not identified in this map as essential fish habitat (EFH) and several streams that do not support fish during winter were included as EFH. Recommend revising as appropriate.		
408.	A3-2	Map 3-2	Kaye/FWS	Map 3-2 shows mines, prospects & mineral occurrences. I don't know about those <u>and</u> I am not aware of prospects & occurrences in the program area, but there are no mines in the program area identified with triangles, so mines should be deleted from the title, as its misleading		
409.	A3-3	Map 3-3	Kaye/FWS	Map 3-3: Are all these wells depicted here "existing"? or are some previous well sites? If that's the case the latter, the map should differentiate between existing & previous well sites		
410.	A3-44	Map 3-44	Kaye/FWS	Special Designations. Although it's outside the program area, could recommend this map show the adjacent designated Wilderness, since it's a significant factor in our proposed boundary stip.		
411.	App A	Map 3-3	O'Dell/FWS	The map should include the KIC #1 exploration well.		
412.	App. A	Map 3-44	S. Arthur/FWS	Not all of the coastal plain is a Marine Protected Area. Recommend revising shading to indicate the correct area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

Deleted: M

Deleted: P

Deleted: does no

Deleted: Revise



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
413.	Appendix 2		Jorgenson/FWS	In appendix 2, 'visual resources photos' has only 2 photos, neither from the program area. It is not clear what the purpose of this appendix is – please provide additional detail.		
414.	Appendix A	Map 3-18	Loya/FWS	Colors in legend do not fit maps; see Map 3-20 for correct colors by category		
415.	Appendix D			Missing pertinent laws and policy –the USFWS does implements a variety of statutes more than ESA/MMPA/FWCA		
				Marine Mammal Protection Act		
				National Wildlife Refuge System Administration Act, amended through the National Wildlife Refuge Improvement Act (including BIDEH policy – Service Manual 601 FW 3, dated 16 Apr 2001)		
				Migratory Bird Treaty Act		
				Bald Eagle and Golden Eagle Protection Act		
				US Fish and Wildlife Service Mitigation Policy dated 23 Jan 1981 (reinstated via 2016 policy withdrawal effective 30 Jul 2018: FWS 2018))		
				The Wilderness Act		
				Wild and Scenic Rivers Act		
				National Historic Preservation Act		
				Native American Graves Protection and Repatriation Act		

Deleted: What is

Deleted: Recommend providing additional detail.?

Deleted: beyond

Deleted: s

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
416.	Appendix E		JohnT/FWS	Please include additional Table for Water Use/Requirements by activity. Similar to tables in GMT2 DEIS		
417.	Appendix G		JohnT/FWS	Tables # in text 3.2.10 do not match actual table #s in Appendix G.		
418.	Appendix G	Table G-2 G-3	JohnT/FWS	Table title: add "Annual"		
419.	Appendix G 3-46	Table G-6 19	JohnT/FWS	Referenced as Table G-5 in text. Titles are not necessarily representative of the data; peak spring breakup was not captured during most years. Please include column with dates of start and end of record for each year. USGS has more recent data for the Canning River, Tamayariak River and is currently gaging the Hulahula River. This information should also be presented		
420.	Appendix G 3-48	Table G-7 12	JohnT/FWS	Change G-6 to G-7		
421.	Appendix G	Tables G-4, G-5	JohnT/FWS	Combine Tables. Remove Atigun, Kongakut and Sagavanirtok Rivers, add Canning, Hulahula, Okpilak, Jago, Aichilik and Saderochit Sprg. Creek to current Table G-5		
422.	Appendix G, 3-45	Table G-1 11-14	JohnT/FWS	Table title: please add "Annual" to Average Monthly Air Temp., the lack of Barter Island and Toolik data and the difference in years do not allow for a comparison as stated in text. Kuparuk data is good- just fix title please.		
423.	D-1	5	Conn / FWS	The name of the treaty being discussed in this section is the "Agreement on the Conservation of Polar Bears" but it is often referred to as the Range States Agreement. I suggest changing the section heading to include this more commonly known nomenclature.		
424.	D3		JohnT/FWS	Bald and Golden Eagle Protection Act, referenced in p. 3-86, I. 35-36, not included in Appendix D.		

Deleted: Include

Deleted: Include

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
425.	D3	21-26	Campbell	Add: ANILCA Section 1431, Arctic Slope Regional Corporation Lands. Specifically Sections 1431(a), (g) and (o)		
426.	D3	21-26	Campbell	Add: Agreement Between Arctic Slope Regional Corporation and the United States of America, August 9, 1983 Specifically Including Appendices 1 and 2		
427.	D3	21-26	Campbell	Add: ANILCA Sections 301, 303(2) and 304.		
428.	D3	21-26	Campbell	Add: Public Land Order 2214 Establishing the Arctic National Wildlife Range, December 6, 1960		
429.	D3	21-26	Campbell	Revised Arctic National Wildlife Refuge Comprehensive Conservation Plan, January 2015		
430.	D-3	21	Carl/FWS	The USFWS has the following additional authority: 1. It is the administering agency under the Federal Advisory Committee Act for all of the Federal Subsistence Regional Advisory Councils established under Title VIII of ANILCA, which includes the North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils. 2. It still possesses authority under Section 1002 of ANILCA to administer elements of an oil and gas exploration program in the Coastal Plain. That provision was not modified or deleted by the Tax Act.		
431.	D-3	21-26	S. Arthur/FWS	Please include the various laws and policies that establish management purposes and govern the administration of a NWR (e.g., National Wildlife Refuge System Improvement Act) and specifically the Arctic Refuge (e.g., PLO 2214, ANILCA). The Arctic Refuge has additional legally mandated purposes that must be addressed.		
432.	D-3	21-26	R. Wilson/FWS	Please also list the Marine Mammal Protection Act? We recommend that the appendix also include a section for NOAA and their mandates under MMPA and ESA.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

**Commented [CD15]:** Check on this

**Commented [CMA16]:** AGREE – DOI Solicitors need to weigh in on this

**Deleted:** Why is there no mention of

**Deleted:** ?

**Deleted:** balanced with the Oil & Gas program, and the FWS has additional responsibilities here besides Endangered Species consultations.

**Deleted:** Shouldn't this

**Deleted:** And also

**Deleted:** T

**Deleted:** should

**Deleted:** ?



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
433.	D-3	21-26	Campbell	Add: Terms and Conditions for Land Exchanges and Resolution of Conveyancing Issues in Arctic Slope Region Between the Department of the Interior and Arctic Slope Regional Corporation. June 29, 1979		
434.	D-3	22	Conn/FWS	Suggest rewriting the section describing ESA. Possible language: The USFWS, along with NMFS, is responsible for administering the Endangered Species Act. Federal action agencies will consult with the USFWS to ensure the effects of the actions they are authorizing are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat. The results of this consultation will be provided in a Biological Opinion and may include Terms and Conditions to reduce any incidental take of a listed species.		
435.	D-3	24	Conn/FWS	Keep language describing FWCA (maybe as a separate bullet to be consistent with other agencies authorities in the document).		
436.	D-3	26	Conn/FWS	Add additional <del>text</del> , for the MMPA as follows: All marine mammals are protected under the Marine Mammal Protection Act. Jurisdiction of the Act is shared by NMFS and USFWS depending upon the species being considered. Using specific criteria, and on application, the USFWS may authorize the take of marine mammals.		
437.	D-3	26	Conn/FWS	Suggest the following language: The Bald and Golden Eagle Protection Act prohibits the taking of eagles including their parts, nests, or eggs. If a project may result in take, and after avoidance and minimization measures are established, the USFWS may issue an eagle take permit.		
438.	D-4	17	Carl/FWS	The Alaska Department of Natural Resources possesses another regulatory authority relevant to the Coastal Plain oil and gas leasing program: the obligation to adjudicate instream flow reservations and other applications for reserved water rights. Recommend revising as appropriate.		

Deleted: anotherif

Deleted: bullet

Deleted: is added. Suggest

Deleted: the

Deleted: i

Deleted: ng language

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
439.	D-7	USFWS Section	Conn/FWS	Re-word the MMPA permit to read "Issue incidental and/or intentional take authorization under the Marine Mammal Protection Act."		
440.	D-7	USFWS Section	Conn/FWS	Add a line "Issue take permits as appropriate pursuant to the Bald and Golden Eagle Protection Act."		
441.	E-1	10	O'Dell/FWS	"Reserves" are proven and economically producible, so term is inaccurately used until you get into the RFD assumptions. Recommend changing Change "reserves" to "undiscovered resources"		
442.	E-1	29-31	Leonard/FWS	Sentence beginning with 'Proposed plans...' is inscrutable. I cannot make a suggestion because multiple grammatical errors in the sentence make it difficult to interpret.		
443.	E-1	Row 17	O'Dell/FWS	There are definitely known plays, but no "proven" plays. Suggest changing "known" to "proven".		
444.	E-1, 3-32	23-25 13-18	JohnT/FWS	The \$42 per barrel (2009 dollars) needs to be converted to today's value to make reasonable comparison to the current price of \$65. Chapter 3 leaves out that \$42 is in 2009 dollars.		
445.	E-14	19	Berendzen/ FWS	Add "All roads are removed and gravel from them is placed back in the gravel pit it was originally extracted from"		
446.	E-16	25	Leonard/FWS	Subject-verb: Change 'is' to 'are'		
447.	E-17	1-3	Berendzen/ FWS	<u>Please provide additional detail as to how BLM concluded that gravel pits are not an oil and gas production or support facility and therefore do not count towards the 2,000-acre surface disturbance cap. Even if not considered within the cap, the short and long-term impact of gravel pits on habitat within the Refuge, and the associated impact on the purposes of the Refuge need to be identified and analyzed.</u>		
448.	E-4	13	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
449.	E-4	16	O'Dell/FWS	Change "reserves" to "undiscovered resources"		

Deleted: . There are

Deleted: today's

Deleted: These

Deleted: will destroy the habitat and clearly compromise Refuge purposes. While the gravel pits may not even if they aren't be considered part of the 2,000 acre surface disturbance cap, they will still have short long term effects on the habitat and potentially the other 4 purposes of the refuge. Please provide additional detail as to how BLM concluded they do not contribute to the surface disturbance cap.

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
450.	E-5	17	O'Dell/FWS	Add at the end: "Drilled in 1986 on village of Kaktovik land, the KIC-1 well is the only well drilled in the Arctic NWR. Data from the well has remained confidential."		
451.	E-5	2	Matz/FWS	Define "play" in footnotes, here or at the first mention of it in this section, as was done with other technical terms in Chapter 3.		
452.	E-5	21	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
453.	E-5	22	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
454.	E-5	4	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
455.	E-7	5	Berendzen/ FWS	I've seen little mention of seismic activity and resulting impacts. Does this document thoroughly evaluate seismic impacts? Short time frames for permitting of seismic and lease sale might complicate this assumption		
456.	E-8	Table E-3	O'Dell/FWS	3D Seismic is projected to take 2 winter seasons (2018/19 & 2019/20). Presumably, the first season would focus on high-potential area of the western part of Coastal Plain. Should the assumption be that 3D will be completed over the highest potential areas? Please clarify.		
457.	E-8	Table E-3	O'Dell/FWS	Additional Seismic Exploration on lease blocks. A more reasonable assumption would be that initial 3D is so designed as to enable targeting of specific exploration AND delineation wells – and would be available for sale to lease holders. Suggest re-evaluation of this progression. (Now noting the description doesn't include a second round of 3D seismic. Should probably be removed from the table.)		
458.	e-8	Table E-3	JohnT/FWS	Add Abandonment and Reclamation to Table E-3.		
459.	E-9	10	JRose/FWS	Please provide clarity on how the estimate of 990 mi <sup>2</sup> was developed. Under alternative D approximately 1600 mi <sup>2</sup> would be available for lease. Is this based upon the maximum amount of area that wells under the development scenario could reach or based upon the 2-D seismic work and the area overlying high and medium plays?		

**Commented [CD18]:** Comment captured in earlier comments.  
**Commented [CMA19]:** Suggest deleting – identified in previous comments

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
460.	E-9	16-17	JRose/FWS	Should clarify how far out the nodes are placed. A 3-mile wide layout is considerably different than a .5 mile layout. There is not enough information provided to convey a sense of scale.		
461.	E-9	16-20	Loya/FWS	The description of seismic lines spacing for post-leasing seismic exploration, which would presumably refine existing information, seems like it should be similar to or smaller than that proposed for the area wide seismic being evaluated in concurrent Seismic EA. Please see Marsh Creek Plan of Operations V.8.1 page 9, which states:  Vibrator source points will be located along source lines every 41.25 feet. Geophone receiver lines will run perpendicular to source lines, and both source and receiver lines are spaced approximately 660 feet apart. Geophones will be located along source lines every 165 feet. Up to 20 receiver lines could be placed on the ground at one time. Wireless nodes and geophones will be laid out by crews on foot and through the use of rubber tracked tundra travel approved vehicles.		
462.	E-9	5	Crane/FWS	Recommend clarifying if the statements made regarding assumptions made about leasing refer to the Tax Cuts and Jobs Act or to assumptions made by BLM in preparation of this EIS. For example, "It is also assumed that 3d seismic studies..." appears to be an assumption made by the BLM, but it is not clear with current wording.		

Deleted: to provide

Deleted: areawide

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
463.	ES-3	37	Loya/FWS	Revise to state known variation in this high uncertainty data: "The program area is estimated to contain between 4.3 and 11.8 billion barrels of technically recoverable oil (BBO), with a mean of 7.7 BBO. Non-associated gas resources are estimated to be between 0 and 10.0 Trillion Cubic Feet (TCF), with a mean of 3.5 TCF." Directly from last paragraph, page AO-14 in USGS assessment. Unable to find the value of 7.041 TCF in gas in USGS assessment.		
464.	ES-3	39	Loya/FWS	Arctic, not arctic.		
465.	ES-4	24-25	Loya/FWS	Revise: Potential impact on marine mammals, including human-polar bear interactions; vehicle, aircraft and boat traffic and noise disturbance; and accidental, unplanned take by vessel strikes or oil spills		
466.	ES-4	26-27	Loya/FWS	Revise: Impacts on terrestrial mammals, including disturbance from vehicle and aircraft noise, human presence and habitat fragmentation and loss		
467.	ES-4	31	Reed/FWS	Change to "Loss or reduced quality of some recreational opportunities around areas leased for energy infrastructure"		
468.	ES-4	35	JFox/FWS	Wording is unclear. Change to "Residents of Kaktovik are the primary users of..."		
469.	ES-4	36	JFox/FWS	Wording is unclear. Change to "The community of Nuiqsut has the potential to..."		
470.	ES-4	Insert after 31	Reed/FWS	Insert below line 31 and above line 32 the following bulleted item: "Loss of some recreational access around areas leased for energy infrastructure" (see Section 3.4.9, Transportation)		
471.	ES-4	Insert after 39	Reed/FWS	Suggested language: The majority of visitors to Arctic Refuge come specifically to the project area. With expected increases in recreational use coupled with decreased access to recreation in areas users of the Coastal Plain would be likely to experience direct and indirect impacts."		
472.						

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified

Commented [CMA20]: What is ES?



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
473.						
474.						
475.						
476.						
477.						
478.	H-I	I		<p>Appendix H does not list taxa specific conservation listings. The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a> .</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
479.	H-I	5	Latty/FWS	This line introduces the listings of birds occurring on the Coastal Plain of Arctic Refuge and a citation for the Refuge CCP is listed. The CCP provided data for the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters. "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" should be substituted for "Coastal Plain of the Arctic NWR" as the aforementioned area includes lands outside the Coastal Plain.		
480.	I-1	17	Matz/FWS	Add size range for Arctic grayling.		
481.	I-1	18	Matz/FWS	Replace "large" with size range of burbot.		
482.	I-1	24	Matz/FWS	Replace "small" with size range of ninespine stickleback.		
483.	I-1	8	Matz/FWS	Replace "relatively small" with size range of round whitefish.		
484.	I-2	20	Matz/FWS	Replace "relatively small" with size range of least cisco.		
485.	I-2	26	Matz/FWS	Replace "relatively large" with size range of broad whitefish.		
486.	I-2	30	Matz/FWS	Replace "relatively small" with size range of Arctic cisco.		
487.	I-2	37	Matz/FWS	Replace "small" with size range of rainbow smelt.		
488.	I-3	16	Randy Brown USFWS	Typo: should read "...fishes may use coastal and lagoon..."		
489.	I-3	24	Matz/FWS	Replace "They are typically a small to medium sized species" with size range of Arctic cod.		
490.	I-3	32	Matz/FWS	Replace "medium to large in size" with size range of saffron cod.		
491.	I-3	36	Matz/FWS	Provide size range of fourhorn sculpin.		
492.	I-3	39	Matz/FWS	Replace "They are a medium sized species" with size range of Arctic flounder.		
493.	I-3	7,8	Matz/FWS	Provide size ranges of resident and anadromous Dolly Varden.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
494.	I-5	22, 23, 32 and 33	Carl/FWS	Regulations are laws, they are merely laws issued by the Executive branch, as opposed to the Legislative branch (which are statutes). To use the phrase "laws, regulations" suggests that they are not, in fact, laws. Recommend deleting "regulations" which would be included in federal laws.		
495.	M-I	10	Matz/FWS	Remove "growth-inducing effects" as it is an unclear example, and examples are not needed for this general and cited description of indirect effects		
496.	M-10	2 through 4	FWS – BAWR (Allen and Collins)	There are established methodologies for evaluating air quality impacts. This statement should be removed.		
497.	M-10	5 through 7	FWS – BAWR (Allen and Collins)	Mitigation and stipulations can change the overall surface and well development. This statement should be removed.		
498.	M-10	8	FWS – BAWR (Allen and Collins)	Please add "air quality" . . . "BLM approval would require further 'air quality' NEPA analysis. . ."		
499.	M-10	M.3.3 Impacts/ Indicators Table	Matz/FWS	Change last bullet in "Action" column to read, "Noise generated in the construction and operation of roads, well pads, and other ancillary support activities"		
500.	M-13	11	JRose/FWS	Is 200 Acres a typo? It seems that this should read "Up to 2,000 acres of gravel...."		

Deleted: Should this

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
501.	M-14, M-15	10	JohnT/FWS	<p>Impacts and Indicators Water Resources: Actions Impacting Resource list is incomplete and/or very general: add Seismic Surveys: Use of rolligons or other orv's; add Water withdrawal from lakes for ice roads, pads, airstrips, dust abatement, camp/facilitie support and other uses; add Construction, placement and use of gravel pads, roads, airstrips.; add construction and use of barge docks; add construction and operation of seawater treatment plant; add placement and use of ice roads, bridges, pads, airstrips; add spills;</p> <p>This table could be modeled similar to the M-table for Wetlands and Vegetation. The actions may bem different, but the construction phase and operation phase are addressed separately.</p> <p>Types of Impact: update impact to match action.</p> <p>Impact Indicators: no units have been identified.</p>		
502.	M-16	19	Jorgenson/FWS	<p>In M.3.12, this phrase (or similar) is used repeatedly: 'no indicator available to assess possible plant community changes'. Given the information that is available, please explain why no indicators can be developed. Some sources of information: I see that some assumptions about development footprint are made on page M-19. The area that would be covered by 3-D seismic exploration in one winter by 2 crews can also be estimated, based on past surveys in NPRA. Also information on vegetation changes in Reynolds 2014.</p>		
503.	M-16	M.3.11 Impacts/Ind Table	Matz/FWS	<p>Change first line under "Action" column to read, "Introduction of contaminants including petroleum products and heavy metals caused by"</p>		

Deleted: aybe

Deleted: not

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
504.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Gravel Mining for road and pad construction," change middle bullet to read, "Changes in water quality, including turbidity and mobilization of contaminants."		
505.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "New gravel roads, pads, culverts, and bridges," change middle bullet to read, "Temporary and periodic turbidity, sedimentation, and contaminant mobilization during gravel placement, compaction, and grading."		
506.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Vehicle traffic on ice or gravel infrastructure," change second bullet to read, "Habitat and water quality alterations, including contaminant mobilization, due to dust, gravel spray, or sediment runoff from gravel roads."		
507.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Off-road vehicle activity on tundra," change bullet to read, "Habitat alteration due to compression or damage to vegetation resulting in soil exposure, sediment runoff, and contaminant mobilization."		
508.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Potential spills....," change first bullet to read, "Habitat alteration or loss due to spills or leaks."		
509.	M-22	M.3.14 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
510.	M-23	M.3.14 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
511.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
512.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		
513.	M-25	4 (last row of table for M.3.15)	Reed/FWS	Carry through resolution of following comment, which seeks clarification in Analysis Assumptions whether/how sport hunting and other recreation access is intended, to specify type of impact for roads and pads (e.g.: change to "Increased/alterd access for subsistence hunter, sport hunters, and other recreationists."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
514.	M-25	7	Reed/FWS	Clarify in Analysis Assumptions the extent to which sport hunting and other recreation access is intended to be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
515.	M-25	Section M3.16, last point in first row of second column	R. Wilson/FWS	Type of impact should also include 'Possible den abandonment and loss of cubs'		
516.	M-25	Section M3.16, second row, second column	R. Wilson/FWS	Should also include 'Behavioral disturbance to polar bears onshore related to landings of marine vessels'		
517.	M-26	12-14	R. Wilson/FWS	This assumption needs to be modified because we know that not all dens will be detected, and could be lower than 60% based on data in Amstrup et al. 2004. Recommend modifying the assumption such that it assumes that upwards of 60% of dens are initially detected.		
518.	M-26	7	R. Wilson/FWS	Need to include a bullet under assumptions that 'Offshore oil spills will be sufficiently rare to ignore their potential impacts to polar bears and other marine mammals'. This may not be an appropriate assumption, but it follows from what is considered in the Affected Environments section  Also, should modify the third bullet point to state that it is unlikely that all dens will be identified during den surveys, and that some percent dens are likely to be missed during surveys (>40%; Amstrup et al. 2004)		

**Deleted:** I would suggested

**Deleted:** I'm not sure I necessarily agree with this

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
519.	M-28	9	DeCleva/USFWS	Previous NRHP eligibility status may prove insufficient due to the passage of time or changes in integrity since the evaluation. It is recommended that the bullet read as: "Cultural resource sites are treated as eligible for the NRHP until they are sufficiently evaluated as determined by BLM."		
520.	M-29	M.3.19 Impact/Ind Table	Matz/FWS	Under "Action Impacting Resource" column for "Contamination," add a bullet: "Release, discharge, or insecure containment of hazardous materials or hazardous wastes." Same line, under "Type of Impact" column, change last bullet to read, "Reduced user access because of perceived or actual increases in subsistence food contamination"		
521.	M-31	M.3.20 Impact/Ind Table	Matz/FWS	For "Action Impacting Resource" column "Disruptions to subsistence activities and uses," add a bullet under Type of Impact: "Reduced social, economic, and nutritional benefits resulting from reduced use of subsistence foods due to actual or perceived increases in subsistence food contamination"		
522.	M-33	12 (table M.3.23 column 3)	Reed/FWS	Delete duplicate second bulleted item		
523.	M-36	10	Matz/FWS	Replace "casual" with more precise terminology, for example, "occasional."		
524.	M-36	16 whole Section M.3.26 Economy	Reed/FWS	Section should be revised to needs to address effects on local tourism enterprise which is employing numerous residents who serve 53 percent of visitors to the project area.		
525.	M-37	M.3.26 Impact/Ind Table	Matz/FWS	Add under "Type of Impacts" column: "Effects on incomes from alterations in subsistence activities" And, provide examples of relevant/selected economic sectors (e.g., tourism, hunting guides, air taxis)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
526.	M-38	M.3.27 Impact/Ind Table	Matz/FWS	For Oil-and-gas development, add an additional impact: " Increase in subsistence food contamination" with an Impact Indicator of "Change in contaminants in subsistence foods"		
527.	M-4	Category Rec and Tourism, Column two (Area)	Reed/FWS	Add: North American Arctic (because context of recreation – particularly polar bear viewing opportunity – extends beyond the region of the North American Arctic)		
528.	M-4	Table M-I	Matz/FWS	For Category Transportation, under Description, add after the first sentence, "Marine transportation in particular is projected to increase with decreases in sea ice associated with climate change."		
529.	M-4	Table M-I	Matz/FWS	For Category Recreation and Tourism, under Description, delete sentence beginning "Air traffic related..." as it is too specific given the general tone of the other Descriptions. Alternatively, add a similar sentence about the effects on wildlife for other Categories, including Oil and Gas Exploration, Development, and Production; Transportation; Subsistence Activities; and Community Development, as all of these have the potential to "impact wildlife species."		
530.	M-5	19	Jorgenson/FWS	Add information on the cat trains, camp and fuel vehicles. Eg. 12 – 15 rubber tracked vibrators plus the number of camp vehicles?		
531.	M-6	43	Reed/FWS	Change to "...occur between Fairbanks and each of the communities within the Arctic Refuge..." (because there are no passenger or air cargo commercial flights between Arctic Village and Kaktovik)		
532.	M-7	I	Reed/FWS	Change to "Government agencies, researchers, and recreationists often charter aircraft for research and travel purposes."		

Deleted: Recommend adding

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
533.	M-7	11	Reed/FWS	Begin first sentence with “ <i>Until recently</i> , recreation...program area.” And follow with this sentence: “While a very small number of local residents have historically participated in recreational guiding and tourism, since 2010 residents have developed tourism around polar bear viewing, and in 2017 over 50 percent of the visitors to the program area are served by locally-owned tourism businesses.		
534.	M-8	1	Matz/FWS	Delete sentence beginning with, “Alaskan officials...” While true, it is not relevant nor explanatory within the paragraph.		
535.	M-8	1	Reed/FWS	Delete first full sentence, beginning with “Alaskan officials...” (or include counter perspective to maintain objectivity)		

**Commented [CD21]:** Addressed in previous comment

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

Cmt #	Page #	Row # or Line #	Reviewer Name/ Agency	Comment	A/R/M <sup>1</sup>	Remarks / How Resolved (Reviewers: Leave this column blank)
536.	Map 3-1. Physiographic provinces, Appendix A.		Jorgenson/FWS	Recommend using more recent data to delineate the boundary between coastal plain and foothills in the program area. It appears that the hand-drawn paper map that was created in the days before GIS, was used to inform the map depicted here at a very broad scale of 1:2,500,000. Given the scale, it is inappropriate to zoom into a small area of the state and use that map to show divisions. The line work on the original map was not done at a scale to justify that. The division between coastal plain and foothills provinces is roughly drawn and follows no discernable topographical breaks on the landscape. Newer and better maps exist. All recent documents produced by the FWS (such as the Arctic NWR CCP 2015) use the Nowacki et al. digital map of ecological regions (2001). It is available at <a href="https://agdc.usgs.gov/data/usgs/erosafo/ecoreg/">https://agdc.usgs.gov/data/usgs/erosafo/ecoreg/</a> . That map is also used by many different agencies in Alaska, for example ADFG: <a href="http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions">http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions</a> . The descriptions of the project area should be rewritten using the newer map. The two maps differ greatly in the program area.		
537.	Map 3-18		R. Wilson/FWS	Recommend including winter, spring migration, and fall migration on the map.		
538.	Map 3-20		R. Wilson/FWS	What is the turquoise line in the maps for Alt C and Alt D, running at the bottom?		
539.	Map 3-21		R. Wilson/FWS	Under lease stipulation 5 (p. 2-7) it states that the coastline buffer goes inland 5 miles and encompasses the drainages that are specified. However, in the map, the coastal buffer goes offshore 5 miles and not inland. The map needs to have the coastal buffer go inland 5 miles and encompass the drainages listed on p. 2-7 for Alt-D.		

**Deleted:** This map should not be used

**Deleted:** The

**Deleted:** .

**Deleted:** Why are

**Deleted:** not depicted?

**Commented [CMA22]:** Wendy – did you and Paul look at this comment?

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
540.	Referen- ces-7	27	JRose/FWS	Jorgensen et al. 2018. Jorgenson et al. was published 8 June 2015. Also check format. Should it be "Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C., & Michaelson, G." or something similar?		
541.	2-19	ROP 4	Burkart/FWS	The scarcity and purposes of the Arctic Refuge warrant greater setback distances for fueling stations and fueling activities. 2,000 feet should be a minimum distance in alternatives D1 and D2. 1,000 feet should be a minimum setback in alternatives B and C.		Note from Wendy: Comments 552-617 have not been reviewed by POCs for inclusion, tone or contradiction to other comments. We will do this Thursday morning.
542.	2-19	Not applicable	Burkart/FWS	Something similar to NPR-A 2013 A-4 ROP should be included. In addition to the A-4 requirements, also include the following: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing 150% of the stored volume when considering terrain and weather conditions, 3) "Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed 210 gallons shall be stored within an impermeable lined and diked area or within approved bear-proof alternate storage containers" and 4) All temporary and permanent Fueling Stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		
543.	2-22	ROP 9, objective	Burkart/FWS	The objective for streams and rivers should be more specific and parallel that for lakes and ponds (e.g. ROP 10). Change the following objective: "Maintain populations of, and adequate habitat for, fish and invertebrates." TO THE FOLLOWING: Maintain natural hydrologic regimes and populations of, and adequate habitat for, fish, and aquatic invertebrates,		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
544.	2-22	ROP 9	Burkart/FWS	Change the ROP to the following: "Withdrawal of unfrozen water or ice aggregates from rivers, streams, and springs during winter is prohibited. If it has been shown that no impacts to hydrology (including hydrologic flow paths) at breakup, channel morphology, and/or impacts to fish and invertebrates and their habitat will occur, withdrawal of up to 20% of ice aggregate from a grounded area ≤4-feet deep may be authorized on a site-specific basis. Monitoring of hydrology and channel morphology prior to and after removal may be required."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

545.	2-22	ROP 10	Burkart/FWS	<p>Rationale for different withdraw volumes compared to NPR-A EIS: 1) impacts on species and habitat are unquantified (NRC 2003), especially impacts of removal of entire permitted volume; 2) lakes are relatively rare in the Arctic Refuge thus a much larger proportion of lakes will be impacted by water withdraw which would have more significant impacts to fish and wildlife in the area; 3) because lakes are rare, companies would be more likely to withdraw fully permitted volume; 4) the original and primary ANILCA purpose of the Refuge is to maintain adequate water quality and quantity to support fish and wildlife and their habitat. Furthermore, impacts of water withdrawal on soils, shorebird habitat (wet meadow zones, and invertebrates in the NPR-A have never been assessed. Studies indicate that dissolved oxygen in untapped lakes is typically close to dissolved oxygen thresholds that, if crossed, would have severe impacts on fish and wildlife habitat. These findings suggest that additional declines in oxygen due to water withdrawal could have a severe negative impact on fish and wildlife habitat. Based on these studies and the Refuge's primary purpose to maintain adequate water quality and quantity, more conservative guidelines need to be in place. Change requirements a-d TO THE FOLLOWING FOR ALL ALTERNATIVES: "</p> <p>a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 10% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.</p> <p>b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 20% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.</p> <p>c. Lakes with no fish present, regardless of depth: water available for use is limited to 20% of total lake volume.</p>		
------	------	--------	-------------	---	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 10%, 20%, or 20% volume calculations.		
546.	2-22	ROP 10	Burkart/FWS	There are no requirements for determining fish presence prior to activities that could impact fish. Add the following requirement: Sensitive and nonsensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.		
547.	2-22	ROP 10g	Burkart/FWS	Compaction or removal of snow cover can have dramatic impacts on invertebrate communities and can alter the timing of hydrologic events. Allowing compaction of or removal of snow on any waterbody without fish CHANGE REQUIREMENT G TO THE FOLLOWING: g. Compaction of snow cover or snow removal from waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice. All areas of compaction and removal must be recorded and reported to the USFWS.		
548.	2-22	ROP 10h	Burkart/FWS	Change H to the following: h. Additional modeling and monitoring of lake recharge shall be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds and macroinvertebrates is maintained. Data from these efforts shall be stored in a geodatabase with appropriate metadata and be accessible to the USFWS and the general public.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
549.	2-22	ROP 10.5?	Burkart/FWS	Because water withdrawal from ice-covered lakes can have severe negative impacts on a wide range of species and habitats there is a need for a BMP that puts a cap on the percentage of lakes in each area that can be impacted by water withdrawals. Add the following requirement for alternative B: a) Up to 20% of lakes in each class (1. deep isolated, 2. deep connected, 3. shallow isolated, and 4. shallow connected) in each major ecoregion and watershed (HUC8) can be tapped annually, b) Up to 30% of lakes in each class in major ecoregion and watershed (HUC8) can ever be tapped unless statistically valid studies with the appropriate level of inference indicate there will be no impacts to hydrology, fish and wildlife, and their habitat.		
550.	2-23	ROP C-2	Burkart/FWS	Change last sentence of requirement for alternative B(a) to the following: Snow depth and density measurements would reflect conditions at the time and location of planned operations.		
551.				ROP C-2 for alternative D should also be applicable to Alternatives B and C.		
552.	2-23	C-2 ROP a, d, and f	Burkart/FWS	a. Add the following to the end of the last sentence: "and the US Fish and Wildlife Service." Change the last sentence to the following: Snow depth and density measurements would reflect conditions at the time and location of planned operations.  d. Add "as approved by the authorized officer" to the end of the first sentence.  f. Add the following to the end of the last sentence "...in consultation with the US Fish and Wildlife Service."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
553.	2-28	ROP 24	Burkart/FWS	Add the following to requirements: d) 5 years of data on stream flow, seasonal patterns in lake connectivity, and sheet flow shall be collected prior to planning bridges and culverts. These data will be stored in a centralized database and available to the general public.		
554.	2-29	ROP 26	Burkart/FWS	ROP 26 Alternative D requirements should be applicable to alternatives B and C as well.		
555.	2-29	ROP 26	Burkart/FWS	There is a need for mining restoration plans. Add the following requirement to each alternative: Each proposed mine site shall have a USFWS-approved restoration plan and effectiveness monitoring plan prior to site approval and construction. Restoration effectiveness monitoring shall continue for ten years following completion of restoration.		
556.	2-26	ROP17, Alt B-D	Burkart/FWS	This measure is not protective of non-fish bearing waters as the objective implies. Furthermore, purposes of the Refuge warrant greater protections than in the NPR-A. Change requirement to the following for all alternatives: Exploratory drilling is prohibited upon or within 100-year flood plain of streams and rivers, on or within 2,000 feet of the ordinary high water mark of potential fish-bearing lakes, and 1,000 feet as measured from the ordinary high watermark of non-fish-bearing waterbodies unless further setbacks are stipulated under Lease Stipulation I.		
557.	2-4, 2-5	Lease Stip I	Burkart/FWS	Aichillik may be misspelled. Angun River may be misspelled.		
558.	2-4	Alternative B/C/D	Burkart/FWS	Spring-fed rivers are the most unique and productive habitats in the Refuge. In Alternative D1 and D2, the following spring-fed rivers should have 2-mile setbacks: Itkilyariak Creek (and associated forks) and Tamayariak (and associated Forks), Katakturuk, Nularvik, and Okerokovik rivers. In alternative B and C, they should have 1-mile setbacks.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
559.	2-5	Lease Stipulation 3, Alternative B/C/D	Burkart/FWS	Protections associated with stipulation 3 need to be applicable to all alternatives (B, C, and D). Spring-fed river systems are the most important, productive and unique aquatic habitats in the Refuge. In addition, they provide benefits to terrestrial wildlife and subsistence users.		
560.	3-47	16-17	Burkart/FWS	Remove the last sentence. Bowling was referenced previously and here it is not cited correctly (precipitation does not make the additional portion of snowmelt)		
561.	3-51	3-5	Burkart/FWS	Are there stipulations requiring designs that prevent degradation of permafrost? If not, it really can't be assumed that they would be followed. If this sentence is to remain in the document, it should be clear that minimizing impacts only applies to minimizing impacts of thermal degradation.		
562.	3-51	11-12	Burkart/FWS	Is this clearly stated in the stipulation? If it will be referenced here as potential mitigation it should be clearly stated in stipulations. If it is not clearly stated in the stipulation, consider incorporating it into stipulations.		
563.	3-51	19-21	Burkart/FWS	This sentence is unclear. Does protecting the structural integrity of the road and pipeline somehow minimize impacts ice-jams, scours, etc. If so, consider revising for clarity.		
564.	3-49 – 3-54	General comment on section	Burkart/FWS	Tiering the impacts on water resources to BLM's documents (NPR-A 2013, NPRA 2004a, BLM 2018) is inappropriate in many cases as impacts in the Arctic Refuge 1002 Area will be different due to the many differences between the 1002 Area and the developed areas in the NPR-A. For example, in the Arctic Refuge 1002 Area, water is relatively scarce, the terrain is steeper, and major groundwater-fed springs are extremely important.		
565.	3-52	17-18	Burkart/FWS	Reference to BLM 2012 – not relevant to the 1002 area. Even in the NPR-A, the long-term impacts of water withdrawal are unknown, especially for isolated lakes that may not fully recharge at snowmelt.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
566.	3-52	30-33	Burkart/FWS	It should be noted that erosion and thermokarst related to development activities will have long-term impacts on surface water quality.		
567.	3-52	33-35	Burkart/FWS	Is there a reference or anecdotal evidence that suggests fugitive dust during winter construction is significant?		
568.	3-52	36-39	Burkart/FWS	Consider moving this paragraph to the previous section on water withdrawals. Also, note that water is not always recharged during snowmelt. Adequate recharge depends on several factors including watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not be fully recharged during snowmelt after water removal, especially during low snow years.		
569.	3-52	11 general comments	Burkart/FWS	It is important to note that contamination related to injection of hazardous wastes in subsurface areas and fracking could have major irreversible impacts to the water quantity and quality of major spring-fed systems that are important for wildlife and subsistence users. The BLM has noted that in the NPR-A groundwater contamination during injection of hazardous materials is not a concern unless it results in drinking water contamination. In the Arctic Refuge, however, the USFWS asserts that contamination of any ground or surface water is a negative impact of concern, especially if major groundwater springs are impacted. Because of these issues, a groundwater expert who can spend a substantial portion of time working on this EIS should conduct the impacts analysis for groundwater.		
570.	2-34	G-I ROP	Burkart/FWS	The requirements under alternative D should also be applicable to B and C.		
571.	E-1 – E17		Burkart/FWS	General comment: It is misleading to call the 2,000-acre cap a surface disturbance cap if the BLM interpretation is that the cap does not include all types of surface disturbance related oil development. Use more appropriate terminology that is not misleading.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
572.	EI-E17		Burkart/FWS	Be explicit about what offshore actions are planned so that these can be considered in the range of effects. Otherwise, these analyses are grossly incomplete.		
573.	E-10	31-32	Burkart/FWS	Substituting ice chips from lakes does not reduce freshwater use it only changes the form of water use (ice versus water). Both forms of use can impact aquatic ecosystems.		
574.	EI	35-36	Burkart/FWS	This line insinuates that surface disturbance will be covered under the development scenarios. The development scenarios, however, do not include destruction of tundra and permafrost related to winter travel. This should be noted.		
575.	EI-17		Burkart/FWS	There is a need for a more rigorous analyses that include a much better assessment of the feasibility of using freshwater resources versus using groundwater versus using an STP. The findings of these analyses are necessary to develop an appropriate analysis of the impacts of development on water resources, fish, other aquatic species, etc. Without this information, the analyses cannot adequately address impacts under different alternatives.		
576.	EI-17		Burkart/FWS	Total projected water use should be presented under development scenarios. It is expected that water use could increase greatly under alternative B. It is not possible to adequately conduct analyses of the impacts of development on water resources, fish, other aquatic species, and birds without detailed projections of water use under all alternatives.		
577.	EI-17		Burkart/FWS	Total projected ice road use should be presented under development scenarios. It is expected that ice road use could increase greatly under alternative B. Without assessments of ice road use under all alternatives, it is not possible to adequately conduct analyses of the impacts of development on vegetation, fish, other aquatic species, birds, soils, and water.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
578.	EI-E17	Table E-5 and other text.	Burkart/FWS	It seems unreasonable to assume that road is only expected to vary by a maximum of 7 acres under all alternatives unless ice roads are used instead of gravel roads. Due to the scarcity of water, use of ice roads may be limited. If leasing occurs in remote areas that are not protected (e.g. alternative B), the ratio of road acres to satellite facilities would decrease. If not, water use for ice roads would have to increase substantially under alternative B.		
579.	M-4	Table M-1	Burkart/FWS	In the scientific field it is widely accepted that climate change is ongoing and has widespread impacts across the North Slope of Alaska. There are numerous scientific reports on the impacts of climate change. These reports include current impacts and future projections. Climate change must be considered as a cumulative stressor if analyses are to be considered scientifically credible.		
580.	M-14	Table M.3.10	Burkart/FWS	Water withdraws should be listed as an action impacting resource. The type of impacts include impacts to surface and ground water quality, water quantity.		
581.	M-15	8	Burkart/FWS	It cannot be assumed that impacts would be similar to those described in Greater Moose's Tooth 2 and other North Slope EIS'. The 1002 area of the Arctic Refuge is very different than developed areas of the NPR-A where the extent and volume of water is much greater and the terrain is not as steep. If the Arctic Refuge were to have the same stipulations and the NPR-A, it is expected that water withdraw would have a much greater impact as the proportion of sources tapped would be much higher in the Refuge and oil companies would use the fully permitted volume (In the NPR-A oil companies only tend to use a small fraction of the permitted volume).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
582.	M-14-15	Table M.3.10	Burkart/FWS	Injection of hazardous wastes should be listed as an action impacting water resources. The type of impact would be potential contamination of ground and surface waters. The impact indicators would be surface water quality/contamination and groundwater quality/contamination. When conducting the analysis, consider that the potential for impacts to groundwater would be reduced under alternatives with stipulations that provide a protective buffer around major spring-fed rivers.		
583.	M-15	II	Burkart/FWS	What does this mean? Does it mean that water needs for specific development scenarios/infrastructure needs have been identified? And/Or the specific locations and orientation of infrastructure have not been identified; thus, it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives.		
584.	M-14-15 general	4	Burkart/FWS	Since the development scenarios for the alternatives did not address a range of development/infrastructure needs at the level necessary to assess impacts on water resources (e.g. water withdrawal needs, ice road length, gravel mine locations and type), it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives. More information is necessary to complete an adequate analysis. This information should include water needs, ice road lengths, etc. When there are a range of possibilities for a given scenario, the range should be given. This type of analysis needs to happen so that document authors can adequately assess impacts for water resources, vegetation, etc.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
585.	M-19-22	Table M.3.13	Burkart/FWS	Since the development scenarios for the alternatives did not address a range of development/infrastructure needs at the level necessary to assess impacts on fish and aquatic species (e.g. water withdrawal needs, ice road length, gravel mine locations and type), it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives. More information is necessary to complete an adequate analysis. This information should include water needs, ice road lengths, etc. When there are a range of possibilities for a given scenario, the range should be given. This type of analysis needs to happen so that document authors can adequately assess impacts for water resources, vegetation, etc. Until this information is available, an adequate analysis cannot be done.		
586.	M-22	12-13	Burkart/FWS	Currently there are no alternatives that include use of STP versus use of freshwater.		
587.	M-22	Table M.3.13, Row 2	Burkart/FWS	Declines in dissolved oxygen and increases in solutes should be mentioned specifically under type of impact. I am not sure turbidity is an impact of water withdrawal. Other types of impacts include the following: loss of littoral habitat and wet meadow zones due to shallowing, increased freezedown of substrate used by some aquatic invertebrates to avoid freezing during winter. See Cott et al 2008 for more information on impacts of water withdraw on fish and other species in ice-covered lakes in Canada. Studies have been done on the North Slope, but many were on deep gravel pits, inconclusive due to broken instruments, had little spatial inference, no quantified ability to detect change and never attempted to look at biological resources, such as invertebrates and wet meadow zones important to water birds. Also National Research Council 2003 -- cumulative impacts of oil on the North Slope.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
588.	M-22	Table M.3.13, Row 2	Burkart/FWS	For impact indicators, consider comparing the total volume of water needed for development (1 billion gallons???) to the estimated volume of liquid water available in lakes and rivers at the end of the winter season in the 1002 area (about 1 billion gallons, Trawicki et al 1991 or Lyons and Trawicki 1994).		
589.	M-20	Table M.3.13,	Burkart/FWS	Culverts can impact fish passage, hydrologic regimes, ice damming, etc.		
590.	M-20	Table M.3.13,	Burkart/FWS	One of the bigger effects of vehicle traffic on ice and gravel roads might be the erosion and thermokarst associated with heavy vehicle traffic, especially on ice roads.		
591.	M-20	Table M.3.13,	Burkart/FWS	Barging of materials – impact indicators – I don't think there are any stipulations targeted at preventing invasive species on incoming barges.		
592.	2-1-39	Table 2-2	Burkart/FWS	Restoration standards need to be set in stipulations. It should also be clearly stated if full restoration will be required for impacts, including but not limited to impacts to vegetation, water resources, permafrost/soils, etc.		
593.	3-240	4 & 5	JWMartin FWS	Add "transportation" as major activity phase of the oil and gas industry (exploration, development, production, transportation, and abandonment/restoration), i.e., the moving of oil and gas from field to product to market		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
594.	3-240 3-241	4ff 9ff	JWMartin FWS	NEPA [Section 101(c)(ii) & (v)] clearly states that agency reporting and/or recommendations for major federal actions affecting the quality of the human environment include a detailed statement on unavoidable adverse effects and irreversible and irretrievable commitments of resources. Sections 3.5 and 3.7 inadequately address the context and intensity (40 CFR 1508.27) or the DEIS self-described context, duration and/or intensity (Pp M-1). See also 40 CFR 1502.14(b).  Critically review and upgrade DEIS Section 3.5 Unavoidable Adverse Effects and 3.7 Irreversible and Irretrievable Commitments of Resources, proportionate to the significance of the impacts and the overall Refuge oil and gas program.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

595.	3-240	21-29	JWMartin FWS	<p>Bonding has nothing to do with unavoidable adverse effects.</p> <p>Focus discussion on unavoidable adverse effects under the context and intensity of past, present, and reasonably foreseeable future actions, e.g., the anticipated lifespan of oil and gas leasing activities – TAPS has just been reauthorized to 2032, Prudhoe Bay oilfield development and expansion now has a documented lifespan of 65 years and reasonably may be projected to 100 years (Clement et al. 2013).</p> <p>Please provide a more meaningful, rigorous and [scientifically and legally] defensible narrative in compliance with the statutory NEPA tenets of unavoidable adverse effects and irreversible and irretrievable commitments of resources. This should be as stand-alone treatment based on information in this DEIS and not incorporated by reference</p> <p>To the effect ...</p> <p>Past, Present or Reasonably Foreseeable Actions. The coastal plain 1002 area had not experienced a notable human presence up to the establishment of the Arctic Refuge (1960), and since its establishment the coastal plain has been managed for its wilderness values and with minimal management (FWS 2015a, 2015b). However, in the context of the larger landscape, the Beaufort Sea coastal plain from Point Barrow to Point Demarcation is increasingly developed. This is especially true of the western half with the NPR-A, Prudhoe Bay and adjoining oilfields along with associated infrastructure. At present, seismic exploration is conducted concurrently with oilfield development and production. Based on the existing history of oil and gas in coastal plain -</p>		
------	-------	-------	-----------------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>exploration, development, production and transportation; the potential lifespan of the proposed program coastal plain 1002 area well-beyond 65 years. This estimation is based upon the initial North Slope oil and gas development in the mid- to late-1960s. The Trans-Alaska Pipeline System (TAPS) began moving oil in 1977 and is approved to operate via DOE permit through development and the biota, J.C. Truett and S.R. Johnson (eds.), San Diego, CA; Academic Press.</p> <p>Batten, J. 2004. When good animals love bad habitats: ecological traps and the conservation of animal populations. <i>Conservation Biology</i> 18(6):1482-1491.</p> <p>Beale, C.M. 2007. The behavioral ecology of disturbance responses. <i>International Journal of Comparative Psychology</i> 20:111-120.</p> <p>Bergerud, A.T. 2000. Caribou. Pp. 658-693 in S. Demarias and P.R. Krausman (eds.), <i>Ecology and management of large mammals in North America</i>. Upper Saddle River, NJ; Prentice Hall.</p> <p>Blix, A.S. and J.W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and developmental activities. <i>Arctic</i> 45(1):20-24.</p> <p>BLM (Bureau of Land Management). 2012. National Petroleum Reserve-Alaska: final integrated activity plan/environmental impact statement (7 vols.). Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office.</p> <p>BLM (Bureau of Land Management). 2014. Supplemental environmental impact statement for the Alpine Satellite Development Plan for the Greater Moose's Tooth I Development Project. Anchorage, AK: Bureau of Land Management.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>BLM (Bureau of Land Management). 2016a. Environmental assessment DOI-BLM-AKF01000-2107-001-EA [Greater Mooses Tooth Unit NPR-A]. Anchorage, AK: ConocoPhillips Alaska.</p> <p>BLM (Bureau of Land Management). 2016b. North Slope rapid ecological assessment: manager's summary. Fairbanks, AK: U.S. Department of the Interior, Bureau of Land Management.</p> <p>BLM (Bureau of Land Management). 2018. Greater Moose's Tooth II Development Project Draft Environmental Impact Statement. Anchorage, AK: Bureau of Land Management.</p> <p>BOEM (Bureau of Ocean Energy Management). 2017. Liberty Development Project: development and production plan in the Beaufort Sea, Alaska, draft environmental impact statement. Anchorage, AK: U.S. Department of the Interior, Bureau of Ocean Energy Management OCS EIS/EA BOEM 2016-010.</p> <p>Brodo, I. M., S.D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven and London.</p> <p>Brown, S., J. Bart, R.B. Lanctot, J.A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the Arctic National Wildlife Refuge. Condor 109:1-14.</p> <p>CAFF (Conservation of Arctic Flora and Fauna). 2010. Arctic biodiversity trends 2010: selected indicators of change. Akureyri, Iceland: Arctic Council, Conservation of Arctic Flora and Fauna International Secretariat.</p>		
--	--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>CAFF (Conservation of Arctic Flora and Fauna). 2013a. Arctic biodiversity assessment: report for policy makers. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>CAFF (Conservation of Arctic Flora and Fauna). 2013b. Arctic biodiversity assessment: status and trends in Arctic biodiversity. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>Cameron, R.D., D.J. Reed, J.R. Dau, and W.T. Smith. 1992. Redistribution of calving caribou in response to oil field development on the Arctic Slope of Alaska. Arctic 45(4):338-342.</p> <p>Cameron, R.D., E.A. Lenart., D.J. Reed, K.R. Whitten, and W.T. Smith. 1995. Abundance and movements of caribou in the oil field complex near Prudhoe Bay, Alaska. Rangifer 15:3-7.</p> <p>Cameron, R.D., W.T. Smith, R.G. White, and B. Griffith. 2005. Central Arctic caribou and petroleum development: distributional, nutritional, and reproductive implications. Arctic 58(1):1-9.</p> <p>Cameron, R.D., K.R. Whitten, W.T. Smith, and D.D. Roby. 1979. Caribou distribution and group composition associated with construction of the Trans-Alaska Pipeline. Canadian Field-Naturalist 93(2):155-162.</p> <p>Cameron, R.D., K.R. Whitten, and W.T. Smith. 1983. Responses of caribou to petroleum-related development on Alaska's Arctic slope. Juneau, AK: Alaska Department of Fish and Game, Progress Report Federal Aid in Wildlife Restoration Project W-21-2 and W-22-1, Job 3.18R.</p> <p>Clement, J.P., J.L. Bengtson, and B.P. Kelly. 2013. Managing for the future in a rapidly changing Arctic: a report to the President. Washington, D.C.: Interagency Working Group</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>on Coordination of Domestic Energy Development and Permitting in Alaska.</p> <p>Clough, N.K., P.C. Patton, and A.C. Christiansen. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resources assessment: report and recommendation to the Congress of the United States and final legislative environmental impact statement (2 Volumes). Washington, D.C.: U.S. Department of the Interior, Geologic Survey and Bureau of Land Management.</p> <p>Cronin, M.A., H.A. Whitlaw, and W.B. Ballard. 2000. Northern Alaska oil fields and caribou. Wildlife Society Bulletin 28(4):919-922.</p> <p>Dau, J., and R.D. Cameron. 1992. Effects of a road system on caribou distribution during calving. Rangifer Special Issue 1:95-101.</p> <p>Day, R.H., J.R. Rose, A.K. Prichard, and B. Streever. 2015. Effects of gas flaring on the behavior of night-migrating birds at an artificial oil-production island, Arctic Alaska. Arctic 69(3):367-379.</p> <p>Felix, N.A. and M.K. Reynolds. 1989. The effects of winter seismic trails on tundra vegetation in northeastern Alaska, U.S.A. Arctic and Alpine Research 21 (2):188-202.</p> <p>Franklin, A.B., B.R. Noon, and T.L. George. 2002. What is habitat fragmentation? Studies in Avian Biology 25:20-29.</p> <p>Fuller, T., D.P. Morton, and S. Sarkar. 2008. Incorporating uncertainty about species' potential distributions under climate change into the selection of conservation areas with a case study from the Arctic coastal plain of Alaska. Biological Conservation 141(6):1547-1559.</p> <p>FWS (Fish and Wildlife Service). 2015a. Arctic National Wildlife Refuge revised comprehensive conservation plan,</p>		
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>final environmental impact statement, wilderness review, and wild and scenic river review. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>FWS (Fish and Wildlife Service). 2015b. Record of decision: revised comprehensive conservation plan Arctic National Wildlife Refuge. Anchorage, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>Gliders, M.A., and M.A. Cronin. 2000. North Slope oil field development. Pp. 15-33 in The natural history of an arctic oil field: development and the biota, J.C. Truett and S.R. Johnson (eds.). San Diego, CA: Academic Press.</p> <p>Gunn, A., C.J. Johnson, J.S. Nishi, C.J. Daniel, D.E., Russell, M. Carlson, and J.Z. Adamczewski. 2011. Understanding the cumulative effects of human activities on barren-ground caribou. Pp. 113-133 in P.R. Krausman and L.K. Harris (eds.), Cumulative effects in wildlife management: impact mitigation. Boca Raton, FL: CRC Press.</p> <p>Gutzwiller, K.J. 2002. Applying landscape ecology in biological conservation. New York, NY: Springer-Verlag.</p> <p>IPCC (Intergovernmental Panel on Climate Change). 2007. Climate change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC (M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.) Cambridge, U.K., Cambridge University Press.</p> <p>Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The effects of linear developments on wildlife: a review of selected scientific literature. Calgary, Alberta: Canadian Association of Petroleum Producers, ARC Wildlife Services.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>Jorgenson, J.C., J.M. Ver Hoef, and M.T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. <i>Ecological Applications</i> 20(1):205-221.</p> <p>Kemper, J.T. and S. Ellen MacDonald. 2009. Effects of contemporary winter seismic exploration on low Arctic plant communities and permafrost. <i>Arctic, Antarctic, and Alpine Research</i> 41(2):228-237.</p> <p>Krausman, P.R., and L.K. Harris. 2011. Cumulative effects in wildlife management: impact mitigation. Boca Raton, FL: CRC Press.</p> <p>Krebs, C.J. 2001. Ecology: the experimental analysis of distribution and abundance. San Francisco, CA: Benjamin Cummings.</p> <p>Liebezeit, J., E. Rowland, M. Cross, and S. Zack. 2012. Assessing climate change vulnerability of breeding birds in Arctic Alaska. A report prepared for the Arctic Landscape Conservation Cooperative. Bozeman, MT: Wildlife Conservation Society.</p> <p>Lindenmayer, D.B., and J. Fischer. 2006. Habitat fragmentation and landscape change: an ecological and conservation synthesis. Washington, D.C.: Island Press.</p> <p>Linnell, J.D., J.E. Swenson, R. Andersen, and B. Barnes. 2000. How vulnerable are denning bears to disturbance? <i>Wildlife Society Bulletin</i> 28(2):400-413.</p> <p>Martin, P.D., J.L. Jenkins, F.J. Adams, M.T. Jorgenson, A.C. Matz, D.C. Payer, P.E. Reynolds, A.C. Tidwell, and J.R. Zelenak. 2009. Wildlife response to environmental Arctic change: predicting future habitats of Arctic Alaska. Report of the Wildlife Response to Environmental Arctic Change (WildREACH): Predicting Future Habitats of Arctic</p>		
--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Alaska Workshop; 17-18 November 2008. Fairbanks, AK: U.S. Department of the Interior, Fish and Wildlife Service, Alaska Region.</p> <p>Mattoli, S. 2011. Family Cervidae (Deer). Pp. 350-443 in D.E. Wilson and R.A. Mittermeier (eds.), Handbook of the mammals of the world. Vol. 2: Hoofed mammals. Barcelona, Spain; Lynx Edicions.</p> <p>Mattson, D.J. 1990. Human impacts of bear habitat use. Bears: their biology and management 8:33-56.</p> <p>McCarter, S.S., A. Rudy, and S.F. Lamoureux. 2017. Long-term landscape impact of petroleum exploration, Melville Island, Canadian High Arctic. Arctic Science 3(4):730-744.</p> <p>McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behaviour, habitat use and demography. Journal of Applied Ecology 25(2):451-460.</p> <p>McLellan, B.N., and D.M. Shackleton. 1989. Immediate reactions of grizzly bears to human activities. Wildlife Society Bulletin 17(3):269-274.</p> <p>Miller, F.L. 2003. Caribou Rangifer tarandus. Pp. 965-997 in G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (eds.), Wild mammals of North America: biology, management, and conservation. Baltimore, MD: John Hopkins University Press.</p> <p>Mitchell, C., and S. Pihl. 2005. Steller's Eider Polysticta stelleri. Pp. 689-692 in J. Kear (ed.), Ducks, geese, and swans (2 Vols.). New York, NY; Oxford University Press.</p> <p>Morrison, M.L., B.G. Marcot, and R.W. Mannan. 2006. Wildlife-habitat relationships: concepts and applications. Washington, D.C.: Island Press.</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Murphy, S.M., and B.E. Lawhead. 2000. Caribou. Pp. 59-84 in The natural history of an arctic oil field: development and the biota, J.C. Truett and S.R. Johnson (eds.). San Diego, CA; Academic Press.</p> <p>Myers-Smith, I.H., B.K. Arnesen, R.M. Thompson, and F.S. Chapin, III. 2006. Cumulative impacts on Alaskan arctic tundra of a quarter century of road dust. <i>Ecoscience</i> 13(4):503-510.</p> <p>Nelleman, C., and R.D. Cameron. 1996. Effects of petroleum development on terrain preferences of calving caribou. <i>Arctic</i> 49(1):23-28.</p> <p>North Slope Borough. 2009. Impacts and benefits of oil and gas development to Barrow, Nuiqsut, Wainwright, and Atkasuk harvesters. Barrow, AK: North Slope Borough, Department of Wildlife by S.R. Bruand and Associates.</p> <p>NRC (National Research Council). 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. Washington, D.C.: National Academies Press.</p> <p>NRC (National Research Council). 2008. Ecological impacts of climate change. Washington, D.C.: National Academy Press.</p> <p>NRC (National Research Council). 2014. The Arctic in the Anthropocene: emerging research questions. Washington, D.C.; National Academy Press.</p> <p>NRC (National Research Council, Polar Research Board; Division on Earth and Life Studies). 2015. Arctic matters: the global connection to changes in the Arctic. Washington, D.C.; National Academy Press.</p>		
--	--	--	--	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>Pepper, C.B., M.A. Nascarella, R.J. Kendall. 2003. A review of the effects of aircraft noise on wildlife and humans, current control mechanisms, and the need for further study. <i>Environmental Management</i> 32(4):418-432.</p> <p>Pickett, S.T.A., and P.S. White. 1985. The ecology of natural disturbance and patch dynamics. San Diego, CA; Academic Press.</p> <p>Pulliam, H.R. 1988. Sources, sinks, and population regulation. <i>American Naturalist</i> 132:652-661.</p> <p>Pulliam, H.R., and B.J. Danielson. 1991. Sources, sinks, and habitat selection - a landscape perspective on population-dynamics. <i>American Naturalist</i> 137 Supplement:S50-S66.</p> <p>Reimers, E., and J.E. Colman. 2006. Reindeer and caribou (<i>Rangifer tarandus</i>) response towards human activities. <i>Rangifer</i> 26(2):55-71.</p> <p>Reynolds, P.E., H.V. Reynolds, and E.H. Follmann. 1986. Responses of grizzly bears to seismic surveys in northern Alaska. <i>International Conference on Bear Research and Management</i> 6:169-175.</p> <p>Romero, L.M., and J.C. Wingfield. 2015. Tempests, poxes and people: stress in wild animals and how they cope. New York, NY; Oxford University Press.</p> <p>Rudnik, D.A., S.J. Ryan, P. Beier, S.A. Cushman, F. Dieffenbach, C.W. Epps, L.R. Gerber, J. Hartter, J.S. Jenness, J. Kintsch, A.M. Merenlender, R.M. Perki, D.V. Preziosi, and S.C. Trombulak. 2012. The role of landscape connectivity in planning and implementing conservation and restoration priorities. <i>Issues in Ecology Report</i> 16.</p> <p>Thomas, D.S., G.E. Fogg, P. Convey, C.H. Fristen, J-M. Gili, R. Gradinger, J. Laybourn-Parry, K.Reid, and D.W.H.</p>	
--	--	--	--	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

			<p>Walton. 2008. The biology of polar regions. New York, NY: Oxford University Press.</p> <p>Trammell, E.J., M.L. Carlson, N. Fresco, T. Gotthardt, M.L. McTeague, and D. Vadapalli. 2015. North Slope rapid ecological assessment. Report prepared for the Bureau of Land Management. Fairbanks, AK: University of Alaska, Alaska Center for Conservation Science, Institute of Social and Economic Research, and Scenarios Network for Alaska and Arctic Planning.</p> <p>Trombulak, S.C., and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. <i>Conservation Biology</i> 14(1):18-24.</p> <p>Truett, J.C., and S.R. Johnson. 2000. The natural history of an arctic oil field: development and the biota. San Diego, CA: Academic Press.</p> <p>Truett, J.C., M.E. Miller, and K. Kertell. 1997. Effects of Arctic Alaska oil development on Brant and Snow Geese. <i>Arctic</i> 50(2):138-146.</p> <p>Van Horne, B. 1983. Density as a misleading indicator of habitat quality. <i>Journal of Wildlife Management</i> 47:893-901.</p> <p>Vors, L.S., and M.S. Boyce. 2009. Global declines of caribou and reindeer. <i>Global Change Biology</i> 15:2626-2633.</p> <p>Walker, L.R. 2012. The biology of disturbed habitats. New York, NY: Oxford University Press.</p> <p>Walker, A.M., and K.R. Everett. 1987. Road dust and its environmental impact on Alaskan tundra and tundra. <i>Arctic and Alpine Research</i> 19(4):479-489.</p>		
--	--	--	---	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				<p>Walker, D. A., D. Cate, J. Brown, and C. Racine. 1987. Disturbance and recovery of arctic Alaskan tundra terrain: A review of recent investigations. CRREL Report 87-11. U.S. Army Cold Regions Research and Engineering Laboratories, Hanover, New Hampshire, USA. Walker, D.A., D. Cate, J. Brown, and C. Racine. 1987. Disturbance and recovery of Arctic Alaskan tundra terrain: a review of recent investigations. Hanover, NH: U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratories CRREL Report 87-11.</p> <p>Wilson, R.R., J.R. Liebezeit, and Wendy M Loya. 2013. Accounting for uncertainty in oil and gas development impacts to wildlife in Alaska. Conservation Letters 6(5):350-358.</p> <p>Wood, E.M., and J.L. Kellermann. 2015. Phenological synchrony and bird migration: changing climate and seasonal resources in North America. Studies in Avian Biology 47.</p> <p>Wormworth, J., and K. Mallon. 2006. Bird species and climate change. Fairlight, New South Wales, Australia: Climate Risk.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
596.	3-241	1	JWMartin FWS	<p>... "natural environmental balances" is undefinable or unattainable as an agency or industry restoration goal</p> <p>Replace with "ecosystem functions and processes" which is definable, attainable and measureable; and further, implies a potential of substitution rather than replication of the pre-development state - alternately "ecosystem services" which is broader yet and includes social/subsistence considerations).</p>		
597.	3-241	6-7	JWMartin FWS	<p>"Section 4.9 of the NPR-A EIS (BLM 2012)" described discussion of short-term uses of industry development and production and long-term resource productivity in the 1002 Area is not possible due to extreme environmental differences between the NPR-A and 1002 Area: topographic relief; precipitation and snow cover: hydrology; among others as described in existing environmental of this DEIS.</p> <p>Illogical/confusing and multiple definitions of "product" and "resource" within sentence - Replace with better narrative, likely multiple sentences.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
598.	3-241	23	JWMartin FWS	<p>Loss or change in subsistence use is not dependent upon just abandonment plans but intervening direct, indirect and cumulative effects of oil and gas leasing activities (exploration, development, production, transportation and restoration) over the lifetime of impacts with the implicit statutory and case law understanding that federal agencies are held to a higher standard (lower threshold of significance) under ANILCA 810 than that of NEPA for subsistence availability, access and abundance (Naiman 1996).</p> <p>NEPA significance (40 CFR 1508.27) is not equal or equivalent to ANILCA Title VIII (Section 810) "significance," i.e., significant restriction of subsistence uses (access, abundance, availability). ANILCA (Section 804 Preference for Subsistence Uses) sets a much higher standard (lower threshold) for significant impacts than NEPA (see Naiman 1996 for review of case law).</p> <p>Citation: Naiman, J. 1996. ANILCA section 810: an undervalued protection for Alaskan villagers' subsistence. Fordham Environmental Law Journal 7:211-350.</p> <p>The ANILCA 810 Evaluation is needed to draft any meaningful narrative on this subject</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
599.	M-5	12-13	JWMartin FWS	<p>"Both onshore and offshore reasonably foreseeable future oil and gas ..." There is no acknowledgement of Canadian projects, present or pending, in the following listing, as implied in Table M-1 (see Canadian Arctic under Effects Analysis Area). These would be additive to the existing marine sea and air traffic as well as background noise, and likely to increase under RFFA.</p> <p>Identify Canadian projects and pending expansion or new development; add increase in noise levels related to surface, air and sea traffic; oil and gas development; and, infrastructure development to Table M-1.</p>		
600.	M-5 – M-6	12ff	JWMartin FWS	<p>Special Alaska Lease Sale Areas (SALSA), including Harrison Bay, Gwydyr Bay and Storms areas of the North Slope are not acknowledged under Oil and Gas Exploration, Development and Production (line 1) (see Anchorage Daily News dated 9 Aug 2018 under title Alaska Puts Chunks of North Slope Up for Single Bids in Unprecedented Lease Sale <a href="https://www.adn.com/business-economy/energy/2018/08/09/alaska-promotes-large-chunks-of-north-slope-in-single-bid-lease-sale">https://www.adn.com/business-economy/energy/2018/08/09/alaska-promotes-large-chunks-of-north-slope-in-single-bid-lease-sale</a>).</p> <p>add to listing of reasonably foreseeable future actions (RFFAs)</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

601.	Chapter 3	all	JWMartin FWS	<p>There are repeated references, incorporation by reference (per 40 CFR 1502.21) in Chapter 3 - the combined affected or existing environment and environmental consequences, to the NPR-A (BLM 2012) or Greater Moose's Tooth 2 (GMT2) (BLM 2018) or other NEPA compliance in the greater NPR-A/North Slope area.</p> <p>(1) there is no reference of where that information may be located among the multiple volumes and documents of the BLM Alaska ePlanning website, to facilitate the average reader reviewing the information;</p> <p>(2) the GMT2 is a DRAFT document, therefore plastic, subject to change without notice and likely change before finalization; therefore, the reader is referencing a moving target – which is not acceptable as an incorporation by reference under NEPA;</p> <p>(3) comparisons between the NPR-A and the 1002 are problematic at multiple levels and scales – they are not similar and environmental effects in the NPR-A does not imply any comparable consequence in the 1002 Area; and,</p> <p>(4) if incorporation by reference and comparisons are to be made with NPR-A as to oil and gas BMPs/ROPs or other aspects of NEPA compliance, it is strongly recommended that comparison table (matrix) be generated to indicate where in those integrated references the relevant information across multiple disciplines may be located by the average reader. For example –</p> <table><tr><td></td><td>DEIS Leasing</td><td>BLM EIS-B</td><td>BLM EIS-C</td></tr><tr><td>Subject 1</td><td>Pp x-y</td><td>Pp x-y</td><td>Pp x-z</td></tr><tr><td>Subject 2</td><td>Pp x-w</td><td>Pp x-a</td><td>Pp x-v</td></tr></table>		DEIS Leasing	BLM EIS-B	BLM EIS-C	Subject 1	Pp x-y	Pp x-y	Pp x-z	Subject 2	Pp x-w	Pp x-a	Pp x-v		
	DEIS Leasing	BLM EIS-B	BLM EIS-C															
Subject 1	Pp x-y	Pp x-y	Pp x-z															
Subject 2	Pp x-w	Pp x-a	Pp x-v															

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
602.	3-1 and through chap	11 ff	JWMartin FWS	<p>"Direct and indirect effects to each resource are analyzed in this chapter [3]. Cumulative effects and reasonably foreseeable future actions are analyzed in Chapter 4, Cumulative Effects."</p> <p>Note that the cumulative impact analysis and cumulative effects narrative discussion of the BLM NPR-A IAP Final EIS required 322 pages, including 26 pages devoted to unavoidable adverse effects (Volume 4 in its entirety, BLM 2012). The depth and detail of discussion, and proportionality of unavoidable adverse effects found in the BLM NPR-A IAP EIS, is lacking in the subject DEIS.</p> <p>As a compounding factor for attempting to make comparisons between the NPR-A and 1002 area, the NPR-A does not have establishing origins in wildlife, wilderness and recreational values (PLO 2214), nor statutory purposes based in natural resource conservation (ANILCA Section 302(2)(B) as the 1002 area of Arctic National Wildlife Refuge. These considerations bear on the impact analysis and potential mitigation measures. As presented in the subject DEIS, this is largely glossed over as opposed to taking a hard look at cause and effects of proposed action [see BLM National Environmental Policy Act Handbook H-1790-1 (2008) 6.8.1.2 Analyzing Effects – a "hard look" is a reasoned analysis containing quantitative or detailed qualitative information].</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
603.				<p>Additionally, the following are not addressed under statutory and regulatory compliance (D-3).</p> <p>Marine Mammals Protection Act</p> <p>National Wildlife Refuge System Administration Act, amended through the National Wildlife Refuge Improvement Act (including BIDEH policy – Service Manual 601 FVW 3, dated 16 Apr 2001)</p> <p>Migratory Bird Treaty Act</p> <p>Bald Eagle and Golden Eagle Protection Act</p> <p>US Fish and Wildlife Service Mitigation Policy dated 23 Jan 1981 (reinstated via 2016 policy withdrawal effective 30 Jul 2018: FWS 2018))</p> <p>The Wilderness Act</p> <p>Wild and Scenic Rivers Act</p> <p>National Historic Preservation Act</p> <p>Native American Graves Protection and Repatriation Act</p> <p>FWS (Fish and Wildlife Service). 2018. U.S. Fish and Wildlife Service mitigation policy. Federal Register 83(146):36472-36475.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
604.	Chapter 3 & Appendix H, M		JWMartin FWS	<p>Multiple BLM NEPA compliances to date mention the phases of oil and gas activity, specifically: exploration, development, production, transportation and abandonment/restoration. However, when abandonment/restoration is discussed, if at all, there is no consideration as an active, ongoing process. This would facilitate the Refuge in meeting a primary ANILCA purpose of "in their natural diversity."</p> <p>There is no mention of developing adaptive management approaches to rehabilitate and restoration impacts in a sequentially phased manner as industry explores, develops, produces, and transports oil and gas so that everything does not occur at some distant end point in time and space. Further, there is no investment in technologies that may be adaptive to variable climates that will differ from those at present. In spite of improved industry standards, some impacts are still measureable 60 years after the activity (Walker et al. 1987; Felix and Reynolds 1989; Gliders and Cronin 2000; Kemper and MacDonald 2009; Jorgenson et al. 2010; McCarter et al. 2017).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

605.	2-39  3-61  Appendix H	M-ROPs  12ff	JWMartin FWS	<p>As stated in the DEIS, a canvas of the North Slope shows no invasive alien vascular plants present now. However, there is no mention of predictive modeling to identify what species may pose a real or potential risk for pioneering: where to look, when to look, how to look for potential invasive alien species – in order to develop preventative monitoring. There are significant risks associated with increased development in the program area either through human-subsidized movement through personnel or material, but also through surface disturbances that create conditions conducive to species pioneering and establishment. ROPs may not be sufficient to offset this risk and may require a concerted effort by all cooperators and academia (Taylor et al. 2017).</p> <p>Citation.</p> <p>Taylor, J., M. Storzer, C. Coon, S. Davis, G. Harrington, B. Anderson, J. Martin, B. Merrill. 2017. DOI Arctic Cumulative Impacts Workshop Final Report. Anchorage, AK: Bureau of Land Management, US Geological Survey, Bureau of Ocean Energy Management and National Oceanic and Atmospheric Administration.</p> <p>References – for consideration in reworking this discussion</p> <p>Bella, E.M. 2009. Predicting invasive plant range expansion in Alaska. Davis, CA: University of California, doctoral dissertation.</p> <p>Conn, J., C. Stockdale, N. Werdin-Pfisterer, and J. Morgan. 2010. Characterizing pathways of invasive plant spread to Alaska: II. Propagules from imported hay and straw. <i>Invasive Plant Science and Management</i> 3(3):276-285.</p> <p>Crowl, T.A., T.O. Crist, R.R. Parmenter, G. Belovsky, and A.E. Lugo. 2008. The spread of invasive species and</p>		
------	------------------------------------	--------------------	-----------------	--	--	--

† A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				<p>infectious disease as drivers of ecosystem change. <i>Frontiers in Ecology and the Environment</i> 6(5):238-246.</p> <p>Davis, M.A. 2009. <i>Invasion biology</i>. Oxford, U.K.: Oxford University Press.</p> <p>Elton, C. 1958. <i>The ecology of invasions by plants and animals</i>. London, U.K.: Methuen.</p> <p>Lassuy, D.R., and P.N. Lewis. 2013. Invasive species: human-induced. Pp. 559-565 in <i>Conservation of Arctic Flora and Fauna Arctic Council (eds.), Arctic biodiversity assessment: status and trends in Arctic biodiversity</i>. Akureyri, Iceland: Conservation of Arctic Flora and Fauna.</p> <p>NRC (National Research Council). 2002. <i>Predicting invasions of nonindigenous plants and plant pests</i>. Washington, D.C.: National Academy of Press.</p> <p>Ricciardi, A., M.F. Hoopes, M.P. Marchetti, and J.L. Lockwood. 2013. Progress toward understanding the ecological impacts of nonnative species. <i>Ecological Monographs</i> 83(3):263-282.</p> <p>Root, T., and L. Hughes. 2005. Present and future phenological changes in wild plants and animals. Pp. 61-69 in T.E. Lovejoy and L. Hannah (eds.), <i>Climate change and biodiversity</i>. New Haven, CT: Yale University Press.</p> <p>Root, T.L., J.T. Price, K.R. Hall, S.H. Schneider, C. Rosenzw</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
606.	3-65	19	JWMartin FWS	Wetland Functions  Please correct to EPA defined Wetland Functions and Values – EPA has purview over the Clean Water Act, and hence wetlands (see <a href="https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF">https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF</a> ).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**To:** Nicole Hayes[mnhayes@blm.gov]  
**Cc:** Mary Colligan[mary\_colligan@fws.gov]; Mitch Ellis[mitch\_ellis@fws.gov]; Greg Siekaniec[greg\_siekaniec@fws.gov]; Karen Clark[karen\_clark@fws.gov]; Sara Boario[sara\_boario@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]  
**From:** Wendy Loya  
**Sent:** 2018-08-17T19:54:50-04:00  
**Importance:** Normal  
**Subject:** FWS Coastal Plain DEIS Comments  
**Received:** 2018-08-17T19:55:03-04:00  
[2018 0817 Final FWS Cover Letter Coastal Plain DEIS Comments \(sn\).pdf](#)  
[140L6318F0003\\_AdminDrftEIS\\_BLM-agency-cmmts\\_201817\\_1530\\_FWS.docx](#)

Hi Nicole,

Thank you for the opportunity to review the DEIS. Attached is a letter from Greg Siekaniec and all of our comments in the table format you requested. They are mostly in order by page number, although the sorting is a little off due to the format. Don't hesitate to let me know if you have any questions.

Thank you,

Wendy

Dr. Wendy M. Loya,  
Arctic Program Coordinator  
Office of Science Applications, US Fish and Wildlife Service  
Anchorage, Alaska  
907.786.3532 (office)  
907.227.2942 (mobile)



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
1.	General comment		Crane/FWS	The DEIS does not fully analyze nor distinguish how the various alternatives affect the other purposes of the refuge. Recommend incorporating this analysis into the affected environment section as appropriate or clarify what assumptions are made regarding the impact of each alternatives on all six of the refuge purposes.		
2.	General comment		Loya/FWS	The DEIS does not consistently analyze nor distinguish how the various alternatives affect individual resources of the refuge. We recommend that BLM provide more specific guidance to the chapter authors on how to incorporate the Reasonably Foreseeable Development Scenario and the Approach to Environmental Analyses (Appendix M) assumptions into the Chapter 3 Environmental Consequences analyses.		
3.	General comment		Loya/FWS	Splitting Alternative D into two alternatives (D1 and D2) is confusing and we recommend that Alternative D1 be eliminated. The primary difference is related to the elements of Stipulation 6 related to timing limitations of activity when caribou use the coastal plain, which are consistent, but less restrictive, than those required under the NPRA Integrated Activity Plan. Alternative D2 allows for the Authorized Officer to waive timing restrictions if caribou are not present in significant numbers (10% of the population) during calving and insect relief periods. If development proceeds in the high resource potential area and in a manner similar to NPRA, with one major construction project occurring at a time, it would be highly likely that timing restrictions could be waived. Recommend rewording Alternative D Stipulation 6 to highlight this flexibility when warranted.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
4.	General comment		Loya/FWS	We recommend including information referred to in other NEPA documents in the appendices, especially in the case of referring to another Draft EIS (e.g. GMT2), that may change in the Record of Decision. We recommend referrals to other documents include chapter or page numbers to guide the reader.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

5.	General comment		Kaye/FWS	<p>The most recent Comprehensive Conservation Plan for the Refuge enacts minimal management prescriptions for the coastal plain and includes a recommendation for designating the area as Wilderness. Even without Congressional Wilderness designation, the wilderness characteristics of area have long been recognized, and are preserved under Public Land Order 2214 and ANILCA sections 101(b) and 304(g). The enduring wilderness characteristics of the area provide the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists. Thus, we believe the DEIS should more thoroughly address the relative impact of the alternatives on resources within the context of the wilderness characteristics of the area.</p> <p>To add clarity regarding wilderness characteristics and values of the coastal plain, we recommend include a preface to the document, or to wilderness section in Chapter 3.4.7, that states:</p> <p>A note about Wilderness and wilderness terminology</p> <p>The Arctic Refuge was first proposed as "The Last Great Wilderness," and wilderness is an original (1960 PLO 2214) and continuing purpose of the coastal plain, which is officially recommended for Wilderness designation. As well, wilderness provides the context within which the area's wildlife, recreational, ecological, scientific, aesthetic, and symbolic values are largely understood and appreciated by both visitors and the millions who find satisfaction and inspiration in just knowing it exists.</p> <p>Given the significance of wilderness in Arctic Refuge issues, it is important to address confusion regarding use of the term. Wilderness can refer to characteristics, qualities, or values held by the entire Refuge, including</p>		
----	-----------------	--	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				the coastal plain, or just to areas designated as Wilderness such as the areas south and east of the 1002 area. To clarify, this document uses the non-capitalized word <i>wilderness</i> when describing wilderness-associated characteristics, qualities and special values (USFWS 2015) of the coastal plain, including the qualities referenced in ANILCA section 101(b) ("wilderness resource values") and Section 304(g) ("wilderness value"). It uses capitalized <i>Wilderness</i> when referring to effects upon the adjacent designated Wilderness areas and to post-development reclamation of the coastal plain to a level where it is again qualified for Wilderness designation.		
6.	General comment		Crane/FWS	Throughout the document there are references to the construction of ice roads and ice bridges to facilitate development similar to NPRA. However, the EIS also describes how the vast majority of lakes in the program area freeze solid and only contain a small volume of unfrozen water. The analysis of the various alternatives does not fully account for what will likely be a lack of sufficient fresh water resources for development needs and what that means for other resources (e.g. gravel mining and surface disturbance). Recommend that the reasonably anticipated water needs of the RFDS be estimated and clearly stated and compared with the identified water supplies in the program area. If a deficit exists, the EIS should identify alternatives to address that shortage.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
7.	General comment		Crane/FWS	Throughout the document, readers are directed to reference documents for additional analysis of impacts. Many of these documents are for impacts associated with development in NPRA. Given the significant difference in terrain and landscape of the program area when compared to NPRA, the affected environment of NPRA is in many cases not comparable to the program area. Recommend providing analysis that reflects the differences between the two areas.		
8.	General Comment		Crane/FWS	The EIS does not really address the forthcoming area wide seismic project currently being reviewed by BLM, despite being included in the list of actions in the Cumulative Impacts section of Appendix M. Recommend addressing the effects of this action either in the baseline or in the cumulative effects sections of each resource as future activities will be additive to the effect of the area wide seismic project.		
9.	General comment		Jorgenson/FWS	Readily available documents that should be cited in the EIS, including all relevant sections of Chapter 3:  National Research Council, 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press.)  Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
10.	General comment		JohnT/FWS	The topography and hydrology on the coastal plain, particularly in the area of high interest are different than that of the NPRA. Arctic Refuge scenario and effects will be different and should not be addressed solely by reference to NPRA documents.		
11.	1-1	21	JohnT/FWS	The introduction should include statement of all of the purposes of the Arctic Refuge. Insert ANILCA and PLO 2214 purposes here.		
12.	1-4	6	Crane/FWS	The section within the ESA that BLM must comply with for ESA consultation is section 7(a)2; however, it is commonly referred to "compliance with section 7. Suggest revising the existing statement.		
13.	2-15	LS 9, Alt D, Requirement c.ii.	Reed/FWS	Change "...impacts on subsistence uses..." to "...impacts on subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
14.	2-16	LS 9, Alt D, Requirement d	Reed/FWS	Change "...on area resources and subsistence uses..." to "...on area resources, and subsistence and other public uses..." or specify transportation infrastructure would be closed to non-subsistence public users (see Section 3.4.9, Transportation)"		
15.	2-17	ROP 2	Swem/FWS	Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made.		
16.	2-17	ROP 2	Putnam/FWS	Recommend the use of bear resistant containers for all waste materials and classes for all Alternatives (not just for Alternative D). Bear resistant containers for all wastes materials and classes is the current best practice and will reduce or prevent the majority of human-bear conflict interactions under all leasing Alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
17.	2-17, 2-18	ROP 2, 3	Matz/FWS	Under Waste Prevention, Handling, Spills, and Public Safety, ensure that Requirement/Standards match for each ROP. Currently Requirement/Standard for ROP 3 under Alternatives B and C is identical to Requirement/Standard under ROP 2 for Alternative D.		
18.	2-18	2	Matz/FWS	Required Operating Procedure 3 under Alternative D should be duplicated under Alternatives B and C, as the activities described therein are in fact required by law.		
19.	2-19		Burkart, Greta, USFWS	Something similar to NPR-A BMP A-4 should be included. In addition to the A-4 requirements, also include the following: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing <b>150%</b> of the stored volume <b>when considering terrain and weather conditions, 3)</b> "Except during overland moves <b>and seismic operations</b> , fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed <b>210</b> gallons shall be stored within an impermeable lined and diked area or within approved <b>bear-proof</b> alternate storage containers" and 4) <b>All temporary and permanent</b> Fueling Stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
20.	2-19	ROP 4	Burkart/FWS	Update ROP4 to be more similar to NPR-A BMP A-4 and NPR-A 2013 A-4 ROP and consider the following additions and edits: 1) containment of fuel over 200 gallons should be bear-proof, 2) spill containment systems for all fuel storage should be capable of containing 150% of the stored volume, 3) "Except during overland moves <b>and seismic operations</b> , fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed 210 gallons shall be stored within an impermeable lined and diked area or within approved bear-proof alternate storage containers" and 4) All temporary and permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills.		
21.	2-2	25	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
22.	2-2	7	JFox/FWS	We can't predict whether or not resource trends will remain the same. Suggest eliminating this part of the sentence.		
23.	2-20	ROP 7, Paragraph b.	FWS – BAWR (Allen and Collins)	Delete "sensitive" from sentence: Class I and Class II area (as identified . . . )		
24.	2-20	ROP 7, Paragraph d.	FWS – BAWR (Allen and Collins)	Add "mercury and other heavy metals" to the end of the sentence: ". . . including greenhouse gases, mercury and other heavy metals and fugitive dust."		
25.	2-21	ROP 7	JFox/FWS	Remove references to Greater Mooses Tooth Unit I and Nuiqsut and replace with Coastal Plain and Kaktovik.		
26.	2-21	ROP 7	JRose/FWS	Appears objective for GMT I was included by accident. If it was included intentionally modifications need to be made to make this relevant to the Refuge communities.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
27.	2-21	ROP 7, Paragraph f.	FWS – BAWR (Allen and Collins)	Replace with: If the air quality analysis shows potential future impacts on National Ambient Air Quality Standards (NAAQS) or Alaska Ambient Air Quality Standards (AAAQS) or impacts above specific levels of concern for Air Quality Related Values (AQRVs), the BLM will require air quality mitigation measures and strategies within its authority and in consultation with local, state, federal and tribal agencies with responsibility for managing air resources in addition to regulatory requirements and proponent committed emission reduction measures and for emission sources not otherwise regulation by the Alaska DEC or EPA.”		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
28.	2-21	ROP 7, Paragraph e.	FWS – BAWR (Allen and Collins)	For additional clarity and accuracy, replace paragraph with “For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM Authorized Officer will require air quality analysis for determining the project’s direct, indirect, cumulative impacts on air quality. The BLM will evaluate the magnitude of potential air emissions from the project or activity, the durations of the proposed action, the proximity to a federally mandated Class I area and Class II area (as identified by EPA, Alaska DEC or a federal land management agency), location to a population center, location to a nonattainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude or existing development in the area, or other issues identified during the project’s NEPA analysis. The BLM will determine the information required for a project-specific air quality analysis by developing a modeling protocol for each air analysis. The BLM will consult and inform the U.S. Fish and Wildlife Service and other appropriate federal, state, or local agencies regarding air quality analysis and analysis decisions to avoid duplication of effort. The air quality analysis will compare predicted impacts on all applicable local, state, and federal air quality standards and increments and impacts on air quality-related values (AQRVs), as well as other scientifically defensible significance thresholds such as incremental cancer risks.”		
29.	2-21	ROP 7, Paragraph g.	FWS – BAWR (Allen and Collins)	Replace the beginning of the sentence with: “If ambient air monitoring indicates that project-related emissions cause or contribute to impacts or cause unnecessary or undue degradation of the lands, cause exceedances or NAAQS or AQRVs or fail to protect health. . .”		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
30.	2-22	I	Matz/FWS	Add, "including human health or public health tribal, state, or federal agencies" after "appropriate entities."		
31.	2-22	ROP 10	Latty-Swem/FWS	Objective should read "Maintain .... and adequate habitat for fish, birds, and aquatic invertebrates." This change is intended to reflect that shorebirds and some passerines also rely on habitats and soils surrounding lakes and ponds (in addition to waterfowl, which is the only category of birds currently mentioned and associated with these habitats).		
32.	2-22	ROP 8	Carl/FWS	Recommend rewording to state that "...the BLM Authorized Officer <u>shall</u> require changes in the operator's processes to reduce or eliminate emissions of the contaminant"		
33.	2-22	ROP 9	Burkart/FWS	Add Springs to ROP 9.		
34.	2-22	ROP 9, objective	Burkart/FWS	The objective for streams and rivers should be more specific and parallel that for lakes and ponds (e.g. ROP 10). Change the following objective: "Maintain populations of, and adequate habitat for, fish and invertebrates." TO THE FOLLOWING: Maintain natural hydrologic regimes and populations of, and adequate habitat for, fish, and aquatic invertebrates,		
35.	2-22	ROP 10	Burkart/FWS	There are no requirements for determining fish presence prior to activities that could impact fish. Add the following requirement: Sensitive and nonsensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.		
36.	2-23	ROP 11	Putnam/FWS	Recommend that Requirement/Standard for Alternative D be used for all Alternatives. For polar bears, the standards described in the Alternative D, ROP 11, parts c and d are consistent with what will likely be required in any MMPA incidental take authorization.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
37.	2-23	ROP 11 for Alt D	R. Wilson/FWS	Requirements/Standard b should include a clause something like, "... by the BLM Authorized Officer and consistent with Incidental Take Regulations and Letters of Authorization issued by the USFWS as part of MMPA regulations' This issue cannot be solely addressed by the BLM, because it stems from the Service's authority under the MMPA.		
38.	2-23	ROP 11, Req. a	S. Arthur/FWS	FWS is unclear if ADFG would be similarly responsible for grizzly bear den detection in the Arctic Refuge, as it done in NPRA. Because grizzly dens excavated into the ground are not typically detected by FLIR used to find polar bears which den in snow, they would require additional effort to find.		
39.	2-24	ROP 12	Loya/FWS	Language in b. was found to be confusing by reviewers. Recommended revision of "note" for both alternatives:  b. Low-ground-pressure vehicles would be used for on-the-ground activities off ice roads or pads. Low-ground-pressure vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra by shearing, scraping, or excessively compacting the tundra mat. Note: Heavy equipment required for ice road construction would be allowed and required to be operated in a manner that eliminates direct impacts on the tundra.		
40.	2-24	ROP 12, Alt B & C	Leonard/FWS	Suggest adding (e): Seismic operations and winter overland travel may be monitored by agency representatives and the operator would be required to accommodate the representatives during operations.		
41.	2-24	ROP 12, Alt B and C	JRose/FWS	Requirement/Standard "a" is nebulous. What are "sufficient depths" and who determines it. Recommend amending first sentence to read "...protect the tundra as determined by the authorizing official."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
42.	2-24	ROP 12, Alt D: (a)	Leonard/FWS	Remove 'highest' and replace: 'over the tussock tops'. This will be an interpreted standard and this language will better reflect the intent of the standard. Because snow densification increases throughout the winter, the standard will become easier to meet as the winter progresses.		
43.	2-25	Alt D: (g)	Leonard/FWS	Recommended wording change: Seismic operations and winter overland travel may be monitored by agency representatives and the operator is required to accommodate the representatives during operations.		
44.	2-26	ROP 17	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt B and C.		
45.	2-26	ROP 19	Reed/FWS	Use consistent language about recreationists and subtypes. Compare to F I ROP language for "...recreationists of the area, including sport hunters and anglers." Specify transportation infrastructure would be closed to non-subsistence public users.		
46.	2-26	ROP 19	Carl/FWS	Under "Facility Design and Construction," this is the first reference to any requirement to protect subsistence use and access. We believe it is currently required for all stages, including seismic, and recommend it be stated to be required throughout the entire process.		
47.	2-27	ROP 21 & 22	Reed/FWS	End both <u>objective</u> sentences with "...anadromous fish, protect subsistence use and access to subsistence hunting and fishing, and opportunities for primitive recreationists of the area, including sport hunters and anglers."		
48.	2-27	ROP 23	JRose/FWS	Requirements/Standards for all alternatives should be the same.		
49.	2-28	ROP 23	JFox/FWS	Incorporate language in Alternative D f. and g. into Alternative C to meet all Refuge purposes.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
50.	2-29	ROP 26	Burkart/FWS	There is a need for mining restoration plans. Add the following requirement to each alternative: Each proposed mine site shall have a USFWS-approved restoration plan and effectiveness monitoring plan prior to site approval and construction. Restoration effectiveness monitoring shall continue for ten years following completion of restoration.		
51.	2-29	ROP 27	Loya/FWS	This ROP should be the same across all alternatives, using language from Alt D. The difference is under 'b.' which prohibits allowing wildlife access to human food or odor-emitting waste. Engaging in conduct that attracts bears to human food and garbage is illegal under 5 AAC 92.230(a)(1). Bears conditioned to human food and food odors would prove fatal for hunters and recreationalists.		
52.	2-29	ROP 27	Swem/FWS	ROP 27: Objective should read "Avoid human-caused changes in predator populations" rather than "Minimize changes in predator populations." While completely avoiding changes is admittedly an impossible standard, this is the objective and the higher standard is an appropriate objective, whereas "minimizing" is subjective and concedes significant failure before the effort is even made. And, Requirement/Standard b for both Alt B/C and D should include "Feeding of wildlife and allowing wildlife to access human food or odor-emitting waste is prohibited."		
53.	2-3	3	JFox/FWS	Do you mean to say "would" or "could" here? As written, this implies that all stipulations would be permanently exempted, exempted on a one-time basis, or changed.		
54.	2-31	ROP E-12	Swem/FWS	Was this accidentally called a "Required Operating Practice" rather than a "Procedure?"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
55.	2-31	ROP E-14	Randy Brown/FWS	ROPs 24b and E-14 are redundant with regards to fish passage guidelines. Recommend either removing E-14 or revising E-14 to reflect contemporary fish passage recommendations presented in ROP 24b, which would then state: To ensure that crossings provide for fish passage, all proposed crossing designs would adhere to the best management practices outlined in Fish Passage Design Guidelines, developed by the USFWS Alaska Fish Passage Program (June 29, 2018), Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (US Forest Service 2008) and other generally accepted best management procedures prescribed by the BLM Authorized Officer and the USFWS.		
56.	2-32	ROP E-15	Loya/FWS	Cliff-nesting raptors are scarce in the program area. Recommend revising to state: a. Removing greater than 100 cubic yards of bedrock outcrops, sand, or gravel from cliffs displaying evidence of raptor nests would be prohibited.		
57.	2-32	ROP E-17	Swem/FWS	The dates for restrictions associated with this ROP can be changed to June 1 through July 31 to reflect FWS efforts to ensure consistency in the restrictions and better reflect improved information on hatching dates across the North Slope. (This change will relax the requirement/standard).		
58.	2-33	F-I Req/Std d	Reed/FWS	End sentence with "...moose hunting) <i>and when recreationists are present.</i> "		
59.	2-33	ROP F-I	Reed/FWS	Throughout: use consistent language about recreationists and subtypes throughout Stips/ROPS Requirements and Standards or specify why not consistent.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
60.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part f states that "hazing wildlife by aircraft is prohibited." The use of helicopters to haze polar bears is an approved method of hazing polar bears under certain circumstances and with appropriate training and MMPA authorization. Recommend adding something like "...unless otherwise authorized...", or something like that, to allow for the use of this method.		
61.	2-33	ROP F-I	Putnam/FWS	Requirement/Standard, part g. Recommend adding "and 0.5 miles horizontal distance" after "1,500 AGL feet". This is what will likely be required in MMPA incidental take authorizations.		
62.	2-34	ROP G-I	Berendzen/ FWS	ROP G-I for Alternatives B & C are inadequate for meeting refuge purposes – the standards in Alt D are more protective. All Alternatives should ensure that reclamation result in Wilderness eligibility.		
63.	2-34	ROP G-I	JRose/FWS	The Presidential Recommendation for Designation as Wilderness still stands. Suggest amending Requirement/Standard to read "...restoration of ecosystem function and meet minimal standards for eligibility of Wilderness designation.		
64.	2-34	ROP G-I	JRose/FWS	In Alternative D Wilderness should be capitalized		
65.	2-34	ROP G-I Req/Std b	Reed/FWS	Change "...habitat condition, and wilderness eligibility." to "...habitat condition, wild and scenic river eligibility/suitability, and wilderness eligibility."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
66.	2-34 & 35	ROP H-1, H-2	Carl/FWS	ROP H-1.a. and b. and H-2.e. for all alternatives, the DEIS references "North Slope and Eastern Interior Subsistence Advisory Panels" or "North Slope and Eastern Interior Subsistence Advisory Councils." We believe you are referring to the FACA-charted Federal Subsistence Regional Advisory Councils created under Section 805 of ANILCA, and the correct names are "North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils." These groups meet through publicly-noticed meetings. These meetings are held in February-March and August-November. As such, the timing of such coordination must take into account those schedules.		
67.	2-36	H-2	Carl/FWS	For the H-2 Required Operating Procedures, the Objective notes: "Prevent unreasonable conflicts ..." It is unclear how "unreasonable" defined; more specific language may help to resolve future conflicts.		
68.	2-37	H-3 ROP	Putnam/FWS	This Requirement/Standard is good, appropriate, and necessary. Recommend keeping this for all Alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
69.	2-39	General Wildlife Protection	Latty-Swem/FWS	<p>The number of helicopter take-offs and landings that may occur associated with permitted activities in the program area may be substantial, but is currently not addressed. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates from the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different sites. Depending on the type of activity and its duration associated with these take-offs and landings, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information)</p> <p>Because the number of potential take-offs and landings at unimproved sites during summer is large and may affect the productivity of breeding birds, please consider adding a Required Operating Procedure to minimize negative impacts to productivity.</p> <p>For example, please consider adding a ROP with an Objective to minimize the disturbance to breeding birds on the Coastal Plain, and a Requirement/Standard that includes a timing restriction on aircraft take-offs and landings at unimproved sites to avoid the nesting season except when doing so would impact the purpose of the approved project.</p>		
70.	2-39	ROP M-2	JohnT/FWS	Invasive Species add additional ROP to address rodent introduction from barge traffic.		
71.	2-4	Table 2-2 LS I	JohnT/FWS	Terminology: active flood plain, bank, and ordinary high water mark are used interchangeably. This comment may apply throughout the document.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
72.	2-4	Table 2-2 and throughout document	Reed/FWS	Change spelling from Aichilak to Aichilik throughout document		
73.	2-5	LS 2	Loya/FWS	Lakes are a unique habitat within the Arctic Refuge given their scarcity, especially in comparison to NPRA. Thus, lakes may serve as irreplaceable habitat for avian and aquatic species, especially in the biological productive area around the Canning River. Requiring a 0.5 mi buffer is a common BMP in the NPRA IAP for protecting wildlife and habitat. This includes the minimum river setbacks (K-1); Brant nests (K4b); caribou approaching a road crossing (K5a, K12); Grizzly bear dens (C-1) and Raptor nests (C-2, F-1). Therefore, we recommend that the LS 2 for Alt D-Canning River Delta and Lakes be applied across all alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
74.	2-5	LS 3	Loya/FWS	<p>Springs and aufeis create unique habitats within the Arctic Refuge in both summer and winter. Therefore, we recommend that the LS 3 for Alt D Springs/Aufeis requiring studies be included under all alternatives. Recommend adding the following to Alt B and C:</p> <p>Objective: Protect the water quality, quantity, and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the Coastal Plain. River systems with springs provide year-round habitat and host the most diverse and largest populations of fish, aquatic invertebrates, and wildlife; they are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs. It helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could be disturbed by drilling or fracking, use buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.</p> <p>Requirement/Standard:</p> <p>a. Before drilling, the lessee/operator/permittee would conduct studies in areas containing springs to ensure subsequent drilling activities would not disrupt flow of the perennial springs, unless such studies have already been completed. Study plans would be developed in consultation with the BLM and USFWS and other agencies, as appropriate.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

75.	2-6	LS 3	Loya/FWS	<p>It was not the intent of LS 3b. to restrict leasing or have NSO below springs. The language in the DEIS suggests these restriction by the use of "Within 3 miles of or above ... ." We recommend revising to state:</p> <p>i. No leasing and no new non-subsistence infrastructure will be permitted within 3 miles adjacent to or above Sadlerochit Spring (04N031E) nor within a 1 mile buffer below the spring to where it enters the Saddlerochit river and along the aufeis formation (04N031E &amp; 05N031E). This spring supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer providing insect relief habitat for caribou.</p> <p>ii. No leasing will be permitted within 3 miles adjacent to or above the perennial spring at Fish Hole 1 on the Hulahula River (05N032E). Further, no new non-subsistence infrastructure within 4 miles of the perennial spring at Fish Hole 1 on the Hulahula River (05N032E) per LS 1, nor within 1 mile of the aufeis field (05N032E &amp; 06N032E). The Fish Hole 1 spring provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer.</p> <p>iii. No leasing will be permitted within 3 miles adjacent to or above the perennial Tamayariak Spring, and no new non-subsistence infrastructure will be permitted within 1 mile of the associated aufeis field (07N026E).</p> <p>iv. No leasing will be permitted within 3 miles adjacent to or above the perennial Okerokavik Spring (04N036E), and no new non-subsistence infrastructure</p>		
-----	-----	------	----------	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				will be permitted within 1 mile of the associated aufeis field in the Jago River drainage (05N035E & 05N036E).		
76.	2-7	5	Loya/FWS	Stipulation 5 about Polar Bear denning critical habitat. This isn't just about protecting the bears, but protecting humans from interactions with bears. Alternative C could include this stipulation for at least 3-4 miles, and perhaps bears would deflect to stay within that closer area more often.		
77.	2-7	First 3-4 lines of Lease stip 7, Requirement/Standard for Alt D	R. Wilson/FWS	This statement '... between May 15 and November 1 or when sea ice is within 10 miles of the coast each season, whichever is later.' should actually be '... between May 15 and November 1 or when sea ice extent (as defined by Fetterer et al. 2017) is beyond 10 miles of the coast each season, whichever is later.' As written, it would imply that when sea ice in right up on shore in December that exploration could not occur. The intent is to say that when ice has retreated from shore, and is beyond a distance that may cause physical distress for bears to swim, activity should cease because bears are likely to be on shore for the summer/autumn. Here is the citation for the sea ice extent data: Fetterer, F., K. Knowles, W. Meier, M. Savoie, and A. K. Windnagel. 2017, updated daily. Sea Ice Index, Version 3. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. doi: <a href="https://doi.org/10.7265/N5K072F8">https://doi.org/10.7265/N5K072F8</a> .		
78.	2-9	LS 6	Loya/FWS	Delete the following sentence at the end of the paragraph on this page last line of the stipulation for Alt D:  The intent of this requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of oilfields in the region.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
79.	3-1	13	Leonard/FWS	Reference to Chapter 4, Cumulative Effects. There is not a Chapter 4. It appears each section in Chapter 3 deals with all the alternatives within each subject. Remove reference to Chapter 4 and clarify reference to Cumulative Effects.		
80.	3-1	25	Leonard/FWS	Reference the 30 yr average as the definition of climate.		
81.	3-105	27	R. Wilson/FWS	Not a valid assumption that all grizzly dens would be detected during den surveys. I would omit “, assuming all such dens are located on those surveys” and replace with ‘, although complete detection of dens is unlikely (Amstrup et al. 2004).’		
82.	3-108	21	S. Arthur/FWS	Revise sentence as: “areas adjacent to the PCH calving grounds contain less high-quality forage and higher predator densities, and exhibit more topographic relief than do the current PCH calving grounds...”		
83.	3-108	3	Crane/FWS	The citation in this line is incorrect (Boulanger et al 2020).		
84.	3-110	26	Matz/FWS	Add this sentence, “Dust generated during creation of and travel on gravel roads may contaminate roadside vegetation, upon which mammals forage.”		
85.	3-110	28-31	Loya/FWS	Recommend expanding the description of seismic activity, and clearly identifying and quantifying impacts.		
86.	3-110	37	S. Arthur/FWS	Citation of Wilson et al. (2012) refers to the TCH, not the PCH		
87.	3-111	25	S. Arthur/FWS	Revise as: “defines the time period as the caribou calving season” rather than “when caribou are present”. As stated on line 26, caribou are present in this area well past June 15.		
88.	3-111	37	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
89.	3-112	17-20	R. Wilson/FWS	It is inconsistent to say that seismic won't be able to occur in areas off limits to leasing when it's scheduled to happen this winter, before a record of decision. This text should be modified to say something to the effect of "following area-wide seismic expected to be conducted prior to the implementation of this plan, future seismic would not occur in areas off limits to leasing."		
90.	3-112	19	Loya/FWS	"Southwestern" should be changed to 'southeastern' if referring the calving area		
91.	3-113	14	S. Arthur/FWS	Table H-5 says 100 acres would have no restrictions, not 1,000. Which is correct?		
92.	3-113	39	S. Arthur/FWS	Delete "activity"		
93.	3-114	1-2	S. Arthur/FWS	Sentence does not make sense. Revise as "Alternative D would also prohibit ...." (beginning on previous page)		
94.	3-114	6	S. Arthur/FWS	Revise "3 mil" as "3 miles"		
95.	3-115	40	S. Arthur/FWS	Revise "documents" as "documented"		
96.	3-116	Table 3.3.5-I	Matz/FWS	Under Potential Effects for "Gravel and Pipeline Infrastructure," add "Contamination of roadside forage due to dust."		
97.	3-117	10	S. Arthur/FWS	Citation should be "Griffith" rather than "Griffiths"		
98.	3-117	13	S. Arthur/FWS	Revise sentence beginning "Additional oil development..." as: "Infrastructure constructed to support development within the program area is likely to facilitate additional oil development west of the program area, which will increase exposure of CAH caribou to development. This could alter their behavior and movements..."		
99.	3-117	Table 3.3.5-I	S. Arthur/FWS	Effect type for Gravel Mine should be "Adverse" rather than "Low"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
100.	3-118	26	Hamilton/FWS	The worldwide population of polar bears should be updated to reflect Regehr et al. Following is copied from IUCN Report - The total number of polar bears worldwide is estimated to be 26,000 (95% CI=22,000–31,000; Regehr et al. 2016)		
101.	3-119	23	Crane/FWS	There are more recent stock assessments for polar bears than 2010. The most recent one is from 2017 and has an estimate of ~ 900 bears. Recommend updating this section.		
102.	3-119	L1-6	R. Wilson/FWS	Need to state that only the SBS stock is being considered for this analysis. Suggest something like the following: "... thus, the program area is in the core activity area of the SBS and the below analyses only consider impacts to the SBS stock"		
103.	3-12	36	FWS – BAWR (Allen and Collins)	Cumulative Impacts Section – The FWS BAWR continues to not recommend a qualitative approach to addressing these air impact concerns. Appropriate time and resources needed to be allocated after the delivery of the Reasonably Foreseeable Development (RFD) documentation for quantitative analysis (project and cumulative level) to be conducted.		
104.	3-12	6	Matz/FWS	Change to: "Collect baseline ambient air data for a time period sufficient to support air quality modeling to analyze direct, indirect, and cumulative impacts (typically, one year) prior to...."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
105.	3-120	11-18	R. Wilson/FWS	If this section is only talking about all polar bears in the US, then also need to include text about the Bilateral Agreement with Russia, the I-I (native-native agreement) between natives in the US and Canada, and a MOU between the US and Canada, signed by the Sec of the Interior. If only referring to the SBS stock, then only the later 2 need to be mentioned. For the first, updated text could be "Polar bears in the Chukchi Sea stock are managed bilaterally with Russia under the Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska—Chukotka Polar Bear Population. The Inupiat-Inuvialuit Agreement is a Native to Native Agreement between the U.S. and Canada for managing the harvest of bears in the SBS stock. It is a voluntary agreement. Finally, the Memorandum of Understanding between Environment Canada and the United States Department of the Interior Concerning the Conservation and Management of Shared Polar Bear Populations enhances the coordination between the U.S. and Canada on the conservation and management of polar bears in the SBS stock."		
106.	3-120	8	Crane/FWS	The existing ITRs for the Beaufort Sea do not cover the program area. Recommend correcting this statement to clarify that new ITRs will need to be developed to address take of polar bears in the program area.		
107.	3-121	12	R. Wilson/FWS	I would change this sentence to read as follows because all age/sex classes are represented on shore: "... besides denning females, adult females with and without cubs, sub adults, and adult males all come ashore."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
108.	3-121, 3-122	39; 1	R. Wilson/FWS	Herreman and Peacock 2013 did not study the Kaktovik Bone pile, or estimate the number of bears using it. It was the bone pile at Point Barrow. They also didn't claim that at least 15% of the SBS used it, but that it could represent 15% of the SBS stock if they all were from the SBS stock, which is unlikely given the large overlap in that area between the CS and SBS stocks. The dissertation by Lillie (2018), however, does provide an estimate of bone pile use in Kaktovik. So, you could include the following text: "As many as 146 (SE=21) bears from the SBS stock were estimated to have used the bone pile in Kaktovik in 2012 based on hair-snare data." Here is the link to the dissertation <a href="https://digitalcommons.usu.edu/etd/7252">https://digitalcommons.usu.edu/etd/7252</a>		
109.	3-123	18-19	R. Wilson/FWS	This citation (Amstrup 2003a) is too outdated to make this statement. Should probably cite Atwood et al. (2016) and statement something like "Up to 37% of adult females have been estimated to use land in the summer, spending an average of 56 days on shore. Given that adult males and sub-adult animals are not able to be collared to track their movements, it's unclear what proportion of those bears use land. However, it is clear that they also use land in the summer and autumn (Miller et al. 2015)"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
110.	3-127	L2-4	R. Wilson/FWS	While it might be true that the amount of critical barrier island habitat present in the 1002 area is only a small proportion available to bears, it does receive a disproportionate amount of use compared to most of the other barrier islands. Thus, the statement is misleading. Add an additional sentence at the end stating that, "Even though the overall proportion of critical barrier island habitat potentially affected is not large in the 1002 area, it does receive a disproportionately high level of use (Wilson et al. 2017) and thus if it were to be affected by program-related activities, it could have a larger impact on bears than indicated based on the proportion of the total amount it represents"		
111.	3-128	32-33	R. Wilson/FWS	It is inaccurate to say that all three alternatives would lead to similar levels of disturbance and displacement. Alt D provides protection for a significant proportion of important denning habitat, which would lead to significantly less potential for disturbance than Alt B, for instance.		
112.	3-13 to 3-14	42& 43 1 & 2	FWS – BAWR (Allen and Collins)	The conclusion that these air impacts are cumulative and are not project is incorrect. Suggested language: "Cumulative visibility impacts and deposition levels for all sources included in the BOEM analysis were above thresholds, and warrant additional quantitative (project and cumulative level) analysis." - Delete the rest of the sentence from "often" to "... "of all sources."		
113.	3-130	41	Crane/FWS	While the current statement is correct regarding population level effects to polar bears, those analyses were based on activities occurring in NPRA and there being no industrial activity in Arctic National Wildlife Refuge, where the habitat is used by a greater proportion of the SBS polar bear population. Recommend clarifying this statement to reflect this detail.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
114.	3-131	26-27	R. Wilson/FWS	It is highly unlikely that the assumption that all dens will be detected by pre-construction den surveys. Under a best-case scenario, where FLIR was used to attempt to detect known dens, Amstrup et al. (2004) only successfully detected 62% of dens after a single FLIR survey. It is likely that this value would be considerably lower when den locations are not previously know. This assumption is not valid.		
115.	3-134	35	Crane/FWS	According to NMFS, past exploration activities have resulted in the death of at least one seal due to a lair being crushed. Recommend coordinating with NMFS for additional details and updating this section as appropriate.		
116.	3-134	4-6	R. Wilson/FWS	It is inaccurate to state that the only type of marine program-related spill that could occur is related to marine vessels. It appears that Alternatives B and C would allow for some development on coastal islands or waters and, if that is the case, we recommend that the potential for an underwater pipeline release should be considered.		
117.	3-136	L	R. Wilson/FWS	Should be changed to '... and as maternal females search for den locations in autumn and leave dens with dependent young in late winter'		
118.	3-14	21-28	Loya/FWS/FWS	It is insufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents and search for information. If DEIS is used, then provide further information such as Chapter and/or page numbers.		
119.	3-140	24	Crane/FWS	There are no current ITRs that cover the program area. Recommend correcting this statement to reflect this detail.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
120.	3-141	30	Crane/FWS	Recommend deleting the sentence that begins "Compared with climate change..." as the effects analysis should not discount nor attempt to justify the adverse effects of the action on natural resources by comparing it to other adverse actions or activities that may occur in the area.		
121.	3-143	10-11	Berendzen/FWS	Unclear what "Of the remaining surface area, 99 percent (138,700 acres) is water" is referring to? Suggests that it would be lagoon waters, but those inside the refuge are administered by FWS. KIC lands are not 99% water??		
122.	3-143	21	Berendzen/FWS	Only aware of one airport. Old Air Force runway is no longer used		
123.	3-145	13-15	Berendzen/FWS	Inaccurate statement - Kaktovik is bordered on south by KIC lands		
124.	3-147	36	LaKonski/FWS	After the sentence ending with "...a 20-mile tractor trail.", I recommend either adding the following sentence (or add as a footnote): "The RS 2477 trails have been identified and asserted by the State of Alaska, but the validity of all RS 2477 trails must be determined either via a determination of perfection prior to FLPMA or through appropriate judicial proceedings.".		
125.	3-153	24	DeCleva/USFWS	Insert "documented" before "cultural resources"		
126.	3-154	6	DeCleva/USFWS	Insert "documented" before "cultural resources"		
127.	3-155	11	Carl/FWS	Please change "are transported" to "migrate."		
128.	3-155	13	Carl/FWS	In reference to the term "contemporary uses." The correct standard under Title VIII is whether the community has an established customary and traditional use. Recommend changing to reflect the correct standard.		
129.	3-156	28	JReam/FWS	It would be helpful to know the actual number of respondents as "all respondents" could indicate a single household.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
130.	3-156	3	JReam/FWS	ANILCA lists one additional element of subsistence that should be included in this line – traditional. It may be inherently part of “cultural” but I would suggest that the sentence be consistent with the legislation.		
131.	3-156	32-33	Carl/FWS	List of terrestrial mammals for residents of Kaktovik should include musk ox. See 50 C.F.R. §100.24(a)(1).		
132.	3-156	4/5	JReam/FWS	I would restructure the sentence a bit and mention explicitly that, concerning the harvest of fish and wildlife, corporation owned land is managed by the State.		
133.	3-156	7	Carl/FWS	This sentence asserts that private lands within the program area are subject to federal subsistence regulations, which is not consistent with 50 C.F.R. §100.4 (definition of “public lands”).		
134.	3-157	26/27	JReam/FWS	Define a “core species”		
135.	3-158	1-2	JReam/FWS	The use of the terms “material” and “cultural” in this sentence and the associated table (J-6) to be awkward. Perhaps “Harvest Contribution (Usable Weigh)” could replace “Material Importance.” I do not think it is appropriate to measure “cultural importance” simply by analyzing % of households trying to harvest and those receiving a given resource. Sure, these can be indicators, but what happens when a resource is scarce, regulations hinder harvest attempts, and sharing is minimal due to unforeseen challenges? Suggest changing the reference to something like “Effort and Sharing Indices.” Same in each community section. Alternatively, we could qualify “importance” as “nutritional importance.”		
136.	3-158	17	JReam/FWS	This should read “for the most recent period [in which information is available]”		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
137.	3-162	11	Carl/FWS	Recommend that the analysis include communities in Canada that rely on the PCH for customary and traditional uses. We recommend that the analysis include those communities in order to "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd by ... in Yukon and Northwest Territories, Native users as defined ..." Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd, Section 2(b)(2). See also id. at Section 3(b) ("The Parties will ensure that the Porcupine Caribou Herd, its habitat and the interests of users of Porcupine Caribou are given effective consideration in evaluating proposed activities within the range of the Herd.") and Section 3(g) ("When evaluating the environmental consequences of a proposed activity, the Parties will consider and analyze potential impacts, including cumulative impacts, to the Porcupine Caribou Herd, its habitat and affected users of Porcupine Caribou."). Additionally, the Federal Subsistence Board has recognized the customary and traditional use of caribou in Unit 26C by the residents of Point Hope, see 50 C.F.R. §100.24(a)(1), who are omitted from this analysis.		
138.	3-163	13-14	Carl/FWS	It is not sufficient to defer analysis because "project details are uncertain or unknown." The RFDS should be used as quantitatively as possible. This, along with known impacts of other similar activities on the North Slope, can inform a more thorough analysis.		
139.	3-163	26	Carl/FWS	Recommend including: (1) impacts to, including loss of habitat and related impacts to subsistence resources, and (2) deflection of migratory species that are relied upon for subsistence.		
140.	3-163	32	Carl/FWS	Please define "short term"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
141.	3-163	35	Carl/FWS	Change "have the potential" to "will," as there is enough data to know for certain that impacts will occur. The only uncertainty is the degree of impact.		
142.	3-164	17	Carl/FWS	Change "may result" to "will result," as there is enough data to know for certain that these activities will occur in connection with oil and gas exploration, leasing, development and production.		
143.	3-164	27	Carl/FWS	After reference to traditional knowledge, add that biological science shows that marine mammals are sensitive to such disturbance. That is why CAAs are required for all oil and gas offshore operations during marine mammal migratory seasons.		
144.	3-165	39-40	Carl/FWS	Recommend revising this sentence, as it is both infrastructure and development activity which causes hunter avoidance. Please delete "...during subsistence harvesting times." Recommended rewording: ...and would likely occur for some Kaktovik harversers if development occurs within their harvesting area."		
145.	3-166	2	JReam/FWS	I would posit that "simply dislike the experience" has a connotation of being "minimal". Perhaps consider "noise pollution and increased human activity may be considered to degrade the subsistence experience."		
146.	3-166	24	Carl/FWS	Recommend changing "could pose" to "will pose"		
147.	3-166	39-40	Carl/FWS	How many residents of the villages have either an ATV or snowmachine? Recommend quantifying this in order to justify including this as a benefit.		
148.	3-166	4	Carl/FWS	Change "could include" to "would include." These types of infrastructure are guaranteed with oil and gas operations.		
149.	3-167	3	Crane/FWS	Impacts of increased access to the area via corridor built to support oil and gas development also include an increase in the likelihood of illegal harvest. Recommend addressing this in the effects analysis.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
150.	3-167	42	Carl/FWS	The assertion that oil spills "would be largely contained" is unsupported and fails to recognize the remoteness and difference in the water regimes in the Coastal Plain compared to the Prudhoe Bay area. There are significantly more river systems in the Coastal Plain by comparison (most water in the Prudhoe Bay industrial area is ponds), and such rivers would not provide for containment of an oil spill. During break-up and associated sheetflow, spills would not be contained.		
151.	3-167	5	JReam/FWS	Another important impact to consider is how project roads could facilitate increased access by non-local hunters and recreational users (resulting in increased competition), especially if project roads connect to statewide road systems, either now or in the future. This fear is commonly voiced at subsistence regional advisory council meetings.		
152.	3-168	12	Carl/FWS	Change "could result" to "will result."		
153.	3-168	22-32	Crane/FWS	Recommend providing further discussion on what is meant by the phrase "Reduced user access and resource availability". For example, does this equal less subsistence food, more food costs, changes in diet, loss of culture, etc.		
154.	3-168	32	Carl/FWS	Please clarify who will provide the "dividends" referred to, and how many residents of what communities will receive such dividends. If there are revenue projections that suggest such dividends will be issued, that should be included.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
155.	3-169	11-13	Joshua Rose/USFWS	It is unclear how "an increase in employment rates or income" will impact "user access". Does this mean more individuals will have money to buy materials needed to access subsistence resources, won't be able to get in and out of the villages because more people will be using the limited flights in and out of communities, they won't have time to access subsistence resources because they will be working? Need to clarify what this means.		
156.	3-169	24-25	Joshua Rose/USFWS	Clarify "timing restrictions on human activity". Does this apply to oil and gas activity, subsistence, all human activity? If this applies to subsistence access there will be greater restrictions than just "timing" once infrastructure is in place.		
157.	3-17; 3-18	30-40; 1-21	Loya/FWS	Noise disturbance from construction and aircraft to humans and wildlife are of great concern to communities across the Arctic. The DEIS does not adequately analyze or attempt to quantify the level of activity and how it will vary across alternatives. An estimate should be provided of annual activity and the acres or proportion of the area that would be affected by noise. Further, the DEIS largely considers Kaktovik Airport to be the hub of aircraft disturbance and does not adequately consider air traffic coming from Prudhoe Bay or other sites on the Dalton highway with airstrips. Further, the DEIS does not account for the impacts associated with support activities, such as surveys, stick-picking and research, much of which is done by helicopters which have been used only rarely under current management. The DEIS should reference the aviation data collected by BLM for landings in NPRA as an example/analog for activity (e.g. ~10,000 landings in 2018) and describe where it is likely to occur under each alternative.		
158.	3-170	15	Carl/FWS	Please change "which could" to "which will"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
159.	3-170	33	Carl/FWS	Change "would lead" to "will," as, by definition, creating an entirely new area for oil and gas activity will further expand oil and gas development in the North Slope.		
160.	3-170	38-39	Carl/FWS	Describe in detail exactly how increased income will help offset impacts to subsistence resources, both in the short term and the long term.		
161.	3-172	11	Carl/FWS	Change "1970 passage" to "1971 passage."		
162.	3-173	21	Crane/FWS	Recommend clarifying what permit authority the EIS is referring to for the FWS, possibly by referencing Appendix D.		
163.	3-174	32	Carl/FWS	Add additional sentence at the end: "As such, those communities do not receive any financial benefit associated with resource development or shares therein by ANCSA corporations."		
164.	3-176	21	Carl/FWS	Recommend changing "may make these" to "will make these," as there is no question as to the impact; the only question is degree.		
165.	3-176	22	Carl/FWS	Recommend changing "wherewithal" to "capacity" or "ability."		
166.	3-178	34-35	Carl/FWS	Recommend changing "has the potential to" to "will likely," as there is no question that it will affect sociocultural systems – this analysis clearly states that. The only question is degree.		
167.	3-179	15	Carl/FWS	This is a general comment on the section starting on this line, this page. There is no indication as to the amount or quality of local employment resulting from oil and gas development in this area. Consider both the short-term and long-term effects (e.g. James, A. 2016. The long-run vanity of Prudhoe Bay. Resources Policy 50: 270-275.		
168.	3-179	36	Carl/FWS	Recommend the DEIS specify by percentage how many super-harvester households also have high income, in order to weigh the merits of this statement.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
169.	3-18 to 3-20		Jorgenson/FWS	The descriptions of the program area should be rewritten using the map in Nowacki et al. 2001. It is a newer, more detailed map than the one used. The two maps differ greatly in the program area.		
170.	3-180	3	Carl/FWS	Previously, text indicates that "many" super-harvesters are high income earners, and here it asserts that they are "often." Be consistent with terminology, as one word indicates number, the other frequency.		
171.	3-181	31	JReam/FWS	Decreased use of certain traditional areas may be influenced by more than resource availability and user access changes – consider how noise, human activity, and competition effect a meaningful subsistence "experience."		
172.	3-186	15	JReam/FWS	I would add "subsistence resources [and their uses]" to encapsulate that subsistence values are broader than the availability of resources for nutritional purposes.		
173.	3-188	16	Carl/FWS	Recommend changing "could" to "will" as it is not a question of if, but to what degree.		
174.	3-188	27	Carl/FWS	Insert the word "adverse" in between "lasting" and "effects."		
175.	3-188	42	Carl/FWS	Recommend quantifying the expected revenue that will accrue, and the basis for the estimate. The estimate provided during the discussion of the Tax Act was not in accord with recent comparable oil and gas lease sales in the NPR-A.		
176.	3-188	8-9	Carl/FWS	Suggest rewording "Potential adverse economic impacts are identified, and potential localized beneficial...." The loss of subsistence resources, and thus increased reliance upon store-bought foods and a cash economy would be a significant adverse economic impact.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
177.	3-189	10-11	Carl/FWS	The history of oil and gas operations reflects that there are potential contamination sources for subsistence foods beyond just oil spills. This should be thoroughly acknowledged and detailed.		
178.	3-189	11	Matz/FWS	Change sentence to read, "...with the possible exception of contamination through an oil spill or through contaminants mobilized through erosion or permafrost degradation."		
179.	3-189	18-19	Carl/FWS	"Until site-specific development activities are proposed, the extent of this effect is not possible to determine." We suggest that analysis can be done of the likely effects if activities were to occur near those areas, given known impacts of such activities elsewhere in the North Slope area. Recommend completing analysis of likely effects should development occur near the areas listed in line 17 using known impacts of such activities in the North Slope area.		
180.	3-189	28	Carl/FWS	Rationale needed for how and why there is going to be an increased level of recreation use in the program area under all alternatives.		
181.	3-19	18-36	Loya/FWS	Recommend revising permafrost text to reflect updated information available in Jorgenson et al. 2015. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
182.	3-19	34 - 36	Jorgenson/FWS	Delete last sentence in this paragraph. The systematic field sample described in Jorgenson et al. 1994 (and a number of other data sets) shows that low-centered polygons are in the minority in the program area; polygons with centers that are drier than the edges (flat centered polygons) are much more common. Low-centered polygons occur in very wet tundra, which is more common west of the refuge than in the refuge.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
183.	3-19	9-17	Loya/FWS	<p>This section is largely duplicated in Section 3.2.8 and could be combined. Text references language (Teshekpuk (1a) and White Hills (1b)) not depicted in Map 3-1 and inconsistent with section 3.2.8 Soil Resources. Map 3-1 uses Coastal Plain, Foothills and Arctic Mountains, as does 3.2.8. Recommended revising this section to be more concise and updated. According to the map included in the DEIS, the majority of the program area is considered to be coastal plain physiography (Map3-1), characterized by relatively flat lowlands with scattered lakes. However, due to the proximity of the Brooks Range to the coast in the eastern end of the Alaskan Arctic, large alluvial fans extend into the program area creating upland terrain with moderate slopes which can extend to the coast, especially south of Camden Bay (Jorgenson et al. 2015). It is misleading to suggest all of the area show in Map3-1 is similar to the coastal plain described as Teshekpuk by Wahrhaftig 1965.</p> <p>Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC.</p> <p><a href="https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a>.</p>		
184.	3-190	12-13	Carl/FWS	We appreciate the acknowledgement of potential impacts on the belief systems, cultural identity, and sacred site of calving grounds. Please explain how these impacts are measured and how they vary across the alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
185.	3-190	25	Carl/FWS	Recommend that "potentially" be removed from this line. Reduction in harvest will result in this shift. The only question is degree.		
186.	3-192	12	Joshua Rose/ USFWS	Strike the words "perceived as" from this line. There is significant documentation of climate driven changes in northern Alaska and that these changes have affected subsistence activities (Hinzman et al. 2005, "Evidence and Implications of recent climate change in northern Alaska and other arctic regions". DOI: 10.1007/~10584-005-5352-2).		
187.	3-192	27	Carl/FWS	Recommend changing "could" to "will" at the beginning of this line. The question is not whether, but to what degree.		
188.	3-192	40-42	Carl/FWS	Quantitative data is lacking as to the extent of enhanced government revenues and increased job opportunities for Alaskans. How much will be provided for both areas?		
189.	3-193	32-33	Carl/FWS	This sentence indicates that hunting and fishing for federally qualified subsistence users is a "primary recreation opportunity." Recommend this be deleted, as it will be inflammatory to federally qualified subsistence users for their customary and traditional activities to be equated with recreational activities.		
190.	3-193	33	Reed/FWS	Correct sentence to read "...to non-Federally qualified..." (recreational hunting, or general hunting, as the SOA refers to it, does not include federally-qualified subsistence users)		
191.	3-193	37-38	Reed/FWS	Replace beginning of second sentence in last paragraph with: "Until recently, most...", and add this sentence after: "Increasingly, visitors come later in the fall season, experiencing rapid decreases in average daily daylight and increased opportunity to view the Northern Lights."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
192.	3-194	10	Reed/FWS	Begin paragraph with: "Visitor use in the project area has increased in recent years with the emergence of polar bear viewing on waters immediately surrounding Kaktovik."		
193.	3-194	10	Reed/FWS	Change sentence beginning with: "More than 90 percent..." to "Prior to the emergence of polar bear viewing, more than 90 percent..."		
194.	3-194	11-15	Reed/FWS	Change following two sentences (beginning with "Other visitors..." and "During the summer...") to past-tense.		
195.	3-194	15	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace paragraph content beginning with "In 2017..." with "In 2017, guided polar bear viewing accounted for approximately 54 percent of all reported guided recreation activities in the program area. Polar bear viewing occurs on waters immediately adjacent to Kaktovik. Of the remaining 46 percent of visitors to the project area, use was more dispersed, and river floaters accounted for the majority (60 percent), while backpackers, base campers, and hunters each made up a portion of the minority of activity types (40 percent). Visitors conducting each of these four recreational activity types depend predominantly on use of river corridors during all or a portion of their visits.		
196.	3-194	23	Reed/FWS	This comment is based on visitor data provided by FWS to BLM on 7-11-2018 via email containing visitation data about the minimum number of client use days within the Coastal Plain within Arctic Refuge 2013-2017. Replace "In 2017, approximately 8 percent..." with "In 2017, approximately 4 percent..." and add the following sentence. Of the visitors to the project area whose use was focused on river corridors (i.e.: not polar bear viewers), approximately 8 percent were hunters. "		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
197.	3-194	6-7	Reed/FWS	End sentence with "...arrive by chartered aircraft." Strike "..., which is part of their special use permit."		
198.	3-194	7	Reed/FWS	Replace sentence beginning with "They..." with "Air operators providing transportation services to visitors are regulated through a special use permit system, which conditions their operations. There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land where surface conditions permit it."		
199.	3-194	8	Reed/FWS	Replace first part of sentence beginning with "Individual hikers..." with "Visitors enter the program area directly via chartered aircraft, from the north via Kaktovik, or to a lesser extent..."		
200.	3-195	25	Reed/FWS	Replace "...unique primitive recreation experiences..." with "...primitive recreation experiences that are unique on a world scale (such as expedition-length float hunts and polar bear viewing)..."		
201.	3-198	11	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		
202.	3-198	39-40	Reed/FWS	Change to read: "This would also <i>minimize impacts to</i> the viability of specially-permitted..."		
203.	3-199	1-2	Reed/FWS	Change to read: "...to meet minimal standards for Wild and Scenic River designation and Wilderness eligibility..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

204.	3-2	17-26	Loya/FWS	<p>Weather data, especially wind and precipitation, from Kaktovik is insufficient to describe conditions across the program area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.</p> <p>Katabatic winds from the mountains have a significant effect on snow distribution in the area.</p> <p>Recommend adding this info after line 26: Inland near the Brooks Range, monthly mean wind speeds are slightly lower (4.2ms<sup>-1</sup>; Olsson and others, 2002), but strong winds from the south, readily exceeding 20ms<sup>-1</sup>, can originate as katabatic flows down the many north-oriented valleys of the Brooks Range (Sturm and Stuefer 2013). In general, snow depth and snow water equivalent (SWE) decrease from inland to the coast (SWE values of 15–20cm near the foothills to 6–12 cm near the coast; Liston and Sturm, 1998), while bulk snow density and the prevalence of wind slabs increase (Sturm and Liston, 2003).</p> <p>Liston GE and Sturm M (1998) A snow-transport model for complex terrain. J. Glaciol., 44(148), 498–516</p> <p>Olsson PQ, Hinzman LD, Sturm M, Liston GE and Kane DL (2002) Surface climate and snow–weather relationships of the Kuparuk Basin on Alaska's Arctic Slope. ERDC/CRREL Tech. Rep. TR-02-10)</p> <p>Sturm M and Liston GE (2003) The snow cover on lakes of the Arctic Coastal Plain of Alaska, USA. J. Glaciol., 49(166), 370–380 (doi: 10.3189/172756503781830539)</p>		
------	-----	-------	----------	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Sturm, M & Stuefer, S (2013). Wind-blown flux rates derived from drifts at arctic snow fences. Journal of Glaciology. 59. 21-34. doi:10.3189/2013JoG12J110		
205.	3-2	21-22	Reed/FWS	No wind rose appears in figure referenced		
206.	3-2	9-22	Leonard/FWS	Meteorology from Kaktovik is unlikely to be representative of large portions of the study area. There are several discontinuous records from MET stations available elsewhere in the study area -- Including data from DOI's Global Terrestrial Network for Permafrost (GTN-P) monitoring sites.		
207.	3-200	11	Reed/FWS	Change to read: "...four <i>additional</i> purposes..."		
208.	3-200	Table 3.4.7-1	Kaye- FWS	Table 3.4.7-1 ANWR Purposes lists only EIS sections relevant to ANILCA purposes but does not include the still applicable PLO 2214 purposes. While ANILCA purpose (i) includes the PLO wildlife purpose, the PLO wilderness and recreational purposes are not referenced. They should be.		
209.	3-201	1-3	Reed/FWS	Change to read: "...opportunity to prioritize using existing management authorities and better understand..."		
210.	3-201	20	Reed/FWS	Break first sentence into two. End first sentence of paragraph with "... (NWSRS)." Second sentence should read: "Federal managers of recommended rivers are obligated to use existing management authorities to protect the characteristics of rivers for the conditions under which they were found eligible and suitable (in this instance, as described in the Wild and Scenic River Review).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
211.	3-202	17	Brady/FWS	When citing the Wilderness Act, please use the language from the Act as follows – 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation an use in an unimpaired condition and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

212.	3-202	2	Kaye/FWS	<p>Recommend expanding description of the Wilderness Characteristics, Qualities and Values section to include the following:</p> <p>Arctic Refuge Coastal plain wilderness characteristics and values</p> <p>The Arctic Range, including the coastal plain, was initially proposed by the National Park Service as “The Last Great Wilderness” (Kaye 2006) and Public Land Order 2214 (1960) which established the Range identified preservation of wilderness values as one of the area’s three purposes. So to clarify, the wilderness characteristics and values described herein are not based on designated (big W) Wilderness, but on the still applicable 1960 wilderness purpose of the original Arctic Range and the wilderness values referenced in ANILCA sections 101(b) and 304(g). Consistent with this wilderness purpose, the Refuge’s 2015 Comprehensive Conservation Plan (CCP) declared that “The Arctic Refuge serves a distinctive role in the National Wildlife Refuge System—exemplifying the qualities of natural condition, wild character, and ecological wholeness.”</p> <p>The Refuge’s CCP went on to recommend the 1002 area for Wilderness designation because it exemplifies these qualities. Studies of Refuge visitors (Christensen and others 2009) and the broader national public’s values and interests related to the Refuge (Bengston and others 2010) show that these wilderness qualities are highly prominent in the public’s perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge’s Special Values (FWS 2015) are understood and appreciated. These include values that are tangible, and those that are intangible and resist quantification but are central to the coastal plain’s wilderness purpose and its function within the larger Refuge. It includes the experiential values of those who visit, and vicarious values for those who find satisfaction just knowing the area exists. Wilderness associated</p>		
------	-------	---	----------	--	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>values include ecological, scientific, wildlife, aesthetic, recreational, and symbolic values, and are summarized as follows:</p> <p>Underpinning the coastal plain's ecological value is its wildness, the characteristic most at risk to development. Wildness is the landscape's freedom from human intent to alter, control, or manipulate its components and ecological and evolutionary processes. This freedom is integral to the area's high degree of biological integrity and natural diversity. It is also integral to the area's scientific value, as a natural laboratory of international significance. Investigations here have and can continue to provide insights into how arctic ecosystems function, transition, and respond to anthropogenic change such as climate change when left alone. Wildlife of the coastal plain remain wild to an unsurpassed degree here, their behavior, interactions, cycles and ecological roles continuing. Caribou, widely recognized as a symbol of the area's wildness, continue their migratory patterns, their ancient memory of unbounded movements to and within their calving grounds, unimpeded by developments. This wild quality of caribou and several of the Refuge's other species led to the research finding that "the national public's interest in the refuge's wildlife would be best served by maintaining the natural roles, interactions, and population dynamics of all species (Bengston and others 2010).</p> <p>Recreational visitors come to the coastal plain seeking a "wilderness experience," enhanced by all the aforementioned values. A 2009 study of Refuge visitors found that wilderness and wildness values were highly important as both motivations for visiting and as conditions that were experienced.</p> <p>As was intended by the Arctic Range's founders, the Arctic Refuge has become a symbolic landscape (Kaye 2006). Since the first efforts to establish a "Last Great Wilderness" here, most people who value this landscape have been less interested in how it can be</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				<p>used than in what its continued preservation represents. Millions who will never set foot in the area find satisfaction, inspiration, and even hope in just knowing it exists. Bequest value is a component of the area's symbolism. For many people, the Refuge represents the hope of a past generation that one of the finest remnants of our natural inheritance will be passed on to future generations, undiminished. For many, the question of the coastal plain's future has come to symbolize daunting questions the nation faces regarding energy policy, sustainability, and our effect upon the larger biosphere we jointly inhabit. The intangible, ineffable yet foundational symbolic value of the area is well summarized by Refuge founder Lowell Sumner (1985) who compared the Refuge to the statue of liberty. In the far north, he wrote, is another American symbol:</p> <p>... and this one too symbolizes freedom . . . freedom to continue, unhindered and forever if we are willing, the particular story of Planet Earth unfolding here—freedom for us as well who need to come to the few out-of-the-way places still remaining . . . but also where we can learn to appreciate and respect the intricate and inscrutable unfolding of the Earth's destiny—when free from meddling human concerns and the urge to take possession of and use up what we so imperfectly understand.</p> <p>Literature Cited Bengston, A. D., D. F. Fan, and R. Kaye. 2010. The national public's values and interests related to the Arctic National Wildlife Refuge. <i>International Journal of Wilderness</i>. 16: 13-20. Christensen, N. and L. Christensen. 2009. Arctic National Wildlife Refuge visitor study: The characteristics, experiences, and preferences of Refuge visitors. Unpublished report, U. S. Fish and Wildlife</p>		
--	--	--	--	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Service, Arctic National Wildlife Refuge, Fairbanks, Alaska. Kaye, R. 2006. Last great wilderness: the campaign to establish the Arctic National Wildlife Refuge. University of Alaska Press, Fairbanks, Alaska. Sumner, L. 1985. Arctic National Wildlife Refuge address, 25 <sup>th</sup> anniversary. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska. U. S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge revised comprehensive conservation plan, final environmental impact, wilderness review, and wild and scenic river review. Anchorage, AK: U.S Department of Interior, USFWS, Alaska Region.		
213.	3-202	8	Kaye/FWS	Change to "a natural and wild condition"		
214.	3-203	36	Kaye/FWS	Change to "biological, ecological, and wilderness concerns"		
215.	3-205	15-16	Reed/FWS	Maintain water quality using Bureau of Land Management's (BLM's) policy and program direction for management of eligible and suitable wild and scenic rivers (WSRs) which directs its plans to "protect and, where feasible, enhance the free-flowing condition, water quality"—through baseline data on quality of water at time of eligibility not by using State water quality standards.		
216.	3-207	17-18	Kaye/FWS	Change to "... measured by the overall visual quality and naturalness and wildness of an area that may be affected by changes to the types and levels of recreational activities, management actions, and surrounding land use."		
217.	3-207	31	Kaye/FWS	Change "could" impact to "would" impact		
218.	3-207	36	Kaye/FWS	Change "natural appearance" to naturalness		
219.	3-208	18	Kaye/FWS	Change "no impacts" top "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
220.	3-208	25	Kaye/FWS	Delete "apparent"		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
221.	3-208	29	Brady/FWS	Need a more robust analysis of the direct/indirect and cumulative effects that each of the alternative oil and gas programs would have on designated wilderness on Arctic Refuge and how an oil and gas program would affect each element of the wilderness; untrammeled; natural, undeveloped, outstanding opportunity for solitude		
222.	3-208	3	Kaye/FWS	Change "could" diminish to "would" diminish		
223.	3-208	9	Kaye/FWS	Change "no impacts" to "no direct impacts" Add: "although wilderness characteristics would be affected by development in adjacent areas"		
224.	3-209	23-24	Leonard/FWS	Replace 'on' with 'to' in 2 places since there is no demarcation mentioned between east and west sections.		
225.	3-21	10	Crane/FWS	Impacts from gravel infrastructure will likely persist in the form of no vegetation, compaction, and thermos-karsting even if infrastructure is removed. Recommend clarifying the statement made on page 3-21.		
226.	3-210	30-31	Leonard/FWS	Replace 'Buildings' with 'Human-built structures' AND 'modify' with 'modified'. Begin next sentence by replacing 'Buildings' with 'These structures'		
227.	3-211	14	Leonard/FWS	'dominate' needs explanation. Suggest removing entire sentence unless quantified differences between air and surface.		
228.	3-211	32-34	Leonard/FWS	But the outcome of such an analysis would not be tied to the lease itself (i.e., Stip) but only to a ROP for that action. This should be made very clear. Suggest adding 'and will inform ROPs on such actions, such as the APD phase'.		
229.	3-213	10	Leonard/FWS	Remove 's' from 'surfaces'		
230.	3-213	12	Leonard/FWS	Subject-verb: Change 'is' to 'are'		
231.	3-215	16	Leonard/FWS	Change 'result' to 'resulting'		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
232.	3-215	2-22	Leonard/FWS	Cumulative Impacts, and most of the visual resource section, are purely descriptive. One way to quickly produce quantitative information is to include a viewshed analysis based on different alternatives.		
233.	3-215	24-40+	Berendzen/ FWS	Affected Environment section is repeated on following page		
234.	3-215	32	Berendzen/ FWS	Several short airstrips are used by small fixed-wing aircraft for landing on wheels to transport recreationalists and researchers.		
235.	3-215	32	Reed/FWS	Change sentence to read: "...snow or <i>land</i> ..." See Reed comment for 3-194, line 7--There is a relative absence of water bodies sizeable enough to support float landings, so the vast majority of landings are made upon land		
236.	3-215	4-8	Berendzen/ FWS	Please identify the anticipated miles of disturbed trail expected from the proposed action, which would be expected to far exceed the 125 miles of disturbance left after damage that occurred 25 years prior. Please identify the effect of this disturbed trail on the ability to achieve refuge purpose #1 – "to conserve fish and wildlife populations and their habitats in their natural diversity."		
237.	3-216	28	Berendzen/ FWS	The message in these paragraphs is unclear, but suggests that enhancement of public and subsistence transportation would be a benefit. Please identify and analyze the impact of additional transportation infrastructure on the achievement of all of the purposes of the Refuge.		
238.	3-216	3-4	Reed/FWS	Commercial snowmachine use for recreation has not been authorized to my knowledge; recommend striking word "commercial" from sentence beginning in Line 3.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
239.	3-217	5	Loya/FWS	The FWS recommends that roads be closed to motorized use by the public. Subsistence access would be determined under LS 11. Recommended revision:  New transportation infrastructure, such as seasonal or year-round roads, airstrips, or other facilities, would not be available for public use using motorized vehicles. Thus, new infrastructure may enhance only non-motorized public access.		
240.	3-217	6-7	Berendzen/FWS	Industry developed infrastructure is not intended or expected to enhance public access opportunities. Sentence not needed.		
241.	3-22	1-24	Loya/FWS	Estimate of gravel footprint is not an adequate analysis of impacts to the physiography or how physiography would affect infrastructure placement. The info presented in this section belongs in the RFDS section.		
242.	3-233	6	Matz/FWS	Change sentence to read, "...completed (ADEC 2018), although cleanup thresholds may have changed since the date of closure (e.g., ADEC 2017)."  ADEC 2017 is Draft Cleanup Levels Guidance for Methods Two and Three, available at: <a href="http://dec.alaska.gov/spar/csp/guidance-forms/">http://dec.alaska.gov/spar/csp/guidance-forms/</a> . There are other documents describing changes in cleanup guidance and levels on there as well.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
243.	3-24	6; 16	Loya/FWS	No geologic map is present. Recommend using Jorgenson et al. 2015 Figure 11. Jorgenson T, Kanevskiy M, Shur Y, Grunblatt J, Ping C, and Michaelson G. (2015). Permafrost database development, characterization and mapping for northern Alaska. Report prepared for the USFWS Arctic LCC. <a href="https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0">https://www.sciencebase.gov/catalogMaps/mapping/ows/5a0ae567e4b09af898cb5ed7?service=wms&amp;request=getcapabilities&amp;version=1.3.0</a> .		
244.	3-240	10-20	Berendzen/ FWS	These adverse impacts are likely to occur and conflict with other refuge purposes. Need to evaluate the extent of these impacts under each of the alternatives and the associated impact on the ability to meet all of the refuge purposes.		
245.	3-240	38-40	Berendzen/ FWS	Proposed activities would likely result in chronic impacts as stated and conflict with refuge purposes. Need to evaluate the extent of these impacts under each of the alternatives and the associated impact on the ability to meet all of the refuge purposes.		
246.	3-240	21-29	Loya/FWS	Recommend revising the discussion on unavoidable adverse effects under the context and intensity of past, present, and reasonably foreseeable future actions, as described in Appendix M. The discussion should frame how the Refuge purposes would be affected by the potential actions. While bonding is important, it is not adequate to offset most of the changes that occur, and many impacts are difficult to quantify and monetize. Loss of wilderness values should be included in the list.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
247.	3-241	1	JWMartin FWS	... "natural environmental balances" is undefinable or unattainable as an agency or industry restoration goal  Replace with "ecosystem functions and processes" which is definable, attainable and measureable; and further, implies a potential of substitution rather than replication of the pre-development state - alternately "ecosystem services" which is broader yet and includes social/subsistence considerations).		
248.	3-240 3-241	Sec 3.5, 3.7	JWMartin FWS	Sections 3.5 and 3.7 inadequately address the context and intensity (40 CFR 1508.27) or the DEIS self-described context, duration and/or intensity (Pp M-1). See also 40 CFR 1502.14(b).  Review DEIS Section 3.5 Unavoidable Adverse Effects and 3.7 Irreversible and Irretrievable Commitments of Resources, proportionate to the significance of the impacts and the overall Refuge oil and gas program. NEPA [Section 101(c)(ii) & (v)]		
249.	3-29	10	Crane/FWS	Recommend expanding the discussion and analysis on the effects of subsidence and permafrost thaw as a result of oil and gas development and on development itself. In 2017, a well failed in NPRA and was attributed to thawing permafrost. With increasing temperatures, it is expected that permafrost thawing will also increase and potentially result in similar incidents.		
250.	3-3	14-15	Leonard/FWS	There are weather stations with data from inside and around the project area that are far closer than Barrow. See <a href="#">GTN-P</a> sites as well former NRCS run <a href="#">SNOTEL</a> sites		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
251.	3-3	21-22	Leonard/FWS	Statement about discernable trends is not fully accurate. Most of the precip is driven by inter-annual variability and there are numerous studies that predict an increasing trend for the arctic and some that show a decreasing trend ( e.g., Stafford, J. M., Wendler, G., & Curtis, J. (2000). Temperature and precipitation of Alaska: 50 year trend analysis. Theoretical and Applied Climatology, 67(1-2), 33-44.) However, Nearly all models agree that with increasing temps, we will see increasing precip. The current problem is that we don't have enough weather stations to properly monitor these changes. More importantly though: Total precipitation (assuming authors are excluding snow per 3-2 lines 10-11) is not the salient measurement for change as it relates to temperature above. Changes in the timing of precipitation are important here (e.g., rain on snow events). See: Bieniek, P., Bhatt, U., Walsh, J., Lader, R., Griffith B., Roach, J., Thoman, R. 2018. Assessment of Alaska Rain-on-Snow Events Using Dynamical Downscaling. American Meteorological Society. 57.1847-1863. <a href="https://doi.org/10.1175/JAMC-D-17-0276.1">https://doi.org/10.1175/JAMC-D-17-0276.1</a>		
252.	3-31	20	O'Dell/FWS	The KIC#1 well is the only well that has been drilled in what is now termed the "Coastal Plain". Suggest changing to "Data from most wells drilled near or in the Coastal Plain are held confidential..."		
253.	3-31	8	LaKonski/FWS	Recommend changing "... (previously known as the 1002 Area)..." to "(also known as the 1002 Area)"		
254.	3-31	9	Crane/FWS	Recommend stating that while the Coastal Plain was not designated wilderness, it was recently recommended for designation in the CCP and executive letter to congress and has been managed as such.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
255.	3-33	Line 18	O'Dell/FWS	Area 1002 has not been "poorly studied" but studied extensively with low volume and quality of data. Suggest just saying: "Given the uncertainty involved in defining undiscovered resources within the Coastal Plain, attempting to define variances in production by alternative is too speculative to provide value in the analysis."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
256.	3-35	1-5	Loya/FWS	<p>Because of the USGS assessment is being used as the basis for oil recovery, and it assumes that oil is not evenly distributed across the program area, recommend the following revision. It is not clear where the “medium” oil potential zone comes from, it does not appear to be described in the USGS assessment. Figures AO6 – AO15 suggest that only the “Thin-skinned Thrust Belt Play” may have indicators of oil bearing sand, otherwise the area is assumed to be more favorable for gas than oil. Using the two zones described in the current USGS assessment seems to be the “best available science”. The USGS describes two zones: undeformed (high potential) and deformed (low potential). Appendix E summarizes the oil potential as 6.420 BBO for high and 1.267 for low areas. Thus, the text in this section should be revised to reflect the estimated unequal distribution of oil.</p> <p>Further, there is quantified uncertainty which should be preserved in the text. The amount of oil that may not be recovered is difficult to determine as directional drilling may make oil accessible even where no leasing occurs. To quantify the amount that may be “unrecovered” divide the value of total oil in Table E-1 (7.668 BBO (range 4.254 to 11.8) by the value for the deformed part in Table E-2 (1.267 (range 0 to 3.185)) and account for the variation reported by USGS which is 0 BBO to:</p> <p>This closure represents approximately 30 percent of the program area; however the area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
257.	3-35	17-19	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
258.	3-35	29-31	Loya/FWS	Same issue as for 3-35 (1-5): Suggested revision: The area closed to leasing is located in the low petroleum potential section of the project area, so the percentage of petroleum resources closed to leasing could be approximately 16 percent (range of 0 to 27 percent).		
259.	3-36	17-22	Loya/FWS	Recommend moving this section on contribution to greenhouse gases to Page 3-4 Section beginning on line 15L Impacts of the proposed action on climate change		
260.	3-36	22	Trawicki/FWS	Is the 9.32 bbo and 4.01 bmt consistent with 3.2.1-2. Use similar units.		
261.	3-39	36	Jorgenson/FWS	Soils are described for lowlands but not for uplands		
262.	3-39	8-16	Loya/FWS	Due to NSO and No leasing, the impacts would not be the same across all alternatives, recommend revising text to reflect at least what percentages of the surface would be undisturbed by development and relate to table 3.2.7-1 PFYC Values of Program Area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
263.	3-39	M-3 and M-4	Loya/FWS	We recommend combining ROPs M-3 and M-4 with the following text: <u>Objective:</u> Minimize loss of populations of, and habitat for, plant and animal species that are rare, sensitive or endemic to the Arctic. <u>Requirement/Standard:</u> If a development is proposed in an area that provides potential habitat for an identified rare, sensitive or endemic plant or animal species in Alaska, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats to determine if the species occurs there. The results of these surveys will be submitted to the BLM with the application for development.		
264.	3-4	24	Leonard/FWS	Add 'and' after 'drilling production'		
265.	3-4	26-30	Hopkins/FWS	Statement about amount of available oil/gas by this project does not cite a study or an analysis and is thus 100% speculation, not factual and should be deleted. Statistics on anticipated oil and gas production are cited later in the EIS – could move those forward to this spot.		
266.	3-4	29	Crane/FWS	The statement regarding no additive effects of combustion of fuels from the program area is based on flawed assumption that development of the program area will preclude the need to develop the same amount of resources elsewhere and vice versa. There does not appear to be a basis for that assumption and is inconsistent with the cumulative impacts language on page 3-36 regarding how production and consumption of fuels from the program area would contribute to climate change. Recommend removing this statement.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
267.	3-4	3-10	Loya/FWS	<p>It does not seem sufficient to cite a Draft EIS as a reference, given it is subject to review and revision; recommend including relevant info into an appendix rather than making readers go to additional documents. If DEIS is used, then provide further information such as Chapter and/or page numbers. Further, rather than taking an entire paragraph to send the reader to the DEIS for GMT2, it is worth copying that info into this important, programmatic document without taking up too much space. Recommend deleting lines 3-10 and replacing:</p> <p>The North Slope experiences the same climate trends as the Arctic as a whole, including increased average temperatures, thawing of permafrost, expanded growing season and decreases in sea ice and snow cover extent (Walsh et al. 2014). Tundra travel open season on the North Slope decreased from approximately 200 days in 1969 to approximately 120 days in 2004 as a result of regulatory changes, a warming climate and methods for measuring frost depth (North Slope Borough Oil and Gas Technical Report 2014). Tundra travel season is likely to continue to shorten in response to rising average temperatures and changes in precipitation patterns on the North Slope. Precipitation on the North Slope is projected to increase in both summer and winter, while snow cover duration is expected to drop (BLM 2014). Projections for snowfall include a later date of first snowfall and an earlier snowmelt (BLM 2014).</p>		
268.	3-4	31-32	Leonard/FWS	This is conjecture without regard to market timing or any of the various complex factors involved with making an equivalency. Remove sentence. Begin following sentence by removing 'However' and combine with previous section.		
269.	3-4	5-10		Provide links to DEIS and GMT2		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
270.	3-40	2	JRose/FWS	Check citation. Jorgenson et al. was published 8 June 2015.		
271.	3-40	24	JRose/FWS	seems to be a typo "...ground surface and, which is..." should read "...ground surface and is ..." or "...ground surface, which is..."		
272.	3-40	4 - 6	Jorgenson/FWS	Clarify when soils are frozen vs. unfrozen, summer vs. winter. Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
273.	3-40	6	JRose/FWS	Clarify, not sure where "usually unfrozen on south-facing slopes" came from. If there is a source please cite. If it is from Jorgenson et al. 2015, it is miss represented. Jorgenson et al. state "Unusually unfrozen on south-facing slopes in the boreal zone" for upland Loess in Table 3 of that document. No portion of the 1002 is in the boreal zone. Also, Line 6 says soils 'are usually unfrozen on south-facing slopes', yet the whole area is underlain by permafrost.		
274.	3-41	1	JRose/FWS	Need to consider impacts from seismic activities associated with leasing. Various levels of impact have been recorded and last from 2 to greater than 40 years. Impacts include subsidence, thickening of the active layer, and changes in soil moisture (Kemper and Macdonald 2009, Jorgenson et al. 2010, Siobhan et al. 2017,		
275.	3-41	25 – 28	Jorgenson/FWS	Citation to add for this paragraph: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
276.	3-41	31-32	JRose/FWS	Need to better explain mechanism "This can increase thermal conductivity... (USACE, 2018)". Decreased albedo in and of itself does not change thermal conductivity. I do not have access to the reference but I am assuming they are indicating that the decrease in albedo results in a warmer denser snowpack with increased thermal conductivity. If this is the case, it may be better to say "This can lead to a denser snowpack with increased thermal conductivity, leading to permafrost thaw (USACE 2018)." Or reword in another way to better reflect the mechanism the original reference is referring to.		
277.	3-42	11-26	Loya/FWS	Impacts by alternative are not specific to the soil resources, which vary considerably across the program area. Alt B should consider if there are particular soil types more susceptible to impacts from gravel fill placement across the program area, while surface restrictions under Alt D would likely concentrate impacts in the western third of the program area, requiring consideration on impacts to the soil types occurring there.		
278.	3-42	29	JRose/FWS	Does not provide context of historic impacts. Recommend "Previous seismic surveys covered 2,500 miles of trail of which 125 miles remained disturbed in 2009. Disturbance from seismic survey exploration and an exploratory test well in the program area included disruption of surface vegetation and increased thaw of permafrost, changes...(Jorgenson et al. 2010, USFWS, 2018)." (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
279.	3-42	29 - 31	Jorgenson/FWS	Add text in red: Previous seismic survey explorations and an exploratory test well in the program area have resulted in disturbance to the surface vegetation and impacted the thaw of permafrost, changes in drainage patterns, and changes in vegetation growth for 25 years after disturbance (Jorgenson et al. 2010, USFWS 2018). (The 2010 paper is a better citation than the 2018 info sheet in the reference list (which was written and posted back in about 2003, I think). The USFWS 2018 citation probably covers the exploratory well, which the 2010 paper doesn't, so leave both citations.)		
280.	3-42	31	JRose/FWS	Cumulative effects do not consider currently proposed seismic or future seismic work. Recommend "...Vegetation growth (USFWS, 2018). Additional seismic surveys over the program area are required at significantly higher density. While improvements have been made to avoid impacts, new seismic surveys may have similar impacts as previous seismic activity."  Under the currently proposed seismic work, I estimate a minimum of 200 miles of camp move, 800 miles of seismic lines run by vibroseis equipment, and 30,000 miles of layout lines run by tucker and snowmachines. This estimate does not include daily trips to and from camp or scouting operations. Any additional seismic activity conducted after the initial surveys will increase the total miles of seismic trails. Recommend using current plans and data from NPR-A to develop more realistic estimates of miles of trails for seismic activities.		
281.	3-44	36	JRose/FWS	Change "...cumulative impacts for soils and permafrost is..." to "...cumulative impacts for sand and gravel resources is..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
282.	3-45	3.2.10	JohnT/FWS	<p>The fourth purpose of the refuge is (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge;</p> <p>Ensuring water quality and quantity (i) to conserve fish and wildlife populations and habitats in their natural diversity including..... is an explicit purpose of the refuge.</p> <p>All alternatives, at a minimum, need to address and meet all purposes of the refuge.</p>		
283.	3-46	19	JohnT/FWS	Edit: ...snowmelt or rain on snow events have produced flood events.		
284.	3-46	19-21	Randy Brown USFWS	<p>"Table G-5 provides historic data of measured discharge..."</p> <p>However, Table G-5 presents stream lengths of major streams in the Coastal Plain. Other references to specific table contents in this section are also incorrect. All should be checked and resolved.</p>		
285.	3-46	35	JohnT/FWS	Add sub heading for lakes and wetlands		
286.	3-47	14-16	JohnT/FWS	Move this statement to 3-50, Changes in Surface Water Flow		
287.	3-47	23	JRose/FWS	<p>Amend to read "...summer season and represent at least one third of the cumulative annual base flow (Yoshikawa et al. 2007); some spring-fed..."</p> <p>"Spring and aufeis (icing) hydrology in Brooks Range, Alaska"</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
288.	3-47	5-6	JohnT/FWS	Not sure what was sampled. Trawicki et al., 1991 conducted bathymetry, but did not conduct water quality sampling. Bayha 1996 also characterized the wet meadow zones associated with most lakes across the coastal plain.		
289.	3-47	16-17	Burkart/FWS	Remove the last sentence. Bowling was referenced previously and here it is not cited correctly (precipitation does not make the additional portion of snowmelt)		
290.	3-50	19	JRose/FWS	Include "ground surface subsidence under some seismic trails" with examples of exploration activities.		
291.	3-50	2	JohnT/FWS	Based on 3-47 lines 14-17; surface disturbance can lead to the development of thaw lakes. Development of additional thaw lakes are likely due to surface disturbance should be added to page 3-50, line 2 Changes in Surface Water Flow		
292.	3-50	5	JRose/FWS	Include "Changes in surface runoff processes and drainage networks" with examples of potential impacts. On steeper slopes especially these changes could result in gullying, thermokarst features, and surface detachment		
293.	3-51	11-15	JohnT/FWS	Please reference ROP 24 and alter language to be consistent with ROP 24		
294.	3-51	32-36	JohnT/FWS	This section should acknowledge that impacts to natural drainage patterns on tundra are permanent and irreversible- reclamation has not been proven for gravel removal in an Arctic environment.		
295.	3-51	3-5	JohnT/FWS	Objective is to design to minimize permafrost degradation, please reference the ROP # this refers to.		
296.	3-51	37-38	JohnT/FWS	Reference ROP 13, for consistent language. Waterway crossing that have been reinforced will be removed, breached or slotted prior to breakup.		
297.	3-51	7	Matz/FWS	Change sentence to read, "...have higher suspended solids concentrations, greater turbidity, and contaminant concentrations (dependent on the underlying geology)."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
298.	3-51	7-12	JohnT/FWS	How much water per activity for conceptual lay out E-1? Analyze water availability (volume by source and distribution)?		
299.	3-52	30-33	Burkart/FWS	It should be noted that erosion and thermokarst related to development activities could have long-term impacts on surface water quality.		
300.	3-52	36-39	Burkart/FWS	Consider moving this paragraph to the previous section on water withdrawals. Also, note that water is not always recharged during snowmelt. Adequate recharge depends on several factors including watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not fully recharge during snowmelt after previous summer and winter water removal.		
301.	3-52	35	Matz/FWS	Change sentence to read, "increasing turbidity and contaminant concentrations (dependent on the underlying geology)."		
302.	3-52	36-39	JohnT/FWS	Logic is flawed: Section should state that if water is withdrawn from lakes during summer, then the lakes will have less water going into winter, resulting in the loss of available water, winter habitat, and lower water quality. Full recharge may or may not occur in some lakes. Surface water hydrology is not the same on coastal plain as the NPRA (2% vs. 22%)		
303.	3-52	38	Crane/FWS	The statement "water would be recharged in the spring when snow and ice melt increases..." assumes withdrawal rates will not exceed recharge rates. Recommend discussing how this assumption will be met for the various alternatives (i.e. do ROPs ensure this, will water use permits...) given the lower snow totals that occur in the program area vs NPRA.		
304.	3-53	1-2	JohnT/FWS	At a minimum, identify/list the water quality/contaminants discussed in BLM 2004.		
305.	3-54	19-20	JohnT/FWS	Delete lines 19-20		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
306.	3-57	Table 3.2.11-4	Matz/FWS	Add a column with the material that was spilled.		
307.	3-58	10	Matz/FWS	Delete "promptly," as this is a values statement (i.e., definition could vary depending on one's values).		
308.	3-58	23	Matz/FWS	Add at end of sentence, "...or at the surface, except where permafrost thaw is exacerbated by climate change and anthropogenic earth-disturbing activities."		
309.	3-6	10	Crane/FWS	The statement regarding summer sea ice extent recovering slightly from the past decade fails to acknowledge that there is still a downward trend in sea ice extent from for the last several decades. Recommend clarifying the existing statement to reflect this.		
310.	3-6	10	Hamilton/FWS	"recovered" in this sentence implies responding to new action, suggest replacing with the word risen		
311.	3-6	20	Leonard/FWS	Add a space between 'program' and 'area'		
312.	3-6	29-35	Leonard/FWS	The Cumulative Impacts here are not summarized. Global emissions increase with increasing human development, and can be calculated. This needs to be evaluated inside the framework of this project. There is better detail on page 3-36 Lines 17-22. This can be used with Appendix E details to actually provide a quantitative assessment.		
313.	3-6	30	Leonard/FWS	Remove word 'provided' after 'projection'		
314.	3-60	1	Matz/FWS	Define location of, or give examples of, "offsite," such as, "in the permitted Kaktovik municipal landfill."		
315.	3-61	20	Jorgenson/FWS	The vegetation mapping available to quantify.... Change to: the vegetation mapping chosen to quantify.... Justification: There are 5 other vegetation maps covering the area in question, all made from Landsat satellite data.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
316.	3-61	23 - 24	Jorgenson/FWS	"The primary data source used was a low resolution map prepared by Ducks Unlimited, Inc. (2013). " That is not actually correct for the program area. DU did not map the program area. The data source for the program area was a land cover map published in 1986 (Markon 1986), made from classified Landsat-MSS satellite imagery from 1981. The map was more recently improved by Torre Jorgenson by applying topographic modelling to the existing map. However, it is still low resolution and a satellite image from 37 years ago. There are at least 5 newer Landsat maps covering the program area, some produced from newer Landsat-TM data, which is higher resolution than Landsat-MSS.		
317.	3-61	8	Matz/FWS	Change, "...detected spills are promptly contained..." to "...detected spills would be contained..."		
318.	3-65	19	JVMartin FWS	Wetland Functions  Please correct to EPA defined Wetland Functions and Values – EPA has purview over the Clean Water Act, and hence wetlands (see <a href="https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF">https://nepis.epa.gov/Exe/ZyPDF.cgi/200053Q1.PDF?Dockey=200053Q1.PDF</a> ).		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
319.	3-67	12 - 25	Jorgenson/FWS	Rewrite of this paragraph: Seismic exploration is proposed to occur during winter with direct surface impacts occurring by passage of camp trains on skis pulled by a tracked dozer directly over the snow-covered tundra surface (Appendix E, RFD Scenario). Impacts to vegetation and wetlands typically includes changes in plant community composition caused by altered hydrology or direct damage to above ground structures such as tussocks or woody stems and branches. Long term studies have shown that the overall impact of seismic vehicle traffic on tundra is low, but impacts can still be measured up to 25 years after exploration (Jorgenson et al. 2010). Seismic vibrator lines and camp train trails on the North Slope were found to be generally visible in summer vegetation for about 5 years after disturbance, and the longer-term impacts involved limited ground subsidence where the trail became a wetter trough (Jorgenson et al. 2003; Jorgenson et al. 2010; Yokel and Ver Hoef 2014). Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree than wetter types dominated by sedges. Studies on best management....		
320.	3-67	23	Crane/FWS	Seismic trails have persisted for much longer than 5 years after disturbance in NPRA. Recommend clarifying the statement made here.		
321.	3-67	23-28	Berendzen/ FWS	Habitat destruction and subsidence conflict with refuge purposes. Protective measures including more snow and frozen soil depth should be discussed to ensure all of the purposes of the Refuge are achieved under all alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
322.	3-68	14 - 16	Jorgenson/FWS	Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to the footprint edge. Thermokarst results in ponded areas extending into the tundra and altering the vegetation and wetland plant community structure. Change to: Gravel roads and pads tend to increase the occurrence of thermokarst directly adjacent to the footprint edge, with ponded areas extending into the tundra and altering the vegetation and wetland plant community structure (Raynolds et al. 2014). Citation: Raynolds, M.K., Walker, D.A., Ambrosius, K.J., Brown, J., Everett, K.R., Kanevskiy, M., Kofinas, G.P., Romanovsky, V.E., Shur, Y. and Webber, P.J. 2014. Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), pp.1211-1224. (Note to FWS: this paper should be cited in the EIS, at least here for thermokarst around pads and roads, on page 3-41 and probably other places in document too.		
323.	3-70	26-33	Berendzen/FWS	In addition to loss of vegetation to placement of fill, there will be vegetation loss to tundra scarring from equipment travel such as seismic or other. This conflicts with refuge purpose. Need to evaluate the impact of the alternatives on all of the refuge purposes.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
324.	3-73	3.2.10	JohnT/FWS	The entire impact analysis is qualitative and references BLM 2004 and BLM 2018. The coastal plain hydrology is significantly different (22% vs 2% of surface area is water) and cannot be evaluated based on different hydrologic conditions or without water use by season, year, and activity. Information on water availability has been identified, but there is no information on water needs by industry (please add table in Appendix E- Water Use and Requirements). How much water is required for ice road construction and exploration? Development? Dust abatement?... How does this compare to water availability and distribution across the coastal plain? Trawicki et al. 1991 identified winter water was limited in quantity and distribution. How will this be addressed?		
325.	3-73	Table 3.3.3-I	Randy Brown USFWS	Spelling issue, correct spelling is: Katakturuk; I've never heard of a West Canning River. Note c indicates that the Marsh Fork is included with the Canning River entry four down from the top so that isn't what is referred to here as West Canning. Sadlerochit River is not included in this list even though it supports resident dwarf Dolly Varden and Arctic Grayling within the program area during summer and winter.		
326.	3-74	Lines 5-7	Randy Brown USFWS	I would rephrase the sentences here to read: "...however, by late fall the lagoons become saline again as freshwater input declines. As ice forms on the lagoons the water below becomes hypersaline and very cold, the result of ion exclusion during ice formation, restricted flow between the lagoons and the open sea beyond, and freezing point depression with greater salinity. These cold, hypersaline lagoon environments become unsuitable habitats for both anadromous and marine fishes during winter."		
327.	3-75	23-29	Randy Brown USFWS	This paragraph is very awkward and aside from the first sentence (lines 23-24), which would be a suitable concluding sentence on an earlier paragraph, should be deleted.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
328.	3-75	5-6	Randy Brown USFWS	The statement that "...only the Dolly Varden, ninespine stickleback and arctic grayling overwinter in freshwater habitats in the program area..." is not correct. The lower Canning River is in the program area and there are burbot and round whitefish in that drainage including the lower reaches. This point is brought up in the next paragraph on line 12, but the original sentence should be modified so it becomes a true statement.		
329.	3-76	7-8	JohnT/FWS	2 Acts are identified, but are not included in Appendix D. Sustainable Fisheries Act, Magnuson-Stevens Fishery.....		
330.	3-76	Table 3.3.3-2	Randy Brown USFWS	Spelling errors: Gadidae is misspelled; scientific name for ninespine stickleback is Pungitius pungitius; as of 2013, the American Fisheries Society (AFS) classifies Arctic Flounder as Pleuronectes glacialis, Fishbase.org currently uses Liopsetta glacialis but we should probably follow AFS;		
331.	3-76	Table 3.3.3-2	Randy Brown USFWS	I would delete sheefish from the table; they are present in the Mackenzie River but rarely go west of Shingle Point, which is far to the east of Herschel Island, which is east of the border between the US and Canada. I have seen no documents suggesting they have ever been encountered at Herschel Island. They should not be in this list.  In a related manner, Slimy Sculpin should also be removed from this list. Appropriate habitats in the Canning River have been sampled many times since the 1970s and nobody has found them. They are very apparent when present. They are present in the Sagavanirktok River drainage and have been found in a small stream to the west of the Canning River but it would require a marine migration to get to the Canning River. They should be removed from the list.		
332.	3-78	15	Matz/FWS	Add to end of sentence, "...decreasing habitat quality, including through mobilization of contaminants specific to the underlying geology."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
333.	3-79	17	Matz/FWS	Change sentence to read, "...can increase sediment runoff, turbidity, and contaminant concentrations in streams."		
334.	3-79	5	Randy Brown USFWS	Edit: should read "...of fish in the program area."		
335.	3-80	27	Matz/FWS	Missing from this section (and from throughout the document) is discussion of how erosion, either from climate change or anthropogenic earth-disturbing activities can mobilize contaminants – elements and minerals found in the underlying geology (e.g., uranium). Also missing is a discussion of contaminant mobilization from melting permafrost (e.g., methyl mercury). These sources have ramifications for Water Quality, Fish and Aquatic Invertebrates, Birds, Marine Mammals and Subsistence. A suggested edit to the paragraph starting on line 28 is: "...hazardous materials, potential spills from wells, pipelines, or other infrastructure, and mobilization of contaminants into aquatic or terrestrial systems from erosion, fugitive dust, and permafrost degradation."		
336.	3-81	20	Crane/FWS	The statement regarding long-term survival and distribution of freshwater fish in the program area being negatively affected implies that this alternative is not consistent with the other purposes of the refuge. This is an example of my general comment above. It is not clear if and how (to what extent) each of the alternatives affect each and all of the 6 purposes of the refuge. Recommend discussing this aspect further and more clearly in the document and in a manner that facilitates comparison across alternatives.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
337.	3-81	21	Loya/FWS	<p>An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt C on fish, aquatic species and habitat. Recommend adding:</p> <p>Due to lack of protection of fish habitat and water resources in areas where fish are mostly present, Alternative C would have similar impacts to Alternative B, which include adversely affecting the long-term survival and distribution of freshwater fish in the program area. Lack of protection of springs and aufeis could result in the loss of fish overwintering habitat.</p>		
338.	3-81	31	Loya/FWS	<p>An overall impact assessment for fish and aquatic resources is needed that summarizes the effects of Alt D on fish, aquatic species and habitat. Recommend adding:</p> <p>Impacts to fish and aquatic species would be reduced under Alt D and occur mostly in the western portion of the program area. Impacts would be predominantly be indirect effects of changes in hydrology associated with infrastructure outside river and lake buffers or where infrastructure crosses river corridors. Protection of springs through studies and NL and NSO would reduce likelihood of disruption of groundwater that supports fish habitat.</p>		
339.	3-81	32	Loya/FWS	<p>Cumulative Impacts does not address the potential for any of the other actions to affect fish resources, including those that may pose the risk of an offshore oil spill. Recommend considering actions in Table M-1.</p>		
340.	3-81	37	Loya/FWS	<p>Recommend adding sentence to cumulative impacts section that addresses seismic impacts: Impacts from areawide seismic may result in changes in hydrology and water quality, potentially affecting fish habitat, if surface damage results in thermokarst and water channel formation.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
341.	3-82	14-15	Latty/FWS	<p>The sentence states that small-bodied birds dominate the ARCP, with shorebirds the guild with the largest population size and provides the Pearce et al. (2018) citation. It doesn't appear that citation states this Arctic Refuge area, but rather for the whole of the Arctic Coastal Plain and originates from Liebezeit et al. (2009). Please consider removing that statement, as there is likely not adequate information to support the conclusion of the predominance of any species group in the program area. Outside of a few species, the lack of data is even greater for the number of birds that stopover or stage in the Refuge foothills, coastal plain, and lagoons.</p> <p>Liebezeit, J. R., S. J. Kendall, S. Brown, C. B. Johnson, P. Martin, T. L. McDonald, D. C. Payer, C. L. Rea, B. Streever, A. M. Wildman, and S. Zack. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications 19:1628-1644.</p>		
342.	3-82	14-16	Latty/FWS	Please define species groups here as it's currently unclear if they align with definitions described later in this section.		
343.	3-82	29-30	Latty/FWS	Please consider changing: "most of the current information on bird abundance and distribution for the program was" to, "detailed distribution and abundance data for the program area are lacking for many, and contemporary data is lacking for most bird species. In addition, much of the contemporary data was ..."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
344.	3-82	9	Latty/FWS	<p>This line introduces the number of bird species known to occur in the Arctic Refuge Coastal Plain. It appears this information comes from the Arctic NWR CCP. If that is correct, than the description of the area this encompasses is not clearly defined here. The CCP states, "In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded". Please consider replacing, "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" for "Arctic Refuge Coastal Plain" as the aforementioned area includes lands outside the Coastal Plain. A citation for the Arctic Refuge CCP should also be provided it this is the source.</p> <p>This line also states, "as of 2015, 156 bird species have been recorded...". I was unable to find specific language in the Refuge CCP that states this list was updated in 2015 (the year the CCP was adopted). Please consider removing, "As of 2015".</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
345.	3-83	2-3	Latty/FWS	<p>The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a> .</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		
346.	3-83	25-31	Latty/FWS	<p>Spectacled eider have been documented breeding in the program area with the most recent known nest occurring at the Canning River Delta in 2017. Please consider adding a sentence stating that spectacled eider have been documented breeding in the program area in recent years citing USFWS, unpublished data. Contact Chris Latty <a href="mailto:Christopher_latty@fws.gov">Christopher_latty@fws.gov</a> for more details. Spectacled eider are an uncommon breeder in the program area.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
347.	3-84	13-16	Latty/FWS	Please consider changing this sentence to: "Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic coastal plain of Alaska to generate indices of breeding waterbird population size and trends over time (Stehn et al. 2013). However, prior to 2018 only about a quarter of the Coastal Plain area was included, and it was surveyed at the lowest intensity, making estimates of waterbird abundance and distribution across the program area relatively unreliable."		
348.	3-85	40	Swem-Latty/FWVS	Please consider changing "diversity in abundance" to "differences in distribution among".		
349.	3-86	32	Swem-Latty/FWS	Please consider adding the sentence, "Northern harrier are an uncommon summer resident and both northern harrier and merlin may breed in the program area (U.S. Fish and Wildlife Service 2015)."  U.S. Fish and Wildlife Service. 2015. Arctic National Wildlife Refuge, Alaska; revised comprehensive conservation plan and final environmental impact statement. US Fish and Wildlife Service.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
350.	3-88	11	Latty/FWS	<p>In addition to changes in predator behavior, impacts may include changes in predator abundance and distribution. Development on Alaska's North Slope, near oilfields and villages, has been demonstrated to lead to increased predator densities, mainly due to anthropogenic food sources, and possibly to a changing composition of predators (Eberhardt et al. 1982, Truett et al. 1997, Burgess 2000, Stickney et al. 2014). Please consider adding, "and changes in predator abundance" after "facilities."</p> <p>(Burgess, R. 2000. Arctic fox. The natural history of an arctic oil field: development and the biota. Academic Press, San Diego, California, USA:159-178. Eberhardt, L. E., W. C. Hanson, J. L. Bengtson, R. A. Garrott, and E. E. Hanson. 1982. Arctic fox home range characteristics in an oil-development area. The Journal of Wildlife Management:183-190. Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. Arctic 67:196-202. Truett, J. C., M. E. Miller, and K. Kertell. 1997. Effects of Arctic Alaska Oil development on brant and snow geese. Arctic 50:138-146.)</p>		
351.	3-88	19-21	Latty/FWS	An additional indirect impact could occur if habitat quality is impacted from water removal on which many birds rely. Please consider adding, "and impacts to habitat quality from water removal" after "...and terrain surfaces"		
352.	3-89	30	Crane/FWS	The statement "use of ice roads is extensive under all action alternatives..." is an example of how this resource need requires further analysis within the document given the limited amount of freshwater resources in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
353.	3-89	37-38	Latty/FWS	<p>Landbirds occur in similar number to waterbirds (e.g., shorebirds, loons, waterfowl, larids) during the breeding season in the program area. For example, Bart et al. (2013) estimated ~ 400,000 waterbirds and Bart et al. (2012) estimated ~300,000 passerines and ptarmigan occur on the Refuge coastal plain (i.e. excluding foothills which was calculated separately) during the breeding season. Because landbirds are also abundant in the program area, they should be considered in this section. Please consider adding a sentence regarding the potential impacts to landbirds which occur at similar or higher densities in moist areas and uplands of the on the Arctic Refuge coastal plain, compared to wetlands (varies by species). Suggest, removing, “which support lower densities of waterbirds” and changing to, “which support higher densities of passerines, ptarmigan, and some shorebirds like whimbrel and American golden-plover”.</p> <p>Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. Arctic shorebirds in north america: a decade of monitoring. University of California Press.</p> <p>Bart, J., R. M. Platte, B. Andres, S. Brown, J. A. Johnson, and W. Larned. 2013. Importance of the National Petroleum Reserve–Alaska for Aquatic Birds. Conservation Biology 27:1304-1312.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
354.	3-89	5-7	Swem-Latty/FWS	Please consider changing the sentence in lines 5-7 to the following.  “When estimating the incidental take of spectacled eiders that would be caused by the construction and operation of oilfield infrastructure, the USFWS considers the direct loss of habitat due to gravel fill plus indirect loss in an adjacent zone of influence (estimated to be ~ 200 m, or 656 ft wide) where disturbance could prevent spectacled eiders from nesting. Implicit in this method of estimating impacts is the assumption that displaced pairs will not move and nest successfully elsewhere.”		
355.	3-90	1-2	Latty/FWS	Please consider changing this sentence to, “Effects to birds from habitat alternation of ice roads is currently unknown, but it is expected to be minor compared to some other risk factors listed below.”		
356.	3-90	12-13	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or add a discussion of the risks to red-throated and Pacific loons that do regularly breed in the program area.		
357.	3-90	15	Loya/FWS	Provide a reference or detail what is meant by: “Rehabilitation would follow North Slope reclamation guidelines.” Ensure that paragraph on gravel is consistent with ROP 26 and differences between the B/C and D are evaluated.		
358.	3-90	17 and 21	Latty/FWS	Line 17 states that non-breeding and brood rearing waterbirds may benefit from gravel pits, but then line 21 states breeding birds may also benefit. Please clarify by adding breeding birds to line 17.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
359.	3-90	17-21	Latty/FWS	The habitat alternation from gravel mining would affect different species differently; therefore, it is not advisable to consider all birds together. These sentences would be more accurate if it stated some species may be harmed, while other species may benefit from habitat alterations associated with gravel extraction.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
360.	3-90	2	Latty/FWS	<p>Jorgenson et al. (2010) reported that severe impacts to tundra vegetation persisted for two decades after disturbance under some conditions in the program area. Kemper and Macdonald (2009) reported that seismic lines in low arctic tundra areas had less vascular plants and more bare ground compared to reference areas and that in upland areas, mosses and lichens also occurred less frequently. In addition, they reported that the active layer increased after seismic disturbance. Although data is not available for the program area, in areas of discontinuous permafrost linear disturbances, such as winter roads and seismic lines, have been reported to alter the hydrology, ecology, and ground thermal regime (Williams et al. 2013, Braverman and Quinton 2015).</p> <p>Given there have not been any studies to examine short- or long-term impacts to birds from ice roads, nor research on how hydrology and subsequently surrounding habitat might be impacted on the Alaska coastal plain, please consider removing, "and the extent would be limited to the immediate area covered by ice."</p> <p>Jorgenson, J. C., J. M. Ver Hoef, and M. T. Jorgenson. 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. <i>Ecol Appl</i> 20:205-221.  Kemper, J. T., and S. E. Macdonald. 2009. Effects of Contemporary Winter Seismic Exploration on Low Arctic Plant Communities and Permafrost. <i>Arctic, Antarctic, and Alpine Research</i> 41:228-237.  Williams, T. J., W. L. Quinton, and J. L. Baltzer. 2013. Linear disturbances on discontinuous permafrost: implications for thaw-induced changes to land cover and drainage patterns. <i>Environmental Research Letters</i> 8:025006.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
361.	3-90	7-8	Latty/FWS	It's stated here that water withdrawal may affect water chemistry. Because changes in water chemistry may impact the aquatic invertebrate that some birds forage on, please consider adding, "and impacts to aquatic invertebrate communities" after, "in some fish mortality".		
362.	3-90	9	Latty/FWS	Yellow-billed loons breed in low numbers on Arctic Refuge, primarily in the northern foothills of the Brooks Range. They are uncommon migrants and summer residents in the marine areas of the Refuge. (see Arctic Refuge CCP). Please change this sentence to accurately reflect the low risk to breeding yellow-billed loons in the program area, or change "yellow-billed loons" to "loons".		
363.	3-90	9-13	Latty/FWS	Water-source lakes may include lakes used by a variety of birds, not just yellow-billed loons. And because yellow-billed loons are not listed as a known breeder in the program area, suggest changing to, "Water-sourced lakes may include lakes used by a variety of birds during the breeding and non-breeding seasons. Drawdowns may lead to changes in the abundance and distribution of foods on which tundra birds rely. Drawdowns may also impact shorelines, thereby degrading the quality of areas as breeding and non-breeding habitat for a variety of waterbirds including shorebirds, loons, and waterfowl."		
364.	3-91	16	Latty/FWS	This section is described as "disturbance and displacement", but the terms are not well defined. Please consider defining these terms at the beginning of this section.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

365.	3-91	22-24	Latty/FWS	<p>Because winter is not defined here, it's unclear if this statement is accurate. Breeding Golden Eagles return to Alaska, presumably including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al. 2002, p. 16). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al. 1995, p. 377). Some Snowy Owls (<i>Bubo scandiacus</i>) winter on Arctic breeding grounds, but most arrive during Apr and May, with egg laying occurring in mid-May (summarized in Holt et al. 2015). The remaining regularly occurring raptors, Peregrine Falcons (<i>Falco peregrinus</i>), Rough-legged Hawks (<i>Buteo lagopus</i>), and Short-eared Owls (<i>Asio flammeus</i>), arrive to the Arctic and initiate nesting in May and early June (summarized in Pitelka et al. 1955, p. 12, Cade 1960, Bechard and Swem 2002, p. 16).</p> <p>Please define the period winter is meant to describe. If it overlaps with periods where breeding raptors occur, please update the document to reflect this.</p> <p>Bechard, M. J., and T. R. Swem. 2002. Rough-legged Hawk (<i>Buteo lagopus</i>). in A. F. Poole, and F. B. Gill, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. University of California Publications in Zoology 63:151-290.</p> <p>Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (<i>Bubo scandiacus</i>). in P. G. Rodewald, editor. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (<i>Aquila chrysaetos</i>). in A. F. Poole, and F. B. Gil, editors. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY, USA.</p> <p>Pitelka, F. A., P. Q. Tomich, and G. W. Treichel. 1955. Breeding behavior of jaegers and owls near Barrow, Alaska. The Condor 57:3-18.</p>		
------	------	-------	-----------	---	--	--

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. Journal of Field Ornithology 66:373-379.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
366.	3-91	36-38	Latty/FWS	<p>No definitions are provided of the various levels of disturbance, therefore it difficult to interpret this sentence. If "low" disturbance is intended to include changes in incubation constancy (as is implied here) please consider adding, "increased predation risk" after "incubation constancy." Although this is also mentioned in "high disturbance" discussion, reduced productivity due to human disturbance by foot traffic at nest sites is the most consistently reported effect of human presence. Reduced nest survival has been demonstrated for many tundra nesting birds, including cackling and greater white-fronted geese; common, king, and spectacled eider; and pacific and yellow-billed loons (Bowman and Stehn 2003, Bentzen et al. 2008, Wilson et al. 2012, Uher-Koch et al. 2015, Meixell and Flint 2017).</p> <p>Bentzen, R. L., A. N. Powell, and R. S. Suydam. 2008. Factors influencing nesting success of king eiders on northern alaska's coastal plain. Journal of Wildlife Management 72:1781-1789.</p> <p>Bowman, T. D., and R. A. Stehn. 2003. Impact of investigator disturbance on spectacled eiders and cackling Canada geese nesting on the Yukon-Kuskokwim Delta. in Unpublished report prepared for US Fish and Wildlife Service, Anchorage, Alaska.</p> <p>Meixell, B. W., and P. L. Flint. 2017. Effects of industrial and investigator disturbance on Arctic-nesting geese. The Journal of Wildlife Management:n/a-n/a.</p> <p>Uher-Koch, B. D., J. A. Schmutz, and K. G. Wright. 2015. Nest visits and capture events affect breeding success of Yellow-billed and Pacific loons. Condor 117:121-129.</p> <p>Wilson, H. M., P. L. Flint, A. N. Powell, J. B. Grand, and C. L. Moran. 2012. Population ecology of breeding pacific common eiders on the Yukon-Kuskokwim Delta, Alaska. Wildlife Monographs 182:1-28.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
367.	3-91	37	Latty/FWS	Please change "increase" to "decrease".		
368.	3-92	11-12	Latty/FWS	<p>Please consider changing this sentence to, "Liebezeit et al. (2009) reported a decrease in nest survival of passerines within 3.1 mi of oilfield infrastructure."</p> <p>Although Liebezeit et al. (2009) speculates that this may be been related to differences in predator density, they state, "Contrarily to expectations, our a priori models suggested that neither subsidized nor non-subsidized predator abundance was related to nest survival." Instead, they report that passerine nest survival was related to the distance of nests to the nearest high structure feature and the gravel footprint area within 3 and 16 km of plots.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

369.	3-92	27	Latty/FWS	<p>Please consider removing, “but are unlikely to affect population sizes or nesting densities of breeding birds”.</p> <p>There is relatively little statistically rigorous information to support or dispute the hypothesis of “no effect” of disturbance on breeding tundra nesting bird density. However, in other habitats several investigators have reported lower density in the vicinity of infrastructure (see Benítez-López et al. 2010 and meta-analysis the references within), while others reported higher densities. For example, Reijnen et al. (1995) found about half the bird species investigated had lower densities adjacent to roads and attributed this to noise load. Green et al. (2017) found abundance at sage-grouse lek sites was negatively related to oil and gas infrastructure density. Nenninger and Koper (2018) found sparrow abundance decreased near oil infrastructure sites. Davis (2017) reported bird density was greater in disturbed compared to undisturbed areas near oil and gas infrastructure in south Texas.</p> <p>Davis, K. R. 2017. Impacts of Oil-and-Gas Development in the Eagle Ford Shale on Quail and Other Birds. Texas A&amp;M University-Kingsville.</p> <p>Green, A. W., C. L. Aldridge, and M. S. O'donnell. 2017. Investigating impacts of oil and gas development on greater sage-grouse. The Journal of Wildlife Management 81:46-57.</p> <p>Nenninger, H. R., and N. Koper. 2018. Effects of conventional oil wells on grassland songbird abundance are caused by presence of infrastructure, not noise. Biological Conservation 218:124-133.</p> <p>Reijnen, R., R. Foppen, C. T. Braak, and J. Thissen. 1995. The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads. Journal of Applied Ecology 32:187-202.</p>		
370.	3-92	28-42	Latty/FWS	Please considering adding a sentence regarding boat traffic not related to screeching and barging to this paragraph.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
				Although it's mentioned elsewhere, it seems most applicable in this paragraph. For example, please consider adding: "Boat operations for other activities may also occur across the duration of the project." after, "visual disturbance." in line 31 and "Displacement and disturbance to birds from other boating activities may also be short in duration, but may occur over a broad area and across the duration of the project." in line 42 after, "small area."		
371.	3-92	31	Latty/FWS	<p>A variety of waterfowl and sea birds use the program area lagoons during summer and fall. For example, Lysne et al. (2004) found up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Refuge coast.</p> <p>Please consider adding: "Many seabird species use the nearshore waters of the Beaufort Sea. Lysne et al. (2004) recorded over 23,000 long-tailed ducks along the Refuge coast during a survey in late summer 2003. They also reported a substantial portion of yellow-billed loons, red-throated loons, scaup, and pacific loons counted during the entire Alaska North Slope survey occurred along the Refuge coast during some years." after, "visual disturbance." In line 31.</p> <p>Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.</p>		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
372.	3-92	34	Latty/FWS	<p>Additional references are available for how marine birds documented in the program area lagoons might respond to disturbance. Please consider adding the sentences: "Johnson (1982) reported displacement of long-tailed ducks in response to aircraft, boats, and human disturbance. Schwemmer et al. (2011) reported ship traffic affected flight reactions in sea ducks and the distribution of loons." after "from wind and waves (Flint et al. 2004)."</p> <p>Johnson, S. R. 1982. Continuing investigations of Oldsquaws (<i>Clangula hyemalis</i> L.) during the molt period in the Alaskan Beaufort Sea. Final Report To Outer Continental Shelf Environmental Assessment Program Research Unit 467.</p> <p>Schwemmer, P., B. Mendel, N. Sonntag, V. Dierschke, and S. Garthe. 2011. Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. <i>Ecological Applications</i> 21:1851-1860.</p>		
373.	3-92	34	Latty-Swem/FWS	Please consider adding the timing of long-tailed duck molt and other seabirds lagoon use to better qualify when the lagoons are predominantly used by seabirds.		
374.	3-92	3-4	Latty/FWS	Please consider moving this sentence to the section describing habitat loss. Although I do not have access to the full Troy and Carpenter citation, it appears to specifically address the redistribution of nesting birds after pad construction (i.e. habitat loss).		
375.	3-92	37-40	Latty/FWS	The sentence as written may not adequately represent the finding in Flint et al. 2003 or Fisher et al. 2002. Please considering changing the sentence to, "Site fidelity was not clearly impacted by seismic surveys (Flint et al. 2003) and aerial surveys did not find a difference in density of long-tailed ducks between industrial and control sites (Fisher et al. 2002)."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
376.	3-93	24-25	Latty/FWS	Although snow geese occur in substantial numbers during the post-breeding period, so do many of species of birds. Please consider changing this sentence to, "All types of air traffic also have the potential to cause disturbance and displacement of birds outside of the breeding season."		
377.	3-93	26	Latty/FWS	Please consider changing "as many as 300,000" to "For example, over 300,000" as 325,760 snow geese were estimated in 1978 (Kendall 2006).  Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service		
378.	3-93	9-16	Latty-Swem/FWS	Although this section provides background on the type of flights that may occur in support of development and some estimates of timing, it does not currently describe the magnitude. An estimate of the level of anticipated helicopter take-offs and landings should be developed, or extrapolated from recent estimates or the NPR-A. For example, for summer 2018, the BLM estimated greater than 10,000 take-offs and landings at over 5,000 different unimproved sites. Depending on the type of activity associated with these take-offs and landings and their duration, and whether the activities are authorized during the nesting season, the associated disturbance could cause nest failure and fragment broods (see the 2018 BLM Biological Assessment and the USFWS Section 7 Programmatic Biological Opinion for the NPR-A for more information).		
379.	3-94	23	Crane/FWS	Small spills still pose a risk to birds and other wildlife regardless if they reach the tundra or not. Recommend rewording this statement to address this potential effect.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
380.	3-97	38-39	Latty-Swem/FWS	In NPR-A, residents of nearby villages may be allowed access to roads which may increase harvest. Please consider updating this sentence to reflect if and how changes in access may impact harvest.		
381.	3-98	13	Latty-Swem/FWS	Please change "sooner" to "earlier".		
382.	3-98	32	Latty-Swem/FWS	Please change "nest sites" to "resources".		
383.	3-99	12	Crane/FWS	While polar bears are marine mammals, polar bears in the SBS population do spend a fair amount of time on land. Recommend rewording the statement that "None of the terrestrial mammals..." are listed..." to account for this. This would then be consistent with language on page 3-113 where polar bears are referenced and protections of polar bear dens is addressed in Alternative D and elsewhere in this section.		
384.	3-99	26-27	R. Wilson/FWS	Recommend changing the sentence to read "... and are an important subsistence resource for Inupiaq and Gwich'in hunters.' The line shouldn't be specific to the refuge, because these animals travel beyond the refuge, and whatever impacts they experience from development in the refuge could be felt beyond it.		
385.	A2-6, A2-8	Map 2-6 and 2-8	Kaye/FWS	On the maps for Individual stips for Alt D1 and D2, we recommend that the Wilderness boundary buffer (3 mi) be shown along the entire boundary, including in the no-lease area associated with the calving area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
386.	A3-12	Map 3-12	Randy Brown USFWS	Dolly Varden also overwinter in the Canning River in the reach upstream (south) of the braided delta on the western edge of the 1002 Area (see Brown et al. 2018).  Perhaps it is best that the EIS reflect the anadromous waters catalog entries, but I think the portrayal of upstream distribution of Dolly Varden in the minor streams between the Canning and Hulahula rivers and between the Hulahula and Aichilik rivers makes it appear that Dolly Varden are more abundant and broadly distributed in freshwater systems than they really are. All the sampling studies I've read on these systems suggests that juveniles are very rarely encountered and almost always in the lower reaches.		
387.	A3-13	Map 3-13	Randy Brown USFWS	Sadlerochit Spring was not identified in this map as essential fish habitat (EFH) and several streams that do not support fish during winter were included as EFH. Recommend revising as appropriate.		
388.	A3-2	Map 3-2	Kaye/FWS	Map 3-2 shows mines, prospects & mineral occurrences. I don't know about those and I am not aware of prospects & occurrences in the program area, but there are no mines in the program area identified with triangles, so mines should be deleted from the title, as its misleading		
389.	A3-3	Map 3-3	Kaye/FWS	Map 3-3: Are all these wells depicted here "existing"? or are some previous well sites? If that's the case, the map should differentiate between existing & previous well sites		
390.	A3-44	Map 3-44	Kaye/FWS	Special Designations. Although it's outside the program area, could recommend this map show the adjacent designated Wilderness, since it's a significant factor in our proposed boundary stip.		
391.	App A	Map 3-3	O'Dell/FWS	The map does not but should include the KIC #1 exploration well.		
392.	App. A	Map 3-44	S. Arthur/FWS	Not all of the coastal plain is a Marine Protected Area. Recommend revising shading to indicate the correct area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
393.	Appendix A	A-9,10	Jorgenson/FWS	In Appendix A, 'visual resources photos' has only 2 photos, neither from the program area. It is not clear what the purpose of this appendix is – please provide additional detail.		
394.	Appendix A	Map 3-18	Loya/FWS	Colors in legend do not fit maps; see Map 3-20 for correct colors by category		
395.	Appendix D			<p>Missing pertinent laws and policy –the USFWS does implements a variety of statues more than ESA/FWCA</p> <p>Marine Mammal Protection Act</p> <p>National Wildlife Refuge System Administration Act, amended through the National Wildlife Refuge Improvement Act (including BIDEH policy – Service Manual 601 FW 3, dated 16 Apr 2001)</p> <p>Migratory Bird Treaty Act</p> <p>Bald Eagle and Golden Eagle Protection Act</p> <p>US Fish and Wildlife Service Mitigation Policy dated 23 Jan 1981 (reinstated via 2016 policy withdrawal effective 30 Jul 2018: FWS 2018))</p> <p>The Wilderness Act</p> <p>Wild and Scenic Rivers Act</p> <p>National Historic Preservation Act</p> <p>Native American Graves Protection and Repatriation Act</p>		
396.	Appendix G		JohnT/FWS	Tables # in text 3.2.10 do not match actual table #s in Appendix G.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
397.	Appendix G	Table G-2 G-3	JohnT/FWS	Table title: add "Annual"		
398.	Appendix G 3-46	Table G-6  19	JohnT/FWS	Referenced as Table G-5 in text. Titles are not necessarily representative of the data; peak spring breakup was not captured during most years. Please include column with dates of start and end of record for each year. USGS has more recent data for the Canning River, Tamayariak River and is currently gaging the Hulahula River. This information should also be presented		
399.	Appendix G 3-48	Table G-7  12	JohnT/FWS	Change G-6 to G-7		
400.	Appendix G	Tables G-4, G-5	JohnT/FWS	Combine Tables. Remove Atigun, Kongakut and Sagavanirtok Rivers, add Canning, Hulahula, Okpilak, Jago, Aichilik and Saderochit Sprg. Creek to current Table G-5		
401.	Appendix G, 3-45	Table G-1  11-14	JohnT/FWS	Table title: please add "Annual" to Average Monthly Air Temp., the lack of Barter Island and Toolik data and the difference in years do not allow for a comparison as stated in text. Kuparuk data is good- just fix title please.		
402.	D-1	5	Conn / FWS	The name of the treaty being discussed in this section is the "Agreement on the Conservation of Polar Bears" but it is often referred to as the Range States Agreement. I suggest changing the section heading to include this more commonly known nomenclature.		
403.	D3		JohnT/FWS	Bald and Golden Eagle Protection Act, referenced in p. 3-86, l. 35-36, not included in Appendix D.		
404.	D3	21-26	Campbell	Add: ANILCA Section 1431, Arctic Slope Regional Corporation Lands. Specifically Sections 1431(a), (g) and (o)		
405.	D3	21-26	Campbell	Add: Agreement Between Arctic Slope Regional Corporation and the United States of America, August 9, 1983 Specifically Including Appendices 1 and 2		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
406.	D3	21-26	Campbell	Add: ANILCA Sections 301, 303(2) and 304.		
407.	D3	21-26	Campbell	Add: Public Land Order 2214 Establishing the Arctic National Wildlife Range, December 6, 1960		
408.	D3	21-26	Campbell	Revised Arctic National Wildlife Refuge Comprehensive Conservation Plan, January 2015		
409.	D-3	21	Carl/FWS	The USFWS has the following additional authority: 1. It is the administering agency under the Federal Advisory Committee Act for all of the Federal Subsistence Regional Advisory Councils established under Title VIII of ANILCA, which includes the North Slope and Eastern Interior Alaska Subsistence Regional Advisory Councils.		
410.	D-3	21-26	S. Arthur/FWS	Please include the various laws and policies that establish management purposes and govern the administration of a NWR (e.g., National Wildlife Refuge System Improvement Act) and specifically the Arctic Refuge (e.g., PLO 2214, ANILCA). The Arctic Refuge has additional legally mandated purposes that must be addressed.		
411.	D-3	21-26	R. Wilson/FWS	Please also list the Marine Mammal Protection Act. We recommend that the appendix also include a section for NOAA and their mandates under MMPA and ESA.		
412.	D-3	21-26	Campbell	Add: Terms and Conditions for Land Exchanges and Resolution of Conveyancing Issues in Arctic Slope Region Between the Department of the Interior and Arctic Slope Regional Corporation. June 29, 1979		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
413.	D-3	22	Conn/FWS	Suggest rewriting the section describing ESA. Possible language: The USFWS, along with NMFS, is responsible for administering the Endangered Species Act. Federal action agencies will consult with the USFWS to ensure the effects of the actions they are authorizing are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat. The results of this consultation will be provided in a Biological Opinion and may include Terms and Conditions to reduce any incidental take of a listed species.		
414.	D-3	24	Conn/FWS	Keep language describing FWCA (maybe as a separate bullet to be consistent with other agencies authorities in the document).		
415.	D-3	26	Conn/FWS	Add additional text for the MMPA as follows: All marine mammals are protected under the Marine Mammal Protection Act. Jurisdiction of the Act is shared by NMFS and USFWS depending upon the species being considered. Using specific criteria, and on application, the USFWS may authorize the take of marine mammals.		
416.	D-3	26	Conn/FWS	Suggest the following language: The Bald and Golden Eagle Protection Act prohibits the taking of eagles including their parts, nests, or eggs. If a project may result in take, and after avoidance and minimization measures are established, the USFWS may issue an eagle take permit.		
417.	D-4	17	Carl/FWS	The Alaska Department of Natural Resources possesses another regulatory authority relevant to the Coastal Plain oil and gas leasing program: the obligation to adjudicate instream flow reservations and other applications for reserved water rights. Recommend revising as appropriate.		
418.	D-7	USFWS Section	Conn/FWS	Re-word the MMPA permit to read "Issue incidental and/or intentional take authorization under the Marine Mammal Protection Act."		
419.	D-7	USFWS Section	Conn/FWS	Add a line "Issue take permits as appropriate pursuant to the Bald and Golden Eagle Protection Act.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
420.	E-1	10	O'Dell/FWS	"Reserves" are proven and economically producible, so term is inaccurately used until you get into the RFD assumptions. Recommend changing Change "reserves" to "undiscovered resources"		
421.	E-1	29-31	Leonard/FWS	Sentence beginning with 'Proposed plans...' is inscrutable. I cannot make a suggestion because multiple grammatical errors in the sentence make it difficult to interpret.		
422.	E-1	Row 17	O'Dell/FWS	There are definitely known plays, but no "proven" plays. Suggest changing "known" to "proven".		
423.	E-1, 3-32	23-25 13-18	JohnT/FWS	The \$42 per barrel (2009 dollars) needs to be converted to today's value to make reasonable comparison to the current price of \$65. Chapter 3 leaves out that \$42 is in 2009 dollars.		
424.	E-14	19	Berendzen/ FWS	Add "All roads are removed and gravel from them is placed back in the gravel pit it was originally extracted from"		
425.	E-16	25	Leonard/FWS	Subject-verb: Change 'is' to 'are'		
426.	E-17	1-3	Berendzen/ FWS	Please provide additional detail as to how BLM concluded that gravel pits are not an oil and gas production or support facility and therefore do not count towards the 2,000-acre surface disturbance cap. Even if not considered within the cap, the short and long-term impact of gravel pits on habitat within the Refuge, and the associated impact on the purposes of the Refuge need to be identified and analyzed.		
427.	EI-17		Burkart/FWS	There are no quantitative and very limited qualitative analyses of the impacts of development on water resources, (quantity and quality) fish and wildlife, and aquatic habitats based on water use and withdrawal. Information provided is insufficient to conduct this analysis. Using the RFD scenario, the alternatives, potential water sources, and timing of use provide a short term and long term and cumulative analysis of the effects of water use on fish and wildlife and aquatic habitats.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
428.	E-4	13	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
429.	E-4	16	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
430.	E-5	17	O'Dell/FWS	Add at the end: "Drilled in 1986 on village of Kaktovik land, the KIC-1 well is the only well drilled in the Arctic NWR. Data from the well has remained confidential."		
431.	E-5	2	Matz/FWS	Define "play" in footnotes, here or at the first mention of it in this section, as was done with other technical terms in Chapter 3.		
432.	E-5	21	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
433.	E-5	22	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
434.	E-5	4	O'Dell/FWS	Change "reserves" to "undiscovered resources"		
435.	E-8	Table E-3	O'Dell/FWS	3D Seismic is projected to take 2 winter seasons (2018/19 & 2019/20). Presumably, the first season would focus on high-potential area of the western part of Coastal Plain. Should the assumption be that 3D will be completed over the highest potential areas? Please clarify.		
436.	E-8	Table E-3	O'Dell/FWS	Additional Seismic Exploration on lease blocks. A more reasonable assumption would be that initial 3D is so designed as to enable targeting of specific exploration AND delineation wells – and would be available for sale to lease holders. Suggest re-evaluation of this progression. (Now noting the description doesn't include a second round of 3D seismic. Should probably be removed from the table.)		
437.	E-8	Table E-3	JohnT/FWS	Add Abandonment and Reclamation to Table E-3.		
438.	E-9	10	JRose/FWS	Please provide clarity on how the estimate of 990 mi <sup>2</sup> was developed. Under alternative D approximately 1600 mi <sup>2</sup> would be available for lease. Is this based upon the maximum amount of area that wells under the development scenario could reach or based upon the 2-D seismic work and the area overlying high and medium plays?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
439.	E-9	16-17	JRose/FWS	Should clarify how far out the nodes are placed. A 3-mile wide layout is considerably different than a .5 mile layout. There is not enough information provided to convey a sense of scale.		
440.	E-9	16-20	Loya/FWS	<p>The description of seismic lines spacing for post-leasing seismic exploration, which would presumably refine existing information, seems like it should be similar to or smaller than that proposed for the area wide seismic being evaluated in concurrent Seismic EA. Please see Marsh Creek Plan of Operations V.8.1 page 9, which states:</p> <p>Vibrator source points will be located along source lines every 41.25 feet. Geophone receiver lines will run perpendicular to source lines, and both source and receiver lines are spaced approximately 660 feet apart. Geophones will be located along source lines every 165 feet. Up to 20 receiver lines could be placed on the ground at one time. Wireless nodes and geophones will be laid out by crews on foot and through the use of rubber tracked tundra travel approved vehicles.</p>		
441.	E-9	5	Crane/FWS	Recommend clarifying if the statements made regarding assumptions made about leasing refer to the Tax Cuts and Jobs Act or to assumptions made by BLM in preparation of this EIS. For example, "It is also assumed that 3d seismic studies..." appears to be an assumption made by the BLM, but it is not clear with current wording.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
442.	ES-3	6	Crane/FWS	Recommend categorizing the alternatives in a way that does not use value based terms. For example, instead of stating "Alternative C balances oil and gas..." it is more accurate to state that "Alternative C includes additional stipulations for the protection of natural resources..." and "Alternative D addresses additional biological and ecological resource concerns by incorporating more prescriptive ROPs and reducing surface occupancy..."		
443.	ES-3	39	Loya/FWS	Arctic, not arctic.		
444.	ES-4	24-25	Loya/FWS	Revise: Potential impact on marine mammals, including human-polar bear interactions; vehicle, aircraft and boat traffic and noise disturbance; and accidental, unplanned take by vessel strikes or oil spills		
445.	ES-4	26-27	Loya/FWS	Revise: Impacts on terrestrial mammals, including disturbance from vehicle and aircraft noise, human presence and habitat fragmentation and loss		
446.	ES-4	31	Reed/FWS	Change to "Loss or reduced quality of some recreational opportunities around areas leased for energy infrastructure"		
447.	ES-4	35	JFox/FWS	Wording is unclear. Change to "Residents of Kaktovik are the primary users of..."		
448.	ES-4	36	JFox/FWS	Wording is unclear. Change to "The community of Nuiqsut has the potential to..."		
449.	ES-4	Insert after 31	Reed/FWS	Insert below line 31 and above line 32 the following bulleted item: "Loss of some recreational access around areas leased for energy infrastructure" (see Section 3.4.9, Transportation)		
450.	ES-4	Insert after 39	Reed/FWS	Suggested language: The majority of visitors to Arctic Refuge come specifically to the project area. With expected increases in recreational use coupled with decreased access to recreation in areas users of the Coastal Plain would be likely to experience direct and indirect impacts."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
451.	H-I	1		<p>Appendix H does not list taxa specific conservation listings. The BLM sensitive species list was not derived with consideration of Arctic NWR and the USFWS birds of conservation concern list may be outdated. Therefore, at minimum, please consider adding statuses for species groups where more up-to-date conservation lists are available. For example:</p> <p>(Shorebirds) U.S. Shorebird Conservation Plan Partnership. 2016. U.S. Shorebirds of Conservation Concern — 2016.  <a href="http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/">http://www.shorebirdplan.org/science/assessment-conservation-status-shorebirds/</a>;</p> <p>(Landbirds). Partners in Flight. 2016. Partners In Flight Landbird Conservation Plan.  <a href="https://www.partnersinflight.org/resources/the-plan/">https://www.partnersinflight.org/resources/the-plan/</a> .</p> <p>It may also be beneficial to update this list with the status listings from IUCN and Audubon Alaska as these lists are regularly updated (i.e., IUCN. 2017. The IUCN Red List of Threatened Species; <a href="http://www.iucnredlist.org/">http://www.iucnredlist.org/</a> ; Warnock, N. 2017. The Alaska WatchList 2017. Audubon Alaska. <a href="http://ak.audubon.org/conservation/alaska-watchlist">http://ak.audubon.org/conservation/alaska-watchlist</a> ).</p>		
452.	H-I	5	Latty/FWS	This line introduces the listings of birds occurring on the Coastal Plain of Arctic Refuge and a citation for the Refuge CCP is listed. The CCP provided data for the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters. "northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters" should be substituted for "Coastal Plain of the Arctic NWR" as the aforementioned area includes lands outside the Coastal Plain.		
453.	I-I	17	Matz/FWS	Add size range for Arctic grayling.		
454.	I-I	18	Matz/FWS	Replace "large" with size range of burbot.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
455.	I-1	24	Matz/FWS	Replace "small" with size range of ninespine stickleback.		
456.	I-1	8	Matz/FWS	Replace "relatively small" with size range of round whitefish.		
457.	I-2	20	Matz/FWS	Replace "relatively small" with size range of least cisco.		
458.	I-2	26	Matz/FWS	Replace "relatively large" with size range of broad whitefish.		
459.	I-2	30	Matz/FWS	Replace "relatively small" with size range of Arctic cisco.		
460.	I-2	37	Matz/FWS	Replace "small" with size range of rainbow smelt.		
461.	I-3	16	Randy Brown USFWS	Typo: should read "...fishes may use coastal and lagoon..."		
462.	I-3	24	Matz/FWS	Replace "They are typically a small to medium sized species" with size range of Arctic cod.		
463.	I-3	32	Matz/FWS	Replace "medium to large in size" with size range of saffron cod.		
464.	I-3	36	Matz/FWS	Provide size range of fourhorn sculpin.		
465.	I-3	39	Matz/FWS	Replace "They are a medium sized species" with size range of Arctic flounder.		
466.	I-3	7,8	Matz/FWS	Provide size ranges of resident and anadromous Dolly Varden.		
467.	I-5	22, 23, 32 and 33	Carl/FWS	Recommend deleting "regulations" which would be included in federal laws.		
468.	M-1	10	Matz/FWS	Remove "growth-inducing effects" as it is an unclear example, and examples are not needed for this general and cited description of indirect effects		
469.	M-10	2 through 4	FWS – BAWR (Allen and Collins)	There are established methodologies for evaluating air quality impacts. This statement should be removed.		
470.	M-10	5 through 7	FWS – BAWR (Allen and Collins)	Mitigation and stipulations can change the overall surface and well development. This statement should be removed.		
471.	M-10	8	FWS – BAWR (Allen and Collins)	Please add "air quality" . . . "BLM approval would require further 'air quality' NEPA analysis. . ."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
472.	M-10	M.3.3 Impacts/ Indicators Table	Matz/FWS	Change last bullet in "Action" column to read, "Noise generated in the construction and operation of roads, well pads, and other ancillary support activities"		
473.	M-13	11	JRose/FWS	Is 200 Acres a typo? It seems that this should read "Up to 2,000 acres of gravel...."		
474.	M-14, M-15	10	JohnT/FWS	<p>Impacts and Indicators Water Resources: Actions Impacting Resource list is incomplete and/or very general: add Seismic Surveys: Use of rolligons or other orv's; add Water withdrawal from lakes for ice roads, pads, airstrips, dust abatement, camp/facilitie support and other uses; add Construction, placement and use of gravel pads, roads, airstrips..; add construction and use of barge docks; add construction and operation of seawater treatment plant; add placement and use of ice roads, bridges, pads, airstrips; add spills;</p> <p>This table could be modeled similar to the M-table for Wetlands and Vegetation. The actions may be different, but the construction phase and operation phase are addressed separately.</p> <p>Types of Impact: update impact to match action.</p> <p>Impact Indicators: no units have been identified.</p>		
475.	M-16	19	Jorgenson/FWS	In M.3.12, this phrase (or similar) is used repeatedly: 'no indicator available to assess possible plant community changes'. Given the information that is available, please explain why no indicators can be developed. Some sources of information: I see that some assumptions about development footprint are made on page M-19. The area that would be covered by 3-D seismic exploration in one winter by 2 crews can also be estimated, based on past surveys in NPRA. Also information on vegetation changes in Reynolds 2014.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
476.	M-16	M.3.11 Impacts/Ind Table	Matz/FWS	Change first line under "Action" column to read, "Introduction of contaminants including petroleum products and heavy metals caused by"		
477.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Gravel Mining for road and pad construction," change middle bullet to read, "Changes in water quality, including turbidity and mobilization of contaminants."		
478.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "New gravel roads, pads, culverts, and bridges," change middle bullet to read, "Temporary and periodic turbidity, sedimentation, and contaminant mobilization during gravel placement, compaction, and grading."		
479.	M-20	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Vehicle traffic on ice or gravel infrastructure," change second bullet to read, "Habitat and water quality alterations, including contaminant mobilization, due to dust, gravel spray, or sediment runoff from gravel roads."		
480.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Off-road vehicle activity on tundra," change bullet to read, "Habitat alteration due to compression or damage to vegetation resulting in soil exposure, sediment runoff, and contaminant mobilization."		
481.	M-21	M.3.13 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Potential spills....," change first bullet to read, "Habitat alteration or loss due to spills or leaks."		
482.	M-22	M.3.14 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
483.	M-23	M.3.14 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
484.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Edit Action Impacting Resource "Use and storage of hazardous materials" lines to be more complete (as in Table M.3.13) to: Action Impacting Resource: "Spills from storage use, and transport of waste and hazardous materials (including crude oil, fuels, salt water, drilling fluids, and other chemicals), and potential oil spills from wells, pipelines, and other infrastructure." Type of Impact: "Injury and mortality from releases/discharges or insecure containment" and "Habitat alteration or loss due to spills or leaks." Impact Indicator: "Describe potential for accidental exposure for individuals and habitats."		
485.	M-24	M.3.15 Impacts/Ind Table	Matz/FWS	Under "Type of Impact" column for "Traffic on gravel roads," change bullet to read, "Habitat alteration and exposure to contaminants from gravel spray and dust fallout."		
486.	M-25	4 (last row of table for M.3.15)	Reed/FWS	Carry through resolution of following comment, which seeks clarification in Analysis Assumptions whether/how sport hunting and other recreation access is intended, to specify type of impact for roads and pads (e.g.: change to "Increased/alterd access for subsistence hunter, sport hunters, and other recreationists."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
487.	M-25	7	Reed/FWS	Clarify in Analysis Assumptions the extent to which sport hunting and other recreation access is intended to be closed to non-subsistence public users (see Section 3.4.9, Transportation)		
488.	M-25	Section M3.16, last point in first row of second column	R. Wilson/FWS	Type of impact should also include 'Possible den abandonment and loss of cubs'		
489.	M-25	Section M3.16, second row, second column	R. Wilson/FWS	Should also include 'Behavioral disturbance to polar bears onshore related to landings of marine vessels'		
490.	M-26	12-14	R. Wilson/FWS	This assumption needs to be modified because we know that not all dens will be detected, and could be lower than 60% based on data in Amstrup et al. 2004. Recommend modifying the assumption such that it assumes that upwards of 60% of dens are initially detected.		
491.	M-26	7	R. Wilson/FWS	Need to include a bullet under assumptions that 'Offshore oil spills will be sufficiently rare to ignore their potential impacts to polar bears and other marine mammals'. This may not be an appropriate assumption, but it follows from what is considered in the Affected Environments section  Also, should modify the third bullet point to state that it is unlikely that all dens will be identified during den surveys, and that some percent dens are likely to be missed during surveys (>40%; Amstrup et al. 2004)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
492.	M-28	9	DeCleva/USFWS	Previous NRHP eligibility status may prove insufficient due to the passage of time or changes in integrity since the evaluation. It is recommended that the bullet read as: "Cultural resource sites are treated as eligible for the NRHP until they are sufficiently evaluated as determined by BLM."		
493.	M-29	M.3.19 Impact/Ind Table	Matz/FWS	Under "Action Impacting Resource" column for "Contamination," add a bullet: "Release, discharge, or insecure containment of hazardous materials or hazardous wastes." Same line, under "Type of Impact" column, change last bullet to read, "Reduced user access because of perceived or actual increases in subsistence food contamination"		
494.	M-31	M.3.20 Impact/Ind Table	Matz/FWS	For "Action Impacting Resource" column "Disruptions to subsistence activities and uses," add a bullet under Type of Impact: "Reduced social, economic, and nutritional benefits resulting from reduced use of subsistence foods due to actual or perceived increases in subsistence food contamination"		
495.	M-33	12 (table M.3.23 column 3)	Reed/FWS	Delete duplicate second bulleted item		
496.	M-36	10	Matz/FWS	Replace "casual" with more precise terminology, for example, "occasional."		
497.	M-36	16 whole Section M.3.26 Economy	Reed/FWS	Section should be revised to needs to address effects on local tourism enterprise which is employing numerous residents who serve 53 percent of visitors to the project area.		
498.	M-37	M.3.26 Impact/Ind Table	Matz/FWS	Add under "Type of Impacts" column: "Effects on incomes from alterations in subsistence activities" And, provide examples of relevant/selected economic sectors (e.g., tourism, hunting guides, air taxis)		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
499.	M-38	M.3.27 Impact/Ind Table	Matz/FWS	For Oil-and-gas development, add an additional impact: "Increase in subsistence food contamination" with an Impact Indicator of "Change in contaminants in subsistence foods"		
500.	M-4	Category Rec and Tourism, Column two (Area)	Reed/FWS	Add: North American Arctic (because context of recreation – particularly polar bear viewing opportunity – extends beyond the region of the North American Arctic)		
501.	M-4	Table M-I	Matz/FWS	For Category Transportation, under Description, add after the first sentence, "Marine transportation in particular is projected to increase with decreases in sea ice associated with climate change."		
502.	M-4	Table M-I	Matz/FWS	For Category Recreation and Tourism, under Description, delete sentence beginning "Air traffic related..." as it is too specific given the general tone of the other Descriptions. Alternatively, add a similar sentence about the effects on wildlife for other Categories, including Oil and Gas Exploration, Development, and Production; Transportation; Subsistence Activities; and Community Development, as all of these have the potential to "impact wildlife species."		
503.	M-5	19	Jorgenson/FWS	Add information on the cat trains, camp and fuel vehicles. Eg. 12 – 15 rubber tracked vibrators plus the number of camp vehicles?		
504.	M-6	43	Reed/FWS	Change to "...occur between Fairbanks and each of the communities within the Arctic Refuge..." (because there are no passenger or air cargo commercial flights between Arctic Village and Kaktovik)		
505.	M-7	I	Reed/FWS	Change to "Government agencies, researchers, and recreationists often charter aircraft for research and travel purposes."		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
506.	M-7	11	Reed/FWS	Begin first sentence with "Until recently, recreation...program area." And follow with this sentence: "While a very small number of local residents have historically participated in recreational guiding and tourism, since 2010 residents have developed tourism around polar bear viewing, and in 2017 over 50 percent of the visitors to the program area are served by locally-owned tourism businesses."		
507.	M-8	1	Matz/FWS	Delete sentence beginning with, "Alaskan officials..." While true, it is not relevant nor explanatory within the paragraph.		
508.	Map 3-1. Physiographic provinces, Appendix A.		Jorgenson/FWS	Recommend using more recent data to delineate the boundary between coastal plain and foothills in the program area. It appears that the hand-drawn paper map that was created in the days before GIS, was used to inform the map depicted here at a very broad scale of 1:2,500,000. Given the scale, it is inappropriate to zoom into a small area of the state and use that map to show divisions. The line work on the original map was not done at a scale to justify that. The division between coastal plain and foothills provinces is roughly drawn and follows no discernable topographical breaks on the landscape. Newer and better maps exist. All recent documents produced by the FWS (such as the Arctic NWR CCP 2015) use the Nowacki et al. digital map of ecological regions (2001). It is available at <a href="https://agdc.usgs.gov/data/usgs/erosafo/ecoregl/">https://agdc.usgs.gov/data/usgs/erosafo/ecoregl/</a> . That map is also used by many different agencies in Alaska, for example ADFG: <a href="http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions">http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions</a> . The descriptions of the project area should be rewritten using the newer map. The two maps differ greatly in the program area.		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

<b>Cmt #</b>	<b>Page #</b>	<b>Row # or Line #</b>	<b>Reviewer Name/ Agency</b>	<b>Comment</b>	<b>A/R/M<sup>1</sup></b>	<b>Remarks / How Resolved (Reviewers: Leave this column blank)</b>
509.	Map 3-18		R. Wilson/FWS	Recommend including winter, spring migration, and fall migration on the map.		
510.	Map 3-20		R. Wilson/FWS	What is the turquoise line in the maps for Alt C and Alt D, running at the bottom?		
511.	Map 3-21		R. Wilson/FWS	Under lease stipulation 5 (p. 2-7) it states that the coastline buffer goes inland 5 miles and encompasses the drainages that are specified. However, in the map, the coastal buffer goes offshore 5 miles and not inland. The map needs to have the coastal buffer go inland 5 miles and encompass the drainages listed on p. 2-7 for Alt-D.		
512.	M-22	12-13	Burkart/FWS	Currently there are no alternatives that include use of STP versus use of freshwater.		
513.	M-4	Table M-1	Burkart/FWS	In the scientific field it is widely accepted that climate change is ongoing and has widespread impacts across the North Slope of Alaska. There are numerous scientific reports on the impacts of climate change. These reports include current impacts and future projections. Climate change must be considered as a cumulative stressor if analyses are to be considered scientifically credible.		
514.	M-14	Table M.3.10	Burkart/FWS	Water withdraws should be listed as an action impacting resource. The type of impacts include impacts to surface and ground water quality, water quantity,		
515.	M-14-15	Table M.3.10	Burkart/FWS	Injection of hazardous wastes should be listed as an action potentially impacting water resources. The type of impact would be potential contamination of ground and surface waters. The impact indicators would be surface water quality/contamination and groundwater quality/contamination. When conducting the analysis, consider that the potential for impacts to groundwater would be reduced under alternatives with stipulations that provide a protective buffer around major spring-fed rivers.		
516.	M-19-22	Table M.3.13	Burkart/FWS	The development scenarios for the alternatives should address a range of development/infrastructure needs at the level necessary to assess impacts on fish and aquatic		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				species (e.g. water withdrawal needs, ice road length, gravel mine locations and type). Without that, it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives. More information is necessary to complete an adequate analysis. This information should include water needs, ice road lengths, etc. When there are a range of possibilities for a given scenario, the range should be given.		
517.	M-20	Table M.3.13,	Burkart/FWS	Culverts can impact fish passage, hydrologic regimes, ice damming, etc.		
518.	M-20	Table M.3.13,	Burkart/FWS	One of the bigger effects of vehicle traffic on ice and gravel roads might be the erosion and thermokarst associated with heavy vehicle traffic, especially with winter tundra travel.		
519.	M-20	Table M.3.13,	Burkart/FWS	Barging of materials – impact indicators – Please include stipulations targeted at preventing invasive species on incoming barges.		
520.	M-22	Table M.3.13, Row 2	Burkart/FWS	Declines in dissolved oxygen and increases in solutes should be mentioned specifically under type of impact. I am not sure turbidity is an impact of water withdrawal. Other types of impacts include the following: loss of littoral habitat and wet meadow zones due to shallowing, increased freezedown of substrate used by some aquatic invertebrates to avoid freezing during winter. See Cott et al 2008 for more information on impacts of water withdraw on fish and other species in ice-covered lakes in Canada. Studies have been done on the North Slope, but many were on deep gravel pits. Also National Research Council 2003 -- cumulative impacts of oil on the North Slope.		
521.	M-22	Table M.3.13, Row 2	Burkart/FWS	For impact indicators, consider comparing the total volume of water needed to the estimated volume of liquid water available for withdrawal in lakes and rivers at the end of the winter season in the 1002 area (about 1 billion gallons, Trawicki et al 1991 or Lyons and Trawicki 1994).		
522.	M-15	8	Burkart/FWS	It cannot be assumed that impacts would be similar to those described in Greater Moose's Tooth 2 and other		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**COASTAL PLAIN OIL AND GAS LEASING PROGRAM  
ENVIRONMENTAL IMPACT STATEMENT**

**BLM and Cooperating Agency Comments on Administrative Draft Review EIS**

				North Slope EIS'. The 1002 area of the Arctic Refuge is very different than developed areas of the NPR-A where the extent and volume of water is much greater and the terrain is not as steep. If the Arctic Refuge were to have the same stipulations and the NPR-A, it is expected that water withdraw would have a much greater impact as the proportion of sources tapped would be much higher in the Refuge. Development would likely use the fully permitted volume (In the NPR-A industry only tends to use a small fraction of the permitted volume).		
523.	M-15	11	Burkart/FWS	Please clarify. Does this assumption mean the specific locations and orientation of infrastructure have not been identified?; thus, it is not possible to conduct an analysis that considers these factors when assessing impacts and comparing alternatives.		
524.	M-5	12-13	JWMartin FWS	<p>"Both onshore and offshore reasonably foreseeable future oil and gas ..." There is no acknowledgement of Canadian projects, present or pending, in the following listing, as implied in Table M-1 (see Canadian Arctic under Effects Analysis Area).</p> <p>Identify Canadian projects and pending expansion or new development; add increase in noise levels related to surface, air and sea traffic; oil and gas development; and, infrastructure development to Table M-1.</p>		
525.	Referen ces-7	27	JRose/FWS	Jorgensen et al. 2018. Jorgenson et al. was published 8 June 2015. Also check format. Should it be "Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C., & Michaelson, G." or something similar?		

<sup>1</sup> A = Comment accepted; R = Comment rejected with explanation; M = Comment-response modified



**To:** Joanna Fox[joanna\_fox@fws.gov]; Joshua Rose[joshua\_rose@fws.gov]; Paul Leonard[paul\_leonard@fws.gov]; Loya, Wendy[wendy\_loya@fws.gov]  
**From:** Berendzen, Steve  
**Sent:** 2018-11-13T13:24:54-05:00  
**Importance:** Normal  
**Subject:** Fwd: [EXTERNAL] Snow monitoring - Seismic activities  
**Received:** 2018-11-13T13:25:12-05:00  
[Monitoring of snow conditions during seismic exploration.doc](#)

I haven't looked at it yet, but Shelly makes it sound like a possible application and I think we should check it out

Steve Berendzen  
Refuge Manager, Arctic National Wildlife Refuge  
907-456-0253

----- Forwarded message -----

From: **Jones, Nichelle (Shelly)** <[njones@blm.gov](mailto:njones@blm.gov)>  
Date: Tue, Nov 13, 2018 at 9:01 AM  
Subject: Fwd: [EXTERNAL] Snow monitoring - Seismic activities  
To: Matt Whitman <[mwhitman@blm.gov](mailto:mwhitman@blm.gov)>, Eric Geisler <[egeisler@blm.gov](mailto:egeisler@blm.gov)>, Murphy, Ted <[t75murph@blm.gov](mailto:t75murph@blm.gov)>, Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)>, LaMarr, Sarah <[slamarr@blm.gov](mailto:slamarr@blm.gov)>, Donna Wixon <[dwixon@blm.gov](mailto:dwixon@blm.gov)>, Steve Berendzen <[steve\\_berendzen@fws.gov](mailto:steve_berendzen@fws.gov)>, Donato Judice <[djudice@blm.gov](mailto:djudice@blm.gov)>

I had not seen this and thought you might be interested. We will need to start pulling our thoughts together and outreach to SAE soon, but it will probably need to be after Thanksgiving based on our schedules.

Shelly Jones  
Acting Manager  
Arctic District Office  
222 University Avenue  
Fairbanks, AK 99709

(907) 474-2310 (w)  
(907) 460-0086 (c)

----- Forwarded message -----

From: **Head, Melissa M (DNR)** <[melissa.head@alaska.gov](mailto:melissa.head@alaska.gov)>  
Date: Fri, Nov 9, 2018 at 1:06 PM  
Subject: [EXTERNAL] Snow monitoring - Seismic activities  
To: Jones, Nichelle (Shelly) <[njones@blm.gov](mailto:njones@blm.gov)>, Leonard, Paul <[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)>

Shelly and Paul,



I was going through and organizing some of our electronic files and found the attached. It's a procedures document written by Torre Jorgenson in 2003 that lays out a plan for monitoring snow conditions seismic activities. This was spurred by a BLM workshop so, you may have this already.

Kind Regards,

Melissa

Melissa Head

Manager, Northern Oil & Gas Team

DNR/DMLW

907-451-2719



# **MONITORING OF SNOW CONDITIONS DURING SEISMIC EXPLORATION**

## **Sampling Plan**

Prepared by Torre Jorgenson, ABR, Inc., Fairbanks, AK (tjorgenson@abrinc.com)  
16 January 2003

### **OVERVIEW**

The BLM held a workshop on 14–15 January 2003 to discuss vegetation and soil impacts associated with winter off-road activities on Alaska's North Slope. The workshop participants recognized two major factors influencing the severity of disturbance to the tundra from seismic exploration activity. These are: (1) snow cover and (2) the type and number of vehicles used on the source lines (vibrators) and camp-moves during seismic exploration. Consequently, the workshop participants recommended monitoring of snow conditions periodically during seismic activity on the two types of trails. Results from the monitoring would then be available for subsequent evaluation of disturbance levels if follow up disturbance studies are conducted in the future. Accordingly, this sampling plan was developed to provide a sampling design and methodology for measuring simple snow characteristics such as depth, mass (snow water equivalent), and density.

### **TECHNICAL APPROACH**

The sampling design was developed: (1) to provide a representative sample of the variation of snow characteristics throughout the winter seismic program and (2) to compare differences between vibrator and camp move trails. The sampling should be done in clusters of sample points along transects (trail segments). This should be both more cost efficient in terms of personnel requirements, and would require less helicopter support during subsequent sampling of disturbance in the summer. The objective of the sampling is to record snow depth at 200 sampling locations along the vibrator (source) trails (10 clusters of 20 points) and 100 points along the camp move trails (5 clusters of 20 points) over the course of the entire trail network. The sampling should be done in clusters of 20 points, at a spacing of 300 m over a trail segment (transect) of 6 km. If English units are easier to work with during surveying, the sampling should be done every 1000 ft over a trail segment of 20,000 ft. To help disperse the sampling effort, the sampling should be done during one day (both vibrator and camp move segments) at approximately 7 day intervals. Time intervals can vary but the general approach is to space the 10 sampling periods for the vibrator lines over the entire length of the program. Note that the camp moves are sampled only during 5 of the sampling periods. Exactly how the segments are spaced and when they are measured is flexible, but sampling should maintain to the objective of the sampling transects being widely dispersed in space and time. For example, if needed the



sampling could be reduced to 5 intervals (2 vibrator segments and 1 camp move segment each sampling interval).

Geodetic coordinates of each sampling location should be obtained (by GPS or other method) and latitude and longitude should be recorded in WGS84 (NAD83) coordinates in decimal degree format. The GPS coordinates should be for the center of the trail or in the heaviest used track. The snow measurements can be made either before or after trafficking has occurred. If measurements are made after traffic has passed, the snow depths should be measured in the undisturbed snow immediately adjacent to the sampling point in the trail. While the snow sampling will be offset from the GPS coordinates for the sampling location in the trail, the offset is closed enough to represent snow conditions in the trail before compaction.

At each sampling point, 5 snow depth measurements should be made by sampling at one step (pace) intervals. Snow depth should be measured above the tundra surface with a stiff metal ruler (preferably in cm) or with a graduated steel probe. Measurement should be made to the nearest cm. A note should be made on any unusual terrain characteristics (i.e, deep gully, ridge).

In addition to snow depths, a snow sample should be collected at every 10<sup>th</sup> sampling location (at first of the 5 step points at each location) for determining mass (snow-water equivalent) and density. First, vertically insert a 2" diameter, thin-walled steel pipe into the snow down to the tundra surface. Second, measure the depth of the snow on the side of the tube. Third, clear the snow away for one side of the tube and insert a thin metal plate or spatula under the tube to prevent snow from falling out from the bottom of the tube. Fourth, remove the tube and empty the contents into a gallon-size ziplock bag (for large samples two bags may be needed). Fifth, weigh the bag (after taring the bag) on an electronic or mechanical scale back in the office or vehicle cab. Record depth, weight, and diameter of tube. Sample can be discarded. Alternatively, a NRCS snow sampling tube can be used to core and weigh the sample with the accompanying spring scale following NRCS procedures used with their sampling tube.

## MATERIALS

Sampling Form on write-in-the-rain paper and pencil

Differential (preferable) or handheld GPS

Metal ruler (yardstick) graduated in cm.

Thin-walled tube (2 in., inside diameter), approx. 2 ft long (for most snow measurements)

Thin-walled tube (2 in., inside diameter), approx. 4 ft long (for deep snow)

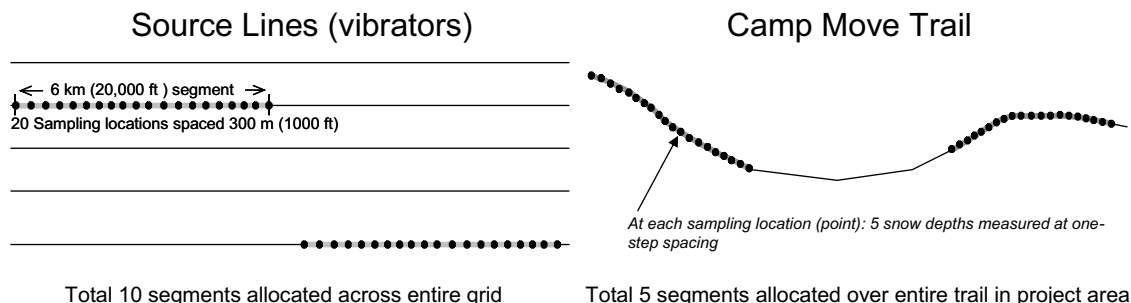
Metal spatula ("pan-cake flipper") 2-3 inches wide

10 gallon size heavy duty ziplock bags (bags can be reused).

Electronic or mechanical scale (500 or 1000 gm capacity, 0.1 gm resolution)

NRCS Snow Sampling Tube (optional if available)

## Sampling Scheme





# SNOW DEPTH SAMPLING FORM

Observer: \_\_\_\_\_ Date: \_\_\_\_\_ Trail Type (circle): vibrator or camp move

[illegible]

SiteID: should include transect (segment) number and sampling location along segment: e.g. 1-1, 8-18.

### SNOW MASS AND DENSITY FORM (sample at every 10<sup>th</sup> location)

SiteID	Depth 1 (cm)	Tube Diam. (inside, cm)	Weight (gm)	Volume (cm <sup>3</sup> )	Density (gm/cm <sup>3</sup> )	Snow Water Equivalent (cm)

Volume, density, and snow water equivalent can be calculated later, not necessary in the field



**To:** Sarah LaMarr[slamarr@blm.gov]  
**Cc:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Leonard, Paul  
**Sent:** 2018-11-15T19:03:21-05:00  
**Importance:** Normal  
**Subject:** Science-Management Discussion with FWS  
**Received:** 2018-11-15T19:03:55-05:00  
[Resources of Concern.docx](#)

Hi Sarah,

Over the last few weeks we have been discussing the possibility of getting together with a few key BLM staff (resource specialists) to have a single day meeting at BLM (targeted for late January - early Feb) that could address upcoming management challenges, questions, and science needs.

The focus would be for us (FWS staff) to sit down with BLM and tease out the management decision points over the next few years. It doesn't need to focus exclusively on the arctic refuge but I think that would be a good place to start. We would like to work with you guys to identify data/science needs that might help inform some of these decision points. We'd also like to hear from BLM about what is working and what is not in regards to stips/rops and or identify if there are opportunities to better examine/understand their effectiveness. In addition, we'd like to get a handle on what data industry typically collects and for what purposes? Ultimately, we would like to use this type of information in a science planning and prioritization process that we are starting.

Wendy and I briefly spoke with Matthew Whitman about this and he liked the idea of using targeted small groups (focused on specific disciplines/themes) to have a free-flowing discussion about how we can work together to achieve the management objectives we all seek. Some of our topics of concern are already being addressed by loosely coordinated groups (e.g., Polar Bears, Snow & Climate) but others need a bit of work to take shape and help get jump started. Regardless, we'd like BLM to play a key role in helping us get a handle on the decision space for some of these groups and we think a meeting might be the best way to start.

Some of our early ideas for issues/groups are focused around:

- Water Resources & Fish
- Vegetation /Soils / Permafrost
- Caribou / Other Mammals
- Paleontological Resources

We welcome your feedback and ideas in regards to identifying key people and for putting a meeting like this together sooner rather than later. If you'd like to schedule a call to discuss or have other suggestions on how to move forward, we'd really appreciate it. Also, I'm attaching a full list of issues we've identified if you have thoughts about omissions or prioritization from BLMs perspective.

Cheers,  
Paul



--

Paul Leonard, PhD

Science Coordinator

[Arctic LCC](#)

101 12th Ave. Room 216

Fairbanks, AK 99701

(907) 456-0445



Background: These themes were created as part of a rapid-response resource assessment in early 2018 that attempted to identify the major resources of concern and recommend studies or actions to help guide funding over the next few years. The focus was on projects that would be useful for improving future regulatory decision making, mitigating the impacts of seismic exploration and establishing contemporary pre-development baseline data.

- Acoustic Environment
- Air Quality
- Birds
- Caribou
- Coastal Resources
- Contaminants
- Cultural Resources
- Fishes
- Oil Spills
- Other Mammals
- Paleontological Resources
- Polar Bear
- Public Health
- Snow & Climate
- Subsistence Use
- Vegetation, Soils, Permafrost, Wetlands
- Visitor Use
- Water Resources



**To:** Roger Kaye[roger\_kaye@fws.gov]; Jennifer Reed[jennifer\_reed@fws.gov]  
**Cc:** Wendy Loya[wendy\_loya@fws.gov]; Steve Berendzen[steve\_berendzen@fws.gov]  
**From:** Leonard, Paul  
**Sent:** 2019-02-16T14:03:01-05:00  
**Importance:** Normal  
**Subject:** Re: Update on Viewsheds  
**Received:** 2019-02-16T14:03:33-05:00  
[Viewshed\\_Alternatives\\_Reanalysis\\_UPDATE.docx](#)

Hello again,

I apologize for this but I just realized that I made a rather troubling typo (using Alternative A where it should have read Alternative B in the relative difference from moving between alternatives)

Please use this version of the document!

On Sat, Feb 16, 2019 at 9:55 AM Leonard, Paul <[paul\\_leonard@fws.gov](mailto:paul_leonard@fws.gov)> wrote:

I just wanted to let you guys know that I've put together a document with the TrueNorth GIS viewshed data reanalyzed within the context of the DEIS. I attempted to clarify what we can and cannot interpret from the reanalysis with bullets and a short summary. Perhaps the most useful part of the analysis deals with moving from one alternative to another (See page 2).

I'll be out next week but if you have questions, I will be able to check emails regularly towards the end of next week.

Spatial data can be found here:

R:\GIS\_Projects\Arctic\Area1002\DEIS\_Alternatives

Cheers,  
Paul

--

Paul Leonard, PhD  
Science Coordinator  
[Arctic LCC](#)  
101 12th Ave. Room 216  
Fairbanks, AK 99701  
(907) 456-0445

--

Paul Leonard, PhD  
Science Coordinator  
[Arctic LCC](#)  
101 12th Ave. Room 216  
Fairbanks, AK 99701



(907) 456-0445



## Re-analysis of Viewshed Modelling for the Arctic Refuge's Coastal Plain Major Rivers

The attached TrueNorth GIS viewshed modelling work did not take into account a maximum visible distance for calculating viewsheds. This approach makes it difficult to interpret for the DEIS. I reanalyzed these data with the leasing alternatives in mind. For details on original methods, please see Smith (2019). I took the analysis for total viewshed of all six rivers (Fig. 11; Smith 2019) and extracted the viewshed models to fit the assumptions in each alternative of the DEIS. I then compared the potential areas impacted by the alternatives in a similar method (% of 1002 area) as the original analysis.

### What this analysis tells us:

- How much area inside river buffers in each alternative protects viewsheds with an NSO stipulation.
- Where an individual person (spatially) is likely to be able see infrastructure of various heights if it were built along river corridors.
- How selecting different alternatives could impact viewsheds along rivers in the 1002.
- Most infrastructure with a maximum of 15m height would be visible (if built within any of the river buffers considered in Alternatives B-D).

### What the analysis does not tell us:

- What size the buffers need to be to protect visual resources (e.g., 'are the buffers big enough?'). The summary results presented in the table are relative to each alternative. However, larger buffers tested in the alternative scenarios do not reach an asymptotic relationship with infrastructure height (e.g., larger buffers = greater area visible as bare ground), and as such it is reasonable to assume that even larger buffers would be necessary to achieve this relationship or until the maximum perceptible visible distance could be reached.
- How far an individual person would be able to see from any place inside a river buffer.
- The cumulative impacts to visibility beyond the largest River Buffers considered in the leasing alternatives.

Summary Table for Alternatives in regards to protecting visual resources along rivers. For example, In Alternative D, nearly 12% of the 1002 area would be protected where infrastructure of any height would be visible from the rivers.

Infrastructure Height (m)	Alt B (km)	% 1002	Alt C (km)	% 1002	Alt D (km)	% 1002
0 (bare ground visible)	446.3581	7.05%	561.2748	8.87%	754.3265	11.92%
15	570.6349	9.02%	914.2789	14.45%	1455.4352	23.00%
30	4.8951	0.08%	11.1259	0.18%	27.0723	0.43%
45	1.1592	0.02%	5.6509	0.09%	7.5490	0.12%
> 45	0.0654	0%	0.3567	0.01%	0.5994	0.02%
Totals		16.17%		23.59%		35.48%



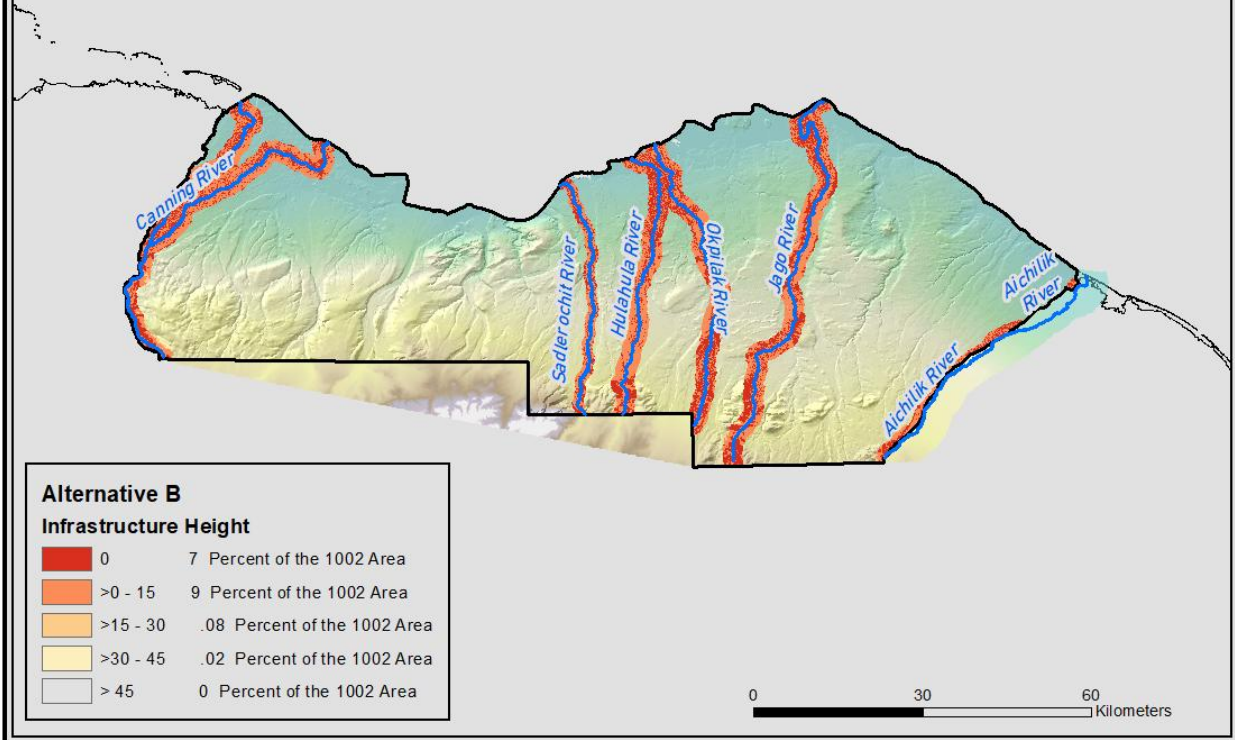
It is useful to keep in mind that bare ground visible in Alternative D would also be visible in Alternative C and B. The same would be true for increasing heights of infrastructure. Moreover, if infrastructure of a maximum height of 15m is visible then bare ground must also be visible. Thus, it is useful to imagine what additional buffer widths provide when moving from one alternative to another.

1. Difference in moving from Alternative B to Alternative C: sets aside an additional 115 sq. km (~11% difference) at risk of being visible from the rivers if any sized infrastructure was placed outside buffers of B but inside buffers of C.
2. Difference in moving from Alternative C to Alternative D: sets aside an additional 193 sq. km (~15% difference) at risk of being visible from the rivers if any sized infrastructure was placed outside buffers of C but inside buffers of D.
3. Difference in moving from Alternative B to Alternative D: sets aside an additional 308 sq. km (~23% difference) at risk of being visible from the rivers if any sized infrastructure was placed outside buffers of B but inside buffers of D.



## Arctic Refuge 1002 Area

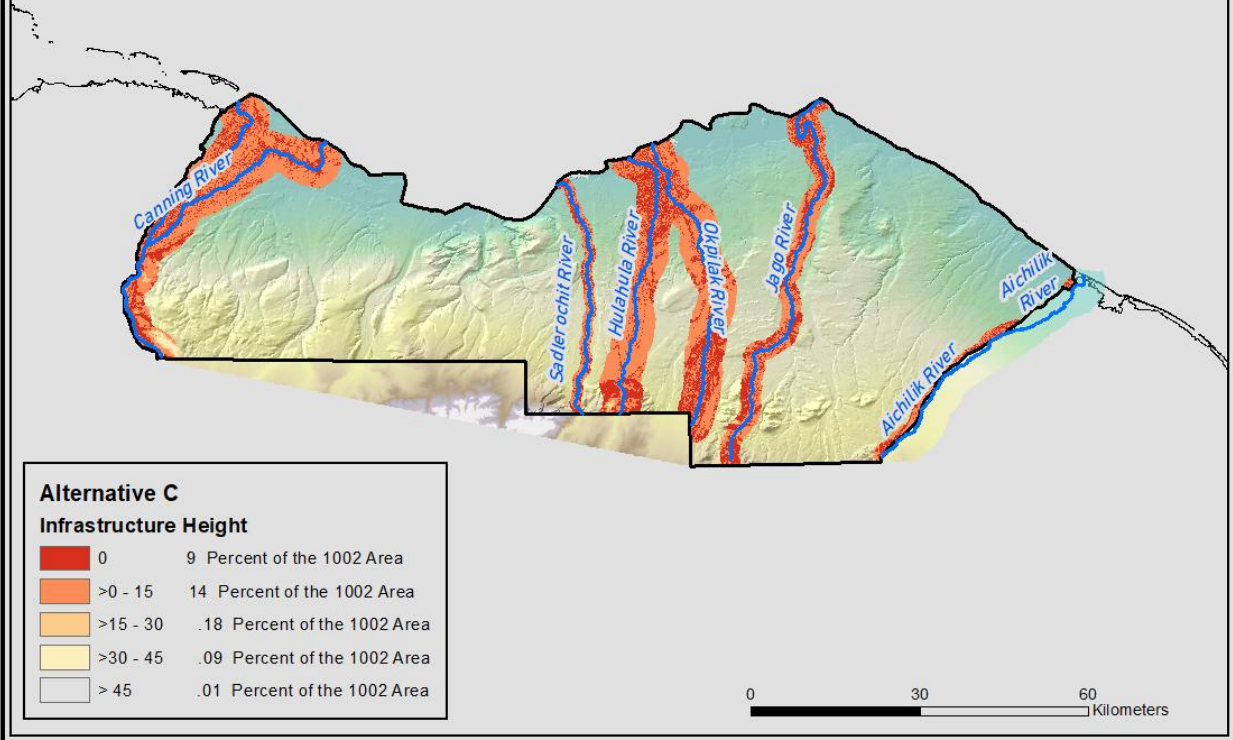
Structure Heights Visible  
From All Six Rivers, Combined





## Arctic Refuge 1002 Area

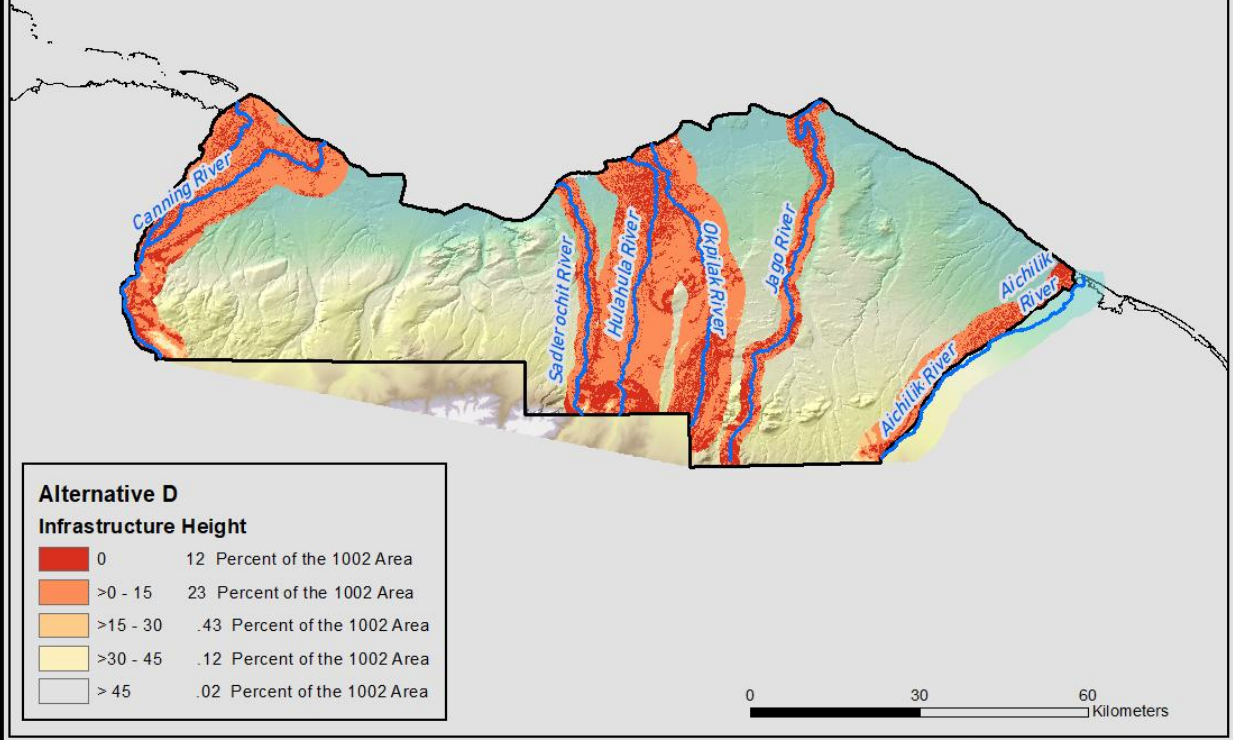
Structure Heights Visible  
From All Six Rivers, Combined





## Arctic Refuge 1002 Area

Structure Heights Visible  
From All Six Rivers, Combined





**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Crane, Drew  
**Sent:** 2019-02-22T19:50:44-05:00  
**Importance:** Normal  
**Subject:** Re: Draft FWS Comments Coastal Plain Draft EIS 022219.docx  
**Received:** 2019-02-22T19:51:02-05:00  
[Draft FWS Comments Coastal Plain Draft EIS 022219\\_DC.docx](#)

Minor changes in the cover letter for you.

Drew Crane  
Regional Endangered Species Coordinator  
Alaska Region  
U.S. Fish and Wildlife Service  
1011 E. Tudor Road  
Anchorage, AK 99503  
907-786-3323

On Fri, Feb 22, 2019 at 2:36 PM Wendy Loya <[wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov)> wrote:

Please provide any further edits you would like to see in the cover memo.

I will start editing the next 3 sections for content in General comments (adding, not removing) and formatting consistency in secs 2 and 3.

Thank you!

Wendy





## United States Department of the Interior

### FISH AND WILDLIFE SERVICE

1011 East Tudor Road  
Anchorage, Alaska 99503-6199



To: Nicole Hayes, Bureau of Land Management, Project Manager Coastal Plain Oil and Gas Leasing Program EIS

From: Greg Siekaniec, US Fish and Wildlife Service, Alaska Regional Director

Subject: Comments on the 2018 Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program for the Arctic National Wildlife Refuge, Alaska

The U.S. Fish and Wildlife Service (Service) appreciates the opportunity to review the Bureau of Land Management's (BLM) Draft Environmental Impact Statement (EIS) for the proposed Coastal Plain Oil and Gas Leasing Program in the Arctic National Wildlife Refuge (Arctic Refuge) for which we are a cooperating agency pursuant to the National Environmental Policy Act (NEPA).

Deleted: d

Our comments and recommendations are provided in accordance with the NEPA, Endangered Species Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Fish and Wildlife Coordination Act, Alaska National Interest Lands Conservation Act (ANILCA), National Wildlife Refuge System Administration Act, Wild and Scenic Rivers Act, and Public Land Order 2214.

#### Background

The Service prepared for working with BLM and its contractors on the development of the draft alternatives by initially completing rapid-response resource assessments completed in partnership with subject matter experts from Service and partner agencies and organizations, in January and February 2018. In June 2018, we gathered our subject matter experts for an internal alternatives workshop to bring together current information and draft proposed stipulations and ROPs, based off the 2012 National Petroleum Reserve Alaska Final Integrated Activity Plan/Environmental Impact Statement (NPRA IAP/EIS). In July 2018, we worked closely with BLM, its contractors and the other cooperating agencies at the BLM-hosted Alternatives Workshop to refine and revise draft stipulations and ROPS, and offer suggestions for a range of alternatives that would meet the requirements for an oil and gas leasing program set out in the Tax Act of 2017.

WORKING DRAFT FOR INTERNAL USE ONLY



## Preferred Alternative

The EIS must evaluate the effects of the various alternatives on the purposes of the Arctic Refuge, which are:

- *Preservation of unique wildlife, wilderness and recreational values;*
- *Conservation of fish and wildlife populations and habitats in their natural diversity;*
- *Fulfillment of international treaty obligations of the United States with respect to fish and wildlife and their habitats;*
- *Continued subsistence uses by local residents;*
- *Ensuring water quality and quantity within the refuge; and*
- *Providing for an oil and gas program on the Coastal Plain.*

Alternative D2 contains the primary elements put forth by Service during the alternatives workshop for cooperating agencies. With the modifications recommended for specific stipulations and Required Operating Procedures in the attachment, Alternative D2 is our preferred alternative for meeting all the purposes of the Arctic Refuge and best preserving the wilderness characteristics protected under the current Comprehensive Conservation Plan (CCP), including meeting management requirements to maintain river values (free-flow, water quality, outstandingly remarkable values) and preliminary river classifications for river corridors determined to be suitable additions to the National Wild and Scenic River System (NWSRS) in this area.

We note that preference for any action alternative should not be based on jobs creation, employment income, revenue to communities or government entities, or recovery/production of oil and gas resources because the Reasonably Foreseeable Development Scenario and associated analyses does not provide any differentiation of these factors among the alternatives. Therefore, decision-making should be weighted on the differing environmental consequences that are borne out in the analyses under the action alternatives. The Service's preference for Alternative D2 as the Environmentally Preferred Alternative is clearly justified by the analyses provided in the DEIS.

In order to expedite the NEPA review process, we provide more detailed comments and recommendations, as well as other editorial recommendations in the Attachment. Specific comments are organized into three sections:

- Section 1: General comments on the overall document
- Section 2: Comments on the Alternatives in the Draft EIS and the proposed stipulations and ROPs; and
- Section 3: Resource-specific comments from Service subject matter experts on the information and analyses presented in the Draft EIS.

Thank you for your continued coordination. We appreciate and value our cooperating agency status on this project, as the Service has managed the Arctic National Wildlife Refuge and its resources for several decades and has information and expertise that is valuable in finalizing the EIS. For questions regarding these recommendations please contact our Arctic Science

WORKING DRAFT FOR INTERNAL USE ONLY



Program Coordinator Dr. Wendy Loya at the Anchorage Regional Office at 907-786-3532 or via e-mail at [wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov).

Attachment

WORKING DRAFT FOR INTERNAL USE ONLY



**U.S. Fish and Wildlife Service Cooperating Agency Review,  
Arctic National Wildlife Coastal Plain Oil and Gas Leasing Program  
Draft Environmental Impact Statement**

General Comments (to be developed)

Many issues we identified during scoping have been included in the Draft EIS, which greatly improves the analysis of potential resource impacts. However, there are several aspects of analysis that should be improved or are missing from the document. Our key remaining general concerns for the project are described below:

The analysis and area estimates for 3-D seismic used in the Reasonably Foreseeable Development Scenario are only about 35% of the project area (900 sq. miles). This estimate originates from typical 3-D survey operations in the NPR-A. However, it is unlikely these efforts are comparable with proposed seismic plans in the project area. For example, Walker et. al (2019) assumed the entire project area would be explored and estimated a total of 37,800 miles of seismic lines could impact an estimated 235 sq. miles with long-term impacts. The document mentions that seismic exploration will be further detailed in the seismic Environmental Analysis, but the assumed timing presented in Table B-3 is highly uncertain. Details and analysis regarding seismic exploration in the program area should be explored further in this document.

We recommend including information referred to in other NEPA documents in the appendices so that information is accessible whenever the EIS is used.. All references to other regulatory documents should include chapter or page numbers to guide the reader.

The effects of a changing arctic environment should be further addressed within the EIS. For example, a recent study by Hjort et al. 2018 indicates that the effects of permafrost melt will be an engineering hazard to infrastructure by mid-century. Additionally, there are specific effects related environmental change such as ice wedge degradation leading to subsidence and changes in hydrology, snow accumulation and plant communities (Jorgenson, M. T., Shur, Y. L., & Pullman, E. R. 2006; Reynolds et al. 2014). Effects of these changes have been shown to be more severe in areas with topographic complexity such as the coastal plain (Liljedahl et al. 2016). Studies like these should be included in the analysis of potential impacts to various development scenarios. Additional information on this topic can also be found in Jorgenson et al. 2016, Frost et al. 2018 and Kanevskiy et al. 2017.

The Draft EIS does an adequate job describing the methods of preventing the introduction of invasive terrestrial plants, additional information about certified weed-free gravel and supplies for road corridor construction and pipeline construction need to be added. Additionally, the document does not adequately address the threat of introduced aquatic invasive species (e.g., Elodea), invasive terrestrial invertebrates, or invasive terrestrial vertebrates (e.g., rodents).

WORKING DRAFT FOR INTERNAL USE ONLY



The Draft EIS should also describe how the proponent will respond to an introduction. Additional recommendations specific to avoiding and minimizing adverse impacts associated with invasive species are provided in the Attachment.

#### Specific Comments

### **Section 1: Comments on Alternatives (including Stipulations and ROPs)**

#### **Comments on Specific Stipulations and Required Operating Procedures:**

##### **Stipulation 1: Rivers and Streams**

- The FWS recommended that a river setbacks be used to meet the objectives stated in Stipulation 1, which include the other Refuge purposes. Alternative D reflects the FWS recommended minimum of 0.5 mi setback for all identified rivers, with the larger setbacks identified for larger rivers, which include Wild and Scenic River values, have greater diversity of habitats within the river and riparian corridors, and support subsistence species and access, fish, polar bear habitat, recreation, springs and aueis, and other natural values. Overlaying the river setbacks on the viewshed study submitted by TrueNorth GIS suggests that Alternative D would set aside approximately 25% more land with NSO than the other alternatives, better protecting the species, habitats and activities identified in the Refuge purposes while encouraging oil and gas development through subsurface leasing. We recommend that all rivers identified in Alternative B have minimum setbacks of 0.5 mi under Alternatives B and C, except for spring-fed rivers which should have minimum setbacks of 1 mile.
- **(polar bears):** Given the high use of the Coastal Plain for denning by polar bears, especially when compared to the rest of northern Alaska, ensuring bears have access to preferred areas of denning habitat is important. This is especially important given that terrestrial denning is likely to continue increasing as sea ice conditions deteriorate further in future years. While Alternatives B and C provide some protection of high use polar bear denning habitat under Lease Stipulation 1, there are large areas where numerous polar bears dens have been recorded (Map 3-24) that do not have restrictions on surface occupancy. Even if surveys were conducted under MMPA Incidental Take Regulations to avoid disturbing denning bears in those areas, those regulations (and hence Stipulation 5 for Alts B and C) would offer no protections against behavioral avoidance of those areas once developed. This could effectively lead to a loss of preferred denning habitat. Stipulation 1 under Alternative D protects a much broader area of important, and highly used denning habitat than the other alternatives, especially in the central portion of the Coastal Plain.
- **(river corridors determined to be suitable additions to the NWSRS):** A final decision about the suitability of eligible rivers within the Arctic Refuge studied for potential inclusion in the NWSRS was made with the Record of Decision published in the Federal Register (Vol. 80, No. 70 / Monday, April 13, 2015 / Notices). This decision determined four Refuge rivers are worthy to pursue congressional designation for inclusion in the National Wild and Scenic Rivers System, each with wild classification, which denotes minimal access and development (CCP, Appendix I: Wild and Scenic River Review).



Interim management prescriptions for suitable/recommended rivers are meant to assure that a river maintains its suitable status while Congress reviews and considers a river for designation, whether determined through a congressionally authorized study or an agency-directed study. Interagency guidance directs land managers to develop interim management prescriptions for suitable rivers. The intent of the prescriptions is to maintain, not enhance, the current condition and values of each suitable river (CCP, Appendix I: Wild and Scenic River Review; and consistent with both 1982 National Wild and Scenic Rivers System Guidelines; and 1999 IWSRCC Study Process Technical Report). While maintenance of a candidate river's free flow, water quality, outstandingly remarkable value(s) (ORV), and preliminary or recommended classification is derived from (and limited to) an agency's existing authorities and subject to existing private land rights, it is the obligation of the USFWS to use those authorities to maintain suitable status and the wild classifications for suitable corridors *whether within or outside the project area, and to prevent* potential effects to the extent of existing Service authorities (Section 4.4 of CCP, Appendix I: Wild and Scenic River Review).

To that end, we recommend that Stipulations and ROPs condition the effects of an oil and gas leasing program wherever the program may affect each suitable corridor's free-flowing condition (including impedance of natural flow in rate or manner); water quality (including standards for aesthetics, and for propagation of fish and wildlife normally adapted to the habitat of the stream); ORVs (as specified for the overview and characteristics for each suitable river in Section 5 of the CCP, Appendix I: Wild and Scenic River Review); and recommended wild river classification (free of impoundments and generally inaccessible; with watersheds or shorelines showing little or no evidence of human activity, essentially free of structures and not containing roads, or other provisions for vehicular travel within the river area; and waters unpolluted (1982 National Wild and Scenic Rivers System Guidelines). Further, interim management prescriptions under the WSRA for the suitable Hulahula River require USFWS to maintain the "...cultural crossroads where cultures interacted and traded...with cultural exchange of national importance" and a place where "...the entire river corridor is intensively used by the Iñupiat people for a variety of subsistence purposes."

Alternatives B-D do not maintain the current condition of suitable rivers as their characteristics are described in Section 5.7. of CCP, Appendix I: Wild and Scenic River Review, and therefore do not meet USFWS interim management prescriptions. The river value and classification protections Alternative D provides for the Hulahula and Marsh Fork-Canning, the main tributary of the Canning River, (through more protective setbacks and ROPs for the Canning River) are beneficial, but additional recommended modifications are suggested for Alternatives B-D to maintain the current condition of suitable rivers.

Protecting suitable river corridor viewsheds to the maximum perceptible visible distance (e.g: how far an individual person would be able to see from any place inside a river corridor) is inherent to preserving most ORVs and the wild classification, and thus, meeting their interim management requirements. Information is lacking to adequately assess the impacts of Alternatives B-D to visual resources of these suitable river values



and their wild classification. Regardless of outstanding need, it is clear Alternative D as written, is the most protective of viewsheds for suitable rivers, and is preferred.

A lease stipulation category for maintaining suitable river characteristics and classification should be added; with the objective of maintaining water quality, free-flowing condition, identified ORVs, and wild classifications. Requirement/standard(s) should be added across alternatives B-D that provides complete viewshed protection buffers for suitable rivers (MF-Canning, Hulahula, and Kongakut Rivers). The viewshed buffers should be determined by considering maximum perceptible visible distances from within suitable river corridors affected by activities within the project area. Additional analysis is needed to determine what size the viewshed protection buffers should be for each suitable river.

Requirement/standard(s) should be added across alternatives B-D that prohibits infrastructure *within* maximum perceptible visible distances (e.g: how far an individual person would be able to see from any place inside a river buffer); or *above* heights that an individual person (spatially) is likely to be able see. Additional analysis is needed to determine the area extent of the infrastructure prohibitions/height limitations.

Analysis by FWS staff using available viewshed information conducted by True North GIS and submitted to the BLM and FWS for consideration in the DEIS shows most infrastructure with a maximum of 15m height would be visible (if built within any of the setbacks for the six rivers as described currently in Alternatives B-D). FWS staff analysis shows Alternative D (with approximately 750 km of the Coastal Plain protected by NSO setbacks on the six named rivers) provides complete viewshed protections for just under 12% of the project area (where infrastructure of any height would otherwise be visible from the rivers). Further, an additional 23% of the viewsheds from these six river corridors are protected when infrastructure is modeled to be at or below 15m in height, as specified in Alternative D. (see pers comm: Paul Leonard, "Re-analysis of Viewshed Modelling for the Arctic Refuge's Coastal Plain Major Rivers."

Protecting natural quiet (as well as natural sounds and noise ) is inherent to preserving river values for suitable rivers classified as wild and possessing recreational and cultural ORVs. We recommend that requirement/standard(s) should be added across alternatives B-D that specify that provides complete acoustic environment protections from within suitable river corridors.

Prevention of invasive species proliferation is inherent to preserving river values for suitable rivers, and is especially important along rivers and streams, which can readily transport invasive species into more remote areas. Interim management guidelines for suitable rivers prohibits the introduction of invasive species. Requirement/standard(s) should be added across alternatives B-D that prevents invasive species proliferation on suitable rivers.

We recommend either for a lease stipulation category for maintaining suitable river characteristics and classification or under Oil and Gas Field Abandonment, that requirement/standard(s) should be added across alternatives B-D that specify that before final abandonment, if a suitable river corridor's eligibility characteristics have been impacted by leasing and production activities, all eligibility findings and suitability



factors as specified in the Arctic Refuge wild and scenic river review, should be restored to a point where the area is again qualified for inclusion in the NWSRS. This standard would uphold the suitable rivers' recommendation to Congress for WSR designation.

Additional requirement/standard(s) should require the lessee to provide support to monitor and analyze effects on suitable river values and wild classification so we can monitor impacts and identify needs for changes in practices. We suggest including language that specifies before activities affecting suitable river corridors can occur: included in the APD, a plan be required for collection of baseline data documenting current suitable river characteristics; the required plan must use generally accepted best management procedures prescribed by the Authorizing Officer and approved by the USFWS for monitoring to detect when values are threatened, including thresholds for when activities should be ceased in those areas when values are found to be threatened; and the required plan must include a method for evaluating when threats are adequately mitigated and activities and subsequent monitoring can resume.

The requirement/standard(s) should also be designed to specifically maintain characteristics of the recreation and scenic ORVs for the Kongakut River, even though it is outside the project area. GIS modeling is needed to determine whether/to what extent a setback within the eastern boundary of the project area would be needed to maintain viewshed characteristics of the scenic ORV for the Kongakut River that attracts "people from around the world who wish to recreate in a stunning viewshed," with "spectacular views throughout its entire length" where the "extensive lagoon system (known as the Beaufort Lagoon), delta, perennial aufeis field, and Icy Reef also add to the viewshed." (Section 5.7.2 of CCP, Appendix I: Wild and Scenic River Review).

Lease Stipulation #1: Alternatives B-D prohibit permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines) within certain river corridors; and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. We recommend changing requirement/standard wording for Cannning and HulaHula rivers under all alternatives to include the following language to: "(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances in order to meet interim management requirements for the Marsh Fork-Canning and Hulahula Rivers under the Wild and Scenic River Review." Alternatives B-D seek to "minimize the disruption of free flow" but language should specify that the bar of *maintaining* free flow is required to meet USFWS interim management requirements for suitable rivers (see CCP, Appendix I: Wild and Scenic River Review).

- **(Recreation access)** Preservation of recreational hunting, fishing, hiking and boating values and opportunities is an original purpose of the Arctic Refuge and the majority of visitors recreate within the project area, so visitor use is an important resource to be addressed directly through this plan. Recreational access and prohibitions before, during, and after leasing and surface activity (where people can/cannot expect to be able to go, and what they expect to be able to do/not do) is not adequately addressed for Alternatives B-D, though it is clear Alternative D minimizes indirect and cumulative effects upon visitor experiences.



Recreation access should be treated as a distinct resource and we recommend a stipulation category addressing visitor use should be developed. Stipulations and ROPs for future exploration and development activities under this leasing program must be described, and must more directly specify the amount, timing, distribution, and types of recreation that will be prohibited and allowed, before, during, and after leasing and surface activity for Alternatives B-D. Proposed stipulation category: **Effects of Permitted Activities on Access to Recreation Opportunities** should contain a ROP with the objective that continuing recreational opportunities will be preserved to the extent possible for safety. Since The Canning, Marsh Fork-Canning (main tributary of the Canning), Hulahula, and Kongakut Rivers are highly valued and/or used by the public for recreation, this objective should also develop a ROP identifying how “Recreational Outstandingly Remarkable Values as described for the Marsh Fork-Canning, Hulahula and Kongakut Rivers shall be maintained,” consistent with USFWS interim management prescriptions for suitable rivers. (Note: The Hulahula “offers an unparalleled northern arctic recreational experience” and “hikers from around the world pursue adventure trips.” Sought for its wildlife-viewing opportunities, characteristics of the Hulahula recreational ORV, “...due to its scenery, accessibility, and floatability, attracts 10 percent of Refuge visitors.” Characteristics of the Marsh Fork’s recreational ORV, including “phenomenal holistic recreational experience, including...productive fishing holes...recreationists come to fish...with...several large grayling and Arctic char spawning areas, and a miniature subspecies of char...” need to be considered. Characteristics of the recreation and scenic ORVs for the Kongakut River need to be considered. GIS modeling is needed to determine whether/how large a setback within the eastern boundary of the project area would be needed to insure characteristics of the scenic ORV protections for the Kongakut River that attracts “people from around the world who wish to recreate in a stunning viewshed,” with “spectacular views throughout its entire length” where the “extensive lagoon system (known as the Beaufort Lagoon), delta, perennial aufeis field, and Icy Reef also add to the viewshed.” (Section 5.7.2 of CCP, Appendix I: Wild and Scenic River Review).) Along with this Stip and ROPs, a requirement/standards specifying the method by which the public will have opportunities to participate in decisions that may limit public access resulting from activities or infrastructure that are part of a leasing program should be developed.

- It is unclear as to why the setback distances are different across alternatives, what the ecological justification for the differences is and how different setbacks would or would not protect the stated objectives. We recommend a quantitative analysis of how the varying setback distances would ‘minimize the “disruption of natural flow patterns and changes to water quality’ be added for each alternative in Chapter 3.2.10, as well as the subchapters in Chapter 3 other stated objectives for this stipulation (subsistence, fish habitat, biodiversity).
- Requirements do not meet all of the stated objectives. recommend deleting the last sentence in the objective “Protect the water quality, quantity....across the coastal plain”, and include “springs and aufeis” in the first sentence following “riparian areas”.
- Sadlerochit Springs is poorly labeled on most maps, and while it appears to be within the Sadlerochit River, it is actually west of the Sadlerochit River and is a tributary to the



Itkilyariak River. We recommend that the Sadlerochit Springs and Creek, and Itkilyariak Creek-complex have a 3-mile setback in all alternatives in Leasing Stipulation 1 due to its cultural significance and unique terrestrial and aquatic communities. The Sadlerochit Spring Creek and Itkilyariak Creek complex have a unique endemic population of dwarf Dolly Varden and is an important subsistence use area. For more information see Arctic Refuge CCP 2015.

- To meet the objective and protect Refuge purposes, gravel mining sites should not be allowed in areas with NSO.
- It is difficult to address the adequacy of a standard that allows "case-by-case" approvals for development in nearshore waters when the objective is to protect habitat. The standard's adequacy will remain unknown until we know more about what will be approved and how those developments will fare over time. The standard states "exploratory drill pads, production pads, or CPFs are not allowed unless they're approved" which imparts significant subjectivity. We recommend that the EIS provide more clarity on how regular case-by-case approvals may occur and how they will be decided, including consensus between the BLM Administrative Officer and authorized FWS representative.

#### **Stipulation 2: Canning River Delta & Lakes**

- Water resources in the Canning River Delta including lakes represents some of the highest quality wetland habitat within the Refuge. Unlike the coastal plain ecosystems to the west of the Refuge, the Refuge Coastal Plain has considerably less lakes, and the Canning River delta and lakes therefore provide important habitat for fish and waterbirds. Protection of these habitats from disturbance is required to conserve fish and wildlife populations and habitats in their natural diversity and ensuring water quality and quantity within the refuge. Therefore, the FWS recommended No Surface Occupancy be allowed in this area except for essential infrastructure approved by the BLM and FWS in consensus. Thus, we support the requirements/standards outlined for Alternative D.

#### **Stipulation 3: Springs/Aufeis**

- Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters, rivers without springs, have no fish. This spring water is believed to be ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic grayling and Dolly Varden are major subsistence resources in the Arctic Refuge and their survival depends on about twenty springs within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition. Because the subsurface flow paths to perennial springs are unknown and could potentially be disturbed by drilling or fracking activity, we recommend buffer areas around the major perennial springs that support fish populations in which no leasing is permitted. This stipulation must ensure that these important and unique habitats and water resources are protected per ANILCA purposes of the Refuge, while accounting for uncertainty regarding sources and flowpaths of groundwater in the Coastal Plain.



- Specific protective setback distances should exist, but not be defined until studies of spring flows and sources are completed, as flow to springs may originate outside of even a 3-mile setback. Also, flows to springs likely traverse or originate in groundwater beneath permafrost; this groundwater is identified as the recipient water body for toxic drilling wastes via injection wells. Studies of springwater flows, including sources, must accurately identify and delineate surface water AND groundwater flow to and from springs; these flow patterns may be linear (channels) or large areas (aquifers) that require differently shaped buffers. Until these studies are completed, delineating specific protective buffers may be insufficient to protect these important aquatic habitats. Change the Requirement/Standard for Stipulation 3 under all Alternatives to: “Before exploratory or production drilling, the lessee/operator/owner would conduct studies to ensure drilling would not disrupt flow to or from, and waste injection wells will not contaminate any, perennial springs, unless such studies have been completed. Study plans would be developed in consultation with the BLM, USFWS, and other agencies, as appropriate.” Under all Alternatives but especially Alternative D, should add after all delineated buffers referring to “above” springs, the phrase “or to a distance that sufficiently protects groundwater sources and flows of (the named spring), whichever is greater.”
- Under alternatives B and C the requirement or standard for achieving the stated objective is that the “permittee would conduct studies in areas containing springs to ensure drilling would not disrupt flow of the perennial springs”. Under these alternatives there are no perennial springs identified, nor are there any setbacks suggested beyond what would be achieved by default under Stipulation 1, which was pertaining to rivers and streams and did not identify perennial springs. However, even the standards outlined in Stipulation 1 for rivers and streams would fail to protect the Sadlerochit spring because its origin and flow path is off to the west of the Sadlerochit River, much of the time farther away than the 0.5 mile NSO standard that was specified. Alternative D, as it relates to lease stipulation 1, similarly does not mention the springs or aufeis other than in the last sentence of the Objective. The perennial springs, however, are specifically identified in alternative D under lease stipulation 3. All the major perennial springs in the coastal plain are identified, locations are provided, and no leasing or surface occupancy setbacks are defined. The perennial springs, associated aufeis downstream, and the rivers they are associated with, are adequately protected to achieve Refuge objectives only in Alternative D.

**Stipulation 4—Nearshore marine, lagoon, and barrier island habitats of the Southern Beaufort Sea within the boundary of the Arctic Refuge (Map 2-2 and Map 2-4)**

- **(Overview)** As stated in the objective, nearshore marine, lagoon and barrier island habitats within the boundary of the Refuge provide important habitat not found anywhere else in the Refuge for diverse fish and wildlife species, many which are important subsistence resources. The nearshore environment in the southern Beaufort Sea, adjacent to the 1002 Area, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie and other rivers along the eastern Arctic coastline. The lagoons are relatively shallow, the amplitude of the tides is very small ( $\leq 30$  cm),



barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons become very productive environments during the brief summers and attract large numbers of marine and anadromous fishes. During winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, some lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments. In particular, coastal lagoons and river deltas are important molting and feeding sites for waterfowl, shorebirds, and loons and will require special protections.

Due to the abundance, diversity and accessibility of subsistence resources in this area, this zone is a significant subsistence hunting area. Allowing subsurface leasing while prohibiting wells and central production facilities to reduce disturbance of people and wildlife, and requiring needed coastal infrastructure be placed in approved locations brings benefits to industry while protecting the Refuge and subsistence users. The additional requirements for consultation with north slope hunters under Alternative D represents best-practices developed for NPRA and the Chukchi Sea leasing programs, and should be applied across all alternatives.

- **(polar bears):** As polar bear use of the onshore environment increases in summer/autumn due to sea ice loss, it will become increasingly important to reduce human-polar bear conflict, ultimately leading to reductions in polar bears killed in defense of life. While all Alternatives provide good protections for polar bears on barrier islands, Alternatives B and C are insufficient for attempting to minimize conflict when bears are active on the mainland coast. Bears move up and down the coastline during summer and autumn as they search for beach-cast marine mammal carcasses or subsistence whale remains. As such, the coastline provides an important movement corridor and habitat for resting for bears during summer and autumn. Alternatives B and C provide no temporal restrictions on activities which could lead to unnecessary conflict with polar bears. Alternative D restricts activities in this area to the time of year when polar bears are less likely to be moving along the coast, thus providing a good mechanism for reducing conflicts, and potential lethal removal of bears. We recommend that the requirements/standards from D be applied across all alternatives.
- Under Objective: 'waterfowl' is used, but should be 'waterbirds', and include 'sea birds and larids', since larids and seabirds are not covered by definition of 'waterbirds' on p. 3-86, or in Table J-9. Please change to "Objective: Protect fish and wildlife habitat, including that for waterbirds, larids, sea birds, and shorebirds, caribou insect relief..."

#### **Lease Stipulation 5—Coastal Polar Bear Denning River Habitat**

- **(polar bears):** Alternatives B and C provide no protections for the possible behavioral avoidance of important denning habitat even with a small development footprint. Alternative D allows polar bears unhindered access to large areas of their preferred denning areas in the Coastal Plain. This will become increasingly important as the density of land-based dens increases in future years due to sea ice loss. We recommend that the requirements/standards from D be applied across all alternatives.



- Changes in denning and/or disturbance needs to be monitored and evaluated over time. Recommend adding a requirement that a minimum of 5 years of study to detect polar bear dens be conducted for all proposed development in lease blocks that overlap with polar bear critical denning habitat. If changes and/or disturbance are identified are revealed then corrective measures can be taken. In order to do this they need to support monitoring efforts and analysis of data by Marine Mammals Management division of the USFWS and partners.

#### **Lease Stipulation 6—Caribou Summer Habitat**

- **(Overview)** As shown in Maps 3-21 and 3-22, the entire Coastal Plain of the Refuge is high value caribou calving and/or insect relief habitat, used by the Porcupine and Central Arctic herds. Female caribou with calves are sensitive to disturbance during the summer periods they inhabit the coastal plain, and thus the FWS recommended timing limitations described under Alternative D in order to minimize impacts on this internationally important herd and subsistence resource. Importantly, Alternative D2 allows for exceptions to the timing limitations if approved by the Authorized Officer in consensus with the FWS, to account for variability in the herd distribution. Because the uncertainty about how much development will occur when and where, Alternative D2 provides managers with the ability to regulate development activity if needed.
- Revise as: “Objective: Reduce disturbance of caribou and hindrance or alteration of caribou movements during periods when caribou are sensitive to disturbance”
- Requirement/standard: Add a statement that a monitoring plan will be developed and implemented to assess the effectiveness of ROP 23 and that modification or additional measures may be required in the future.

#### **Lease Stipulation 7—Porcupine Caribou Primary Calving Habitat Area (Map 2-2)**

- A significant number of scoping comments called for protection of the Porcupine Caribou herd calving grounds, as has been done for the Teshekpuk and Western Arctic herds in NPRA. In the absence of delineated Special Areas identified for NPRA, the Draft EIS has chosen to use high density calving habitat to delineate the area where disturbance should be minimized during calving. The FWS recommended the requirements under Alternative D to minimize impacts on caribou and their calves and protect the spring and fall primary migration corridor for the entire herd. The No Leasing restrictions occur in the area of lowest resource potential, while still allowing sufficient acreage to meet the requirements of PL 115-97. The timing limitations under Alternative B minimize construction activity during the calving period would only be effective during the 1-2 years of an individual wellpad construction, but would not minimize disturbance during exploration nor during 30+ years of operations. Alternative C would allow for exploration, which includes disturbance during summer for studies, “stick-picking” and other activities.
- Reword this Note as “For the purposes of this document, the PCH primary calving habitat area was defined as the area with a higher-than-average density of cows about to give birth during more than 40 percent of the years surveyed. It is recognized that



locations of important calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”

- Revise the objective as “Reduce the possibility of disturbance of caribou or hindrance or alteration of their movements in the south-southeast portion of the Coastal Plain, which has been identified as important caribou calving habitat during many years.”
- Requirement/standard: Add a statement that a monitoring plan will be developed and implemented to assess the effectiveness of these stipulations and that modification or additional measures may be required in the future.

#### **Lease Stipulation 8—Porcupine Caribou Post-Calving Habitat Area**

- Because of the level of activity, noise and larger footprint associated with Central Processing Facilities, the FWS recommended that they be prohibited from the lands identified as calving and post-calving habitat in Maps 3-22 and 3-23 for the PCH and CAH, as described in Alternative D. The footprint limits recommended in Alternative D are intended to avoid high-density infrastructure in this area and ensure that caribou can move freely and undisturbed through the area per the requirements of ROP 23.
- Revise as: “Note: For the purposes of this document, the PCH post-calving area was defined as the area with a higher-than-average density of cows during the post-calving period for more than 40 percent of the years studied. This includes and extends beyond the primary calving area. It is recognized that locations of important post-calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”
- Objective: To protect key surface resources and subsistence resources/activities from disturbance resulting from permanent oil and gas development and associated activities in areas used by caribou during post-calving and insect-relief periods.”
- Requirement/standard: Add a statement that a monitoring plan will be developed and implemented to assess the effectiveness of ROP 23 and that modification or additional measures may be required in the future.

#### **Lease Stipulation 9—Coastal Area (Map 2-2)**

- **(polar bears):** While an impact and conflict avoidance plan would help reduce conflict with polar bears, it is an insufficient protection for bears on shore in summer and autumn. First, it would not account for the potential behavioral avoidance of polar bears seeking maternal denning habitat. Additionally, while polar bears have been observed traversing oil facilities along the coast during summer/autumn, by not restricting infrastructure along the coast, there is still an increased risk of human-polar bear conflict that could lead to more bears being killed in defense of life, or that come into contact with hazardous materials which if consumed could be lethal. Thus, Alternative B does not provide sufficient protections for polar bear coastal habitat. Alternative C begins to make meaningful progress towards minimizing effects to coastal denning habitat and reducing the probability of human-polar bear conflict. However,



Alternative D would provide the highest levels of protections for polar bears and their habitat.

- Under Alt. B, recommend revising as follows: ....lessee/operator/contractor would develop and implement a USFWS-approved Polar Bear impact and conflict avoidance and monitoring plan.

#### Lease Stipulation 10—Wilderness Boundary

- The Service recommends that a setback be stipulated in order to protect wilderness values of the Mollie Beattie Wilderness Area from visual and acoustic disturbance associated with oil and gas exploration and development. The NSO setback should be based off viewshed and soundscape analysis. Without those data during alternative development, the Service recommended a 3 mile buffer to provide some protection, and thus supports Alternative D or a variation as refined by further viewshed and soundscape modeling.

#### All ROPs:

- The use of the word “minimize” as an objective in many of the ROPs is misleading. Minimizing impacts would require eliminating them completely. What is really meant here is to reduce impacts to a level deemed acceptable to resource users/managers without restricting operations to a level deemed unacceptable by industry. I suggest the word “minimize” be replaced with “reduce” or “mitigate” in all cases. Otherwise, revise as “to the extent that is economically feasible, minimize...” to each objective.(SArthur)
- We recommend adding a ROP under all alternatives the requirement for development of spill response plans, which is currently only under Stipulation 4, Alternative D, Standard iv (with *these edits*): “Operators would be responsible for developing comprehensive *spill* prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans and maintain adequate oil spill response capability to effectively respond during periods of *ice*, broken ice, or open water, based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM *and* USFWS.”

#### ROP 1:

- To meet all purposes of the Refuge, the Requirement/Standard for this ROP should read: “Areas of operation would be left clean of all debris, residual soil contamination, surface water contamination, and groundwater contamination where groundwater is hydrologically connected to springs.”

#### ROP 2:

- Please adjust wording as follows: The plan would be submitted to the BLM Authorized Officer ~~for approval~~, in consultation with federal, State, and NSB regulatory and resource agencies for approval, as appropriate.



- b. Lessees/operators/contractors would have **an approved** a written procedure.
- ROP #2.c: To protect the water quality standard inherent to the wild river classification, add: "i. within setbacks for all suitable rivers, no pumpable, solid, liquid, and sludge waste shall be disposed of by injection (as is the standard elsewhere). Rather, ADEC approved storage for backhaul shall be the standard method for disposal of pumpable waste products."
- Under disposal of rotting waste: Incineration of waste in open environments often attracts scavenging predators; including eagles. Eagles scavenging at incineration sites are often injured or die when attempting to pull food from smoldering or burning piles. To prevent unauthorized take (including injury or disturbance) of eagles we recommend appropriate exclusionary devices (grating, mesh, fence, etc.) be installed at all incineration sites to preclude access by eagles and other federally protected scavengers.

**ROP 3:**

- Recommended revision: The BLM Authorized Officer may allow storage and operations at areas closer than the stated distances if properly designed *and contained* to account for local hydrologic conditions.
- Add to the Requirement/Standard under all Alternatives language that requires secondary containment and spill response equipment for all fuel equipment and caches.
- For Alternatives B-D: To protect the water quality standard inherent to the wild river classification, insert a requirement/standard specific to suitable rivers: "Refueling equipment within setbacks for all suitable rivers is prohibited. Fuel storage stations would be located outside the setbacks except for small caches (up to 210 gallons) for motor boats, float planes, and ski planes, and for small equipment such as portable generators and water pumps, which would be located at least 100 feet from the active floodplain of suitable rivers."

**ROP 5: (Reduce air quality impacts "and protect health")**

- The Requirements/Standard section under ROP 6 should be moved in its entirety to ROP 5 and added to the current ROP 5 Requirement/Standard.
- Paragraph b and e -- to be able to determine air impacts to the Arctic National Wildlife Refuge, add "and Class II" after Class I areas.
- Paragraph g -- Ambient monitoring data can be used to determine impacts to Air Quality Related Values (AQRVs). This paragraph should include "or shows impacts above specific levels of concern for AQRVs".
- Understanding that BLM is the lead agency FWS requests the decision making role between the agencies be built on collaboration, consultation, and consensus for impacts to air natural resources.

**ROP 6:**

WORKING DRAFT FOR INTERNAL USE ONLY



- Suggest the following language under Objective, instead of what's there now. This is similar to language used on the Kenai NWR:

Consistent with the USFWS mandate for habitat protection within the project area(s), environmental damage and unnecessary or undue degradation of the lands must be avoided and minimized to the greatest extent practicable, including that which may be caused by vehicular traffic.

**ROP 8:**

- Requirement does not meet the stated objective or ANILCA purposes for the refuge. Edit objective to "In flowing waters (rivers, streams and springs) ensure water of sufficient quality and quantity to conserve fish and wildlife populations and habitats in their natural diversity. Requirement/Standard: for all Alternatives:
  - a. Withdrawal of unfrozen water from springs, rivers and streams during winter (onset of freeze-up to break-up) is prohibited. The removal of ice aggregate from grounded areas 4 feet deep or less may be authorized from rivers on a site-specific basis.
  - b. Water withdrawal is prohibited year round from the following rivers, streams and springs: Canning, Hulahula, and Sadlerochit rivers including Itekilyariak Creek, a tributary of the Sadlerochit River that drains the Sadlerochit Spring, and perennial springs on the Tamayariak, Sadlerochit (the spring is located just west of the main stem in a tributary of the Sadlerochit River), Fishhole 1 Spring on the Hulahula River, and the perennial spring on the Okerokovik River, which is a tributary to the Jago River.
  - c. Water withdrawal from other rivers and streams may be approved by the BLM Authorized Officer with adequate protection of hydrologic regimes, water quality and fish and wildlife habitats and populations.
- We recommend the ROP identify who will monitor these requirements/standards and how will operator determine the best approach to achieve required percentages and depths.
- Change the ROP to the following: "Withdrawal of unfrozen water **or ice aggregates** from rivers, streams, and springs during winter is prohibited. If it has been shown that no impacts to hydrology (including hydrologic flow paths) at breakup, channel morphology, and/or impacts to fish and invertebrates and their habitat will occur, withdrawal of up to 20% of ice aggregate from a grounded area ≤4-feet deep may be authorized on a site-specific basis if it is determined that such removal will not impact natural hydrologic regimes or habitats. This will be determined by the BLM authorizing officer in collaboration with the USFWS. Monitoring of hydrology and channel morphology prior to and after removal may be required. The design of the monitoring effort must be peer-reviewed to ensure the ability to detect changes in hydrology, substrate, and morphology."
- Under Objective: Should include 'waterbirds' after 'fish'.



- Edits to ROP 8 for rivers, streams and springs should be developed to address the suitable river interim management prescriptions that require the Refuge to maintain current river flow (free condition and natural flow volume) under objective: “Ensure water of sufficient quality and quantity to conserve fish and wildlife populations and habitats in their natural diversity.”

#### ROP 9:

- All Water Use: under g., interim management requirements for suitable rivers requires that the following be inserted: 1. Introduction of species not naturally occurring within the Refuge is prohibited on suitable rivers; the Authorizing Officer will oversee a plan to prevent water withdrawal equipment from introducing non-native species.
- Rationale for different withdraw volumes compared to NPR-A EIS: 1) impacts on species and habitat are unquantified (NRC 2003), especially impacts of removal of entire permitted volume; 2) lakes are relatively rare in the Arctic Refuge thus a much larger proportion of lakes will be impacted by water withdraw which would have more significant impacts to fish and wildlife in the area; 3) because lakes are rare, companies would be more likely to withdraw fully permitted volume; 4) the original and primary ANILCA purpose of the Refuge is to maintain adequate water quality and quantity to support fish and wildlife and their habitat.
- Change requirements a-d TO THE FOLLOWING FOR ALL ALTERNATIVES: “a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 10% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.  
b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 20% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep.  
c. Lakes with no fish present, regardless of depth: water available for use is limited to 20% of total lake volume.  
d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 10%, 20%, or 20% volume calculations.
- There are no requirements for determining fish presence prior to activities that could impact fish. Add the following requirement: Sensitive and nonsensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.
- Under Requirement/Standard: Connectivity to adjacent bird nesting sites should be included. Please change to, “Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas 4 feet deep or less during winter and withdrawal of water from lakes during the summer may be authorized on a site-specific basis, depending on water volume and depth, the fish community, and connectivity to other lakes or streams and adjacent bird nesting sites”.
- Alt D: This ROP is applicable to all birds. Please change “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime,



water quality, and aquatic habitat for migratory birds” to “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for birds”.

**ROP 10:**

- **(polar bears):** This ROP states that these restrictions do not apply to the use of equipment on ice roads after they are constructed. But this is inconsistent with the language below and also with standards promulgated in ITRs. Once an ice road is constructed, if a polar bear den is detected within 1 mile of it, industry will likely have to reroute the road. Also, none of the alternatives state how polar bear dens will be detected. While it’s true that ITRs will likely have requirements about detecting dens, this ROP doesn’t provide enough detail. Without a survey, there would be no known dens, and therefore no need to modify activity. I Section b under Alternative D seems necessary to be included in Alternatives B and C as well, given that there is a requirement that all known dens be avoided. Those dens can’t be avoided if a survey hasn’t been conducted. Additional, Section b should modify the date range to end on April 18th, as this is the upper tail of den emergence for land-based denning for bears in the Southern Beaufort Sea as calculated from data published in Rode et al. (2018) and summarized in USGS Alaska Science Center, Polar Bear Research Program (2018).
- Requirement/standard (a) states that use of vehicles and other equipment is prohibited within 0.5 miles of grizzly bear dens identified by ADFG, however ADFG does not identify grizzly bear dens in the Refuge. Revise this to state that grizzly bear dens will be identified by FWS, and if the data are not available then the lessee will provide funding to FWS to conduct the d to model habitat use (including denning, foraging and travel) by grizzlies in and around 1002.
- Recommend explaining in the EIS why are activities around grizzly dens prohibited within 0.5 miles but within 1 mile of polar bear dens.

**ROP 11:**

The project area is steeper, more incised, and includes more river systems compared to flat areas in NPRA where extensive 3D-seismic surveys have been conducted. Topography strongly affects snow, hydrology and permafrost regimes of this generally hilly region and increases the potential for significant impacts to vegetation. Detailed microtopographic transects across existing 3D seismic trails show that there is compression of the tundra vegetation mat that is up to 20 cm. These changes to microtopography within the track cause other changes to snow, hydrology, and thermal regimes, which make the tracks visible from the air and set the stage in some areas for thermokarst and thermal erosion. Changes in the microtopography and compression of the vegetation mat also would have likely large consequences to habitats of many species of plants, insects, small mammals, and birds (Walker et al. 2019). In order to minimize these effects, we suggest the following:



- For Alts B-D, change requirement/standard h. to “...overland travel *must* be monitored by agency representatives, and the operator *will* be required to accommodate the representative during operations.”
- Alternatives A-D contain no language about how snow depth/density will be measured and by whom. Suggest a snow monitoring plan, that outlines measurement protocols (occurring before and during operation) be submitted to BLM for review in conjunction with FWS prior to work being conducted to ensure habitat impacts are avoided.
- Under Requirement/Standard “a,” all Alternatives, indicate that the exact dates are determined annually.
- Change Requirement/Standard “b,” second sentence, under all Alternatives to read: These vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra *caused by* shearing, scraping, ....”
- Alternatives A-D treat physiographic regions across the program area as homogenous. Suggest a delineation of regions with tundra travel opening criteria based on terrain ruggedness, elevation, and landforms (e.g., Map 3-1).
- Alternative D (standard a) mentions measurements should be made ‘over the highest tussocks’. No features are mentioned in alternatives A-C leaving the question open from where measurements can originate. Suggest standardizing across alternatives (e.g., ‘above tussock tops’).
- The following is required on the Kenai NWR for work outside of an existing oil/gas unit:

Permittee will provide for on-site environmental monitoring of proposed project. Said environmental monitor(s) will be responsible for overseeing all aspects of field operations within the Refuge for compliance with stipulations of this Permit and with other applicable federal, state or local regulations. The USFWS must be kept informed in a timely manner of all operations conducted on Refuge lands. The environmental monitor(s) will therefore provide a progress report of field operations, in writing, on a daily basis to the USFWS.

- We also require that, prior to hiring these environmental monitors, USFWS be able to review resumes of any of these people they are considering hiring for the job to ensure they have adequate credentials and experience.
- The following conditions are required for seismic work outside of an existing oil/gas unit on the Kenai NWR but could also be used for oil/gas development activities:
  - Permittee will provide a single point of contact for coordination between field crews and Refuge staff during all phases of the seismic survey operations. This employee will be responsible for adherence to the Permit stipulations, checking avoidance buffers, holding pre-project meetings with key operations staff, answering Service questions regarding the project, providing written or verbal daily reports of field operations, and reporting all spills in accordance with Permit stipulations as well as state and federal regulations. The point of contact will coordinate with the USFWS for transportation to the project area for routine inspections of ongoing activities (as necessary), in addition to a final



inspection of the project area to determine compliance with the terms of this Permit.

- Permittee is responsible for ensuring that all personnel, including those of its assigns, conducting activities authorized under this Permit are familiar with and adhere to its General and Special Conditions.
- Permittee will provide a detailed schedule and locations of project activities to the USFWS as soon as possible, but in no case later than 30 days prior to initiation of project operations within the Refuge. Before program commencement, a map will be required that, consistent with the intensity of seismic activities as described in the Environmental Action Statement, depicts planned routes of travel, the planned array of seismic lines and locations of shot holes, and locations of any support facilities required including fuel storage sites, and satellite areas of storage of explosives. All of these sites located on Refuge lands must be approved by the USFWS before onset of field operations.
- For major projects such as this one, there is a constant shuffling of contracted labor, in and out of the field, where new employees are coming and going from all over the country. It is therefore prudent to ensure that each time a new hire comes onboard that they be required to review and become familiar with all of the stipulations and requirements.
- Under **Requirement/Standard h**. Seismic operations and winter overland travel may be monitored by agency representatives, and the operator ~~will~~ ~~may~~ be required to accommodate the representative during operations.
- Requirement/standard (a) for alternative D should be changed to the following to help ensure protection: "Snow depth and density and vegetation data should be collected where ground operations will actually be occurring. There is a great deal of evidence that shows how variable these conditions are even within the same watershed. The exact dates should be determined by the BLM authorized officer in coordination with the USFWS."
- For all Requirements/Standards that need to be approved by the BLM authorized official, the decision on approval should be made in coordination with USFWS subject matter experts familiar with the area. Winter ground operations are known to have negative impacts on the tundra. These impacts have cascading effects on water quantity, water flow paths, and habitat quality for fish and wildlife.

**ROP 15:**

- May be in conflict with ROP 11, standard G.

**ROP 16:**

- The two statements in the Requirement are contradictory. We recommend removing the 2nd statement, e.g. on a case by case basis, and require that only directional



drilling be allowed for exploratory purposes, to avoid impacts in the floodplains of these streams.

- Non-fish bearing systems provide important habitat that supports invertebrates, migratory birds and other wildlife. Change requirement to the following for all alternatives to help ensure protection of fish, invertebrates, riparian vegetation and water resources:

Exploratory drilling is prohibited upon or within 100-year flood plain of streams and rivers, on or within 2,000 feet of the ordinary high water mark of potential fish-bearing lakes, and 1,000 feet as measured from the ordinary high watermark of non-fish-bearing water bodies unless further setbacks are stipulated under Lease Stipulations.

**ROP 19:**

- a. Pipeline and road crossings would be permitted on a case-by-case basis by the BLM Authorized Officer, following coordination with **and approval by** the appropriate entities.
- Statement in Requirement/Standard a. should read "...unless further setbacks are stipulated under lease stipulations 1, 2, and 3."
- ROP #19a and c.: Alternatives B-D allow for non-permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines); and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. Change requirement/standard wording to: "(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances outlined below that would threaten the preliminary wild classification of suitable rivers characterised by impoundment-free, essentially primitive, inaccessibility except by trail, and water quality maintained to current natural condition..."
- ROP #19c.: Change to: "Siting temporary winter exploration and construction camps on river sand and gravel bars is allowed and encouraged, *except on suitable river setbacks.*"

**ROP 21:**

- For any gravel-related work, where that gravel is brought in from off the Refuge, should require Certified Weed-Free Gravel be used, as is done in all instances on the Kenai NWR, to lessen chances of introducing invasives.
- Edit "e" to read, "Using approved impermeable liners under gravel infrastructure to minimize the potential for hydrocarbon and other hazardous materials spills to migrate to underlying ground or adjacent water resources."

WORKING DRAFT FOR INTERNAL USE ONLY



- j. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow. (intent is to address the topography/gradient difference of the refuge as compared to the NPRA)

**ROP 22:**

- Recommend the following changes:
  - d. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow.
  - a. To allow for sheet flow and floodplain dynamics and to ensure passage of fish and other organisms, *single span* bridges are preferred.....
  - Add the following to requirements: d) 5 years of data on stream flow, seasonal patterns in lake connectivity, and sheet flow shall be collected prior to planning bridges and culverts. These data will be stored in a centralized database and available to the general public.

**ROP 23:**

- These recommendations were developed for the CAH. Given the differences in herd and range characteristics, they may or may not be appropriate or effective at mitigating impacts to the PCH. We recommend adding to the requirement that a monitoring plan will be developed and implemented to assess the effectiveness of these requirements and that these may be modified or additional restrictions may be added to make them effective measures for the PCH.
- Ten years does not seem like an appropriate interval for studies of movement to inform industrial activity given the large inter-annual movement patterns observed for the herds, especially the PCH. There is a long-term record. Additionally, what constitutes an “acceptable study” should be further defined because it’s unclear what that means at present. We recommend that any development proposal should include funding for studies of caribou movements before, during and after completion.

**ROP 24:**

- ROP 24 addresses gravel mines. But why place standards/restrictions on an surface use activity that doesn’t even merit being included in the accounting of the legally mandated limit of 2000 acres of disturbance? Referring to Appendix B, “gravel mines” fit cleanly within the ordinary dictionary definition standard that the document provides. A gravel pit will be “established for a particular purpose” in this case solely to “facilitate” development, production, and transportation of oil and gas from the Coastal Plain. The analyses (use of surface with long-term environmental consequences for the sole purpose of facilitating oil and gas activities) conflicts with the conclusion that gravel mines are not a facility to be included in the 2000-acre limitation on surface use. In effect, the interpretation would seem to arbitrarily change the 2000-acre limitation to 2,300 acres of surface use.



- ....The plan would be developed in coordination with **and approved by** the appropriate entity...
- ROP 24: For alternatives B and C, in Requirement/Standard: suggest deleting “c. Potential use of the site for enhancing fish and wildlife habitat.” It may be that fish will eventually find gravel pit water reservoirs and use them, but it would not be in keeping with Refuge purposes to promote this. ROP 24: Any impoundments affecting suitable rivers would threaten the interim management responsibilities of USFWS to maintain free-flowing condition.
- ROP 24: Alternatives B and C should include the Requirement/Standard “a” that is in Alternative D. Gravel pits and subsequent water storage excavations should not be in the major fish bearing rivers if that can be avoided. Also, Requirement/Standard “a” in Alternative D can be modified to read “...floodplains of the three rivers...” and remove the Aichilik River from the list of major fish bearing rivers because it is outside of the 1002 Area.
- ROP #24 a.: Alts B-C: Change gravel mine site language to “Locate outside the active floodplain; *except where further setbacks are stipulated under Lease Stipulation 1.*” Alt D: insert additional requirement: “Construction of gravel mine sites or water reservoirs may not be considered within the setbacks stipulated for suitable rivers under Lease Stipulation 1.”
- There is a need for mining restoration plans (see 2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003). Add the following requirement to each alternative: Each proposed mine site shall have a USFWS-approved restoration plan and effectiveness monitoring plan prior to site approval and construction.

**ROP 25:**

- USFWS should be allowed to monitor during operations to determine if there is an issue. An annual report does nothing to prevent these changes. Therefore, recommend requirement that USFWS be involved in the development and approval of a Plan to address this deficiency as well as assist in monitoring during on-going activities.
- “*Objective: Avoid human-caused changes in predator populations of ground-nesting birds.*” Lessee needs to support/fund monitoring efforts by FWS.

**ROP 27:**

- The Service recommends the use of lattice towers and avoidance of guy wires which pose a significant collision risk for birds.
- Page 2-29 ROP 27: Under Requirement/Standard: The Avian Power Line Interaction Committee produced a document in 2012 with guidance for reducing bird collisions with power lines. We recommend the Requirement/Standard include complying with the most up-to-date, suggested practices as published in the 2012 APLIC document, “Reducing Avian Collisions With Power Lines: The State Of The Art In 2012” and future



updates to this guidance to minimize collisions and subsequent unauthorized take of eagles, other protected species, and birds in general.

- Under Requirement/Standard: If exceptions are granted to the requirement/standard, wires would pose a risk to birds, but mitigation measures are available. Please change to, "If exceptions are granted allowing overhead wires, overhead wires would be clearly marked along their entire length to improve visibility to low-flying birds. Such markings would be developed through consultation with the USFWS", after items "i" through "iii:".

**ROP 28:**

- Current plans for developing an Ecological map does not specify including information on habitat needs of priority birds and mammals to help determine *a priori* which land is most likely important for these animals. Information currently available on habitat suitability should be part of the ecological mapping process. Further >1 year of surveys is needed to understand wildlife values, particularly for species showing large variation in numbers from year to year (e.g., opportunistic shorebirds such as Pectoral Sandpipers, Red and Red-necked Phalaropes, Buff-breasted Sandpipers).
- Their proposed "*ecological land classification map of the area*" is too simple to address the objective. A database and map and models of likelihood of use need to be developed for targeted species. As stated above, more than one year of data is needed.
- The requirement should include cooperation with the USFWS to assess the information necessary for a plan.

**ROP 29:**

- Add to requirement/standard: "Cultural Outstandingly Remarkable Values as described for the Hulahula River shall be maintained."
- **Standard condition for work on Kenai NWR:**

If the Permittee discovers any historic, prehistoric, or archaeological sites or artifacts during the course of field operations, all activity at that site shall cease and the State Historic Preservation Office in conjunction with BLM and USFWS shall be contacted immediately but not more than 24 hours after the incident occurs.

**ROP 30:**

- **Avoid and reduce temporary impacts on productivity from disturbance near Steller's or spectacled eider nests:**

Please return the units in this ROP to 200 meters rather than 656 feet. Use of English units implies a level of precision and exactness that is not appropriate and throughout our other Biological Opinions and BLM's NPR-A ROPs and Stips metric units are used. This change will ensure consistency and reducing confusion.



- Under Requirement/Standard: Activities associated with removal of less than 100 cubic yards of bedrock outcrops, sand or gravel from cliffs also have potential to result in raptor mortality and nest/territory abandonment (all of which are prohibited under the Bald and Golden Eagle Protection Act). To avoid unauthorized take of these protected species, project proponents must consult with the Migratory Bird Management Permit Office prior to conducting these activities. The presence of nests may not preclude the work, but an Eagle or Eagle Nest Take Permit may be required before work commences to avoid unauthorized eagle take. Please add a statement that lessee/operator/contractor will consult with the USFWS Migratory Bird Management Permit Office prior to conducting activities that disturb potential eagle habitat.

**ROP 33:**

- In order to monitor and assess and impacts of construction on wildlife movements leasee needs to support/fund studies and monitoring efforts. Not just provide information on locations of new infrastructure.

**ROP 34:**

- The ROP needs to include text about minimizing disturbance to denning polar bears, as well as those active on the coast during summer and autumn. It is lacking for all alternatives.
- Under Requirement/Standard, Effects of low-flying aircraft on wildlife: To avoid unauthorized take (including disturbance) of eagles, aircrafts operating within 0.5 mile of any eagle nest should be prohibited below 1,500' regardless of nest substrate. As currently written, the ROP only precludes aircraft activity around nests on cliff substrates. In reality, protected nests may be located on almost any substrate type including the ground (e.g. owls) or in trees (e.g. bald eagle). Furthermore, it should be noted that any eagle disturbance regardless of activity type (including takeoffs and landings) is prohibited by federal law without a USFWS Eagle or Eagle Nest Take Permit.

**ROP 35:**

- The lack of adequate restoration plans and adequate bonds to cover reclamation of areas impacted by oil and gas development on the North Slope is a major problem (2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003)). Restoration standards need to be set in stipulations in this EIS. It should also be clearly stated what level of restoration will be required before land is no longer considered part of the infrastructure development cap. Restoration plans should be required and reviewed prior to issuing a lease.
- Literature does not support that this objective can be obtained, see Becker et al. 2016; Walker et al 2019; NRC 2003; GAO 2002.
- Under Alt. B & C ...would be adequately reclaimed to ensure eventual restoration of ecosystem function, productivity and value. The leaseholder would develop and implement a BLM and USFWS-approved abandonment and reclamation plan. (LKahn)



- Under Alt D ...would be restored to ensure eventual restoration of ecosystem function, **productivity and value**, and meet **adequate** ~~minimal~~ standards.... (LKahn)
- The leaseholder would develop and implement a BLM- **and USFWS**-approved abandonment and reclamation plan.
- Under all Alternatives, change "...visual, hydrological, and productivity objectives..." to "visual, hydrological, *contamination*, and productivity objectives..."
- Not sure if this is the most suitable place to include this condition, but this is required for activities on the Kenai NWR:

All survey flagging, stakes, wire, or other debris associated with this program must be removed from the Refuge. However, shot points may remain identified to assist the required summer cleanup crew until that project has been completed and final approval is received from the USFWS.

Within **Subsistence Consultation for Permitted Activities**: add a ROP above current ROP #36 with this objective: "Cultural Outstandingly Remarkable Values as described for the Hulahula River shall be maintained," and requirement/standard to provide opportunities for subsistence users to participate in interim management methods to develop and maintain cultural ORVs.

**ROP 36:**

- Change Requirement/Standard, line "d" to, "...assess and appropriate range of potential effects on resources and subsistence, *including contamination of those resources*, as determined..."

**ROP 40:**

- Please see comments under **ROP 11** regarding requiring 3rd party environmental monitors.

**ROP 41:**

- Along with approved studies that stipulate individual vehicles, suggest adopting general stipulations similar to guidance from state of AK DNR about summer off-road travel including:
  - Operations shall be restricted to dry uplands whenever possible
  - The crossing of wetlands shall be kept to an absolute minimum
  - Multiple passes over the same area shall be kept to a minimum
  - All operators should be made familiar with arctic vegetation types to ensure compliance

**ROP 42:**

- Chasing wildlife with ground vehicles **or aircraft** is prohibited.



- Add statement that disturbing nesting birds is prohibited, unless deemed to be an invasive or invading species that may negatively impact other animals that are deemed to be a priority.
- Under Requirement/Standard: Disturbance to both eagles is prohibited under the Migratory Bird Treaty and Bald and Golden Eagle Protection Act. Appropriate spatial buffers around nests may be required to avoid take (including disturbance) by project activities. Buffer distances are both species and activity (e.g. land clearing, vehicle operation, building construction, pile driving, aircraft operation, etc.) specific (see USFWS Bald Eagle Management Guidelines and USFWS Golden Eagle Disturbance policies). Buffer sizes range from 330' to 2 miles. To avoid violations, the USFWS recommends project proponents apply for a USFWS Eagle and/or Eagle Nest Take Permit prior to conducting any activity with potential to take (including disturb) eagles or their nests (occupied or unoccupied).

**ROP 43:**

- If gravel is to be brought in from off the Refuge, Certified Weed-Free gravel must be used.
- Monitoring annually will not allow for adequate eradication and control measures to be implemented. Because most invasives are wind-dispersed, if anything is detected, it must be eradicated immediately, not the following year. Therefore, all appropriate NEPA documents, Refuge Pesticide Use Permits, and Certifications must be in place prior to any oil/gas activities occurring on the Refuge, to allow an ADEC-certified chemical applicator to conduct eradication/control efforts at a moments notice, in response to the observance and documenting of invasives during growing season.
- Executive Order 13112 (1999) requires all federal agencies to prevent the introduction of invasive species; provide for their control; and minimize their impacts to the local economy, ecology, and human health. In consultation with the USFWS, the operator/contractor shall develop and implement a long-term monitoring and treatment plan for invasive plant species, in conjunction with the authorized work.

This plan shall be developed within 60 days of start of work, for review and subsequent approval by the USFWS.

- **Two standard conditions used by Kenai NWR:**

Due to the potential long-term impact to the Refuge from the introduction and dispersal of non-native plants, the operator/contractor shall utilize weed-free staging areas for crews, aircraft and equipment to be used for project operations within the Refuge. Prior to their use on or transport into the Refuge, specific best management practices will be developed and implemented to clean and decontaminate helicopters, drilling equipment, crew clothing and other potential vectors of injurious invasive species. Power washing or steam-cleaning of all potential seed transport surfaces (equipment, helicopter skids and boots of work crews) prior to entering the Refuge will be required.



All equipment and vehicles that access the Refuge are required to be cleaned of any attached grease and grease residue on wheel tracks, undercarriage and engine. In addition, equipment shall be cleaned of all mud, dirt, and plant parts to reduce the potential for introduction of non-native and invasive plants. Cleaning shall occur at an appropriate vehicle washing station or steam cleaning facility (power or high pressure wash) off of Refuge lands.

Change R/S to read: “...detailing the methods for cleaning equipment and vehicles, including off-site disposal of cleaning fluids or materials and detected organisms, and monitoring...”

- An approved Invasive Plant Management and Response Plan must be in place that addresses all approved chemicals for use on the Refuge, certifications of those who will be applying those chemicals and how often those chemicals can be used.
- Erosion waddles and similar have been identified as vectors for invasives. Therefore, these must be certified weed-free prior to allowing their use on the Refuge.
- There are so few invasives that have been documented north of the Brooks Range that it is imperative a project of this magnitude be required to implement a higher standard of care when addressing the potential for the spread of invasives. Therefore, all equipment must be thoroughly washed at the point of departure to ensure invasives are not brought onto the Refuge. If being transported on trailers up the haul road, by barge or plane, all equipment should be cleaned at the point of departure and NOT cleaned in Deadhorse, Kaktovik, etc.

### Additional Stipulations or ROPS

- We recommend adding under all alternatives the requirement for development of spill response plans, which is currently only under Stipulation 4, Alternative D, Standard iv (with *these edits*): “Operators would be responsible for developing comprehensive *spill* prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans and maintain adequate oil spill response capability to effectively respond during periods of *ice*, broken ice, or open water, based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM and USFWS.” Alternatively, create a Stipulation or ROP to address this requirement, which is actually required across all habitats. Any requirement for development of spill response plans should reference water quality standards for a suitable river’s preliminary classification (see CCP, Appendix I: Wild and Scenic River Review and 1982 National Wild and Scenic Rivers System Guidelines).
- A major problem with oil development on the North Slope has been the lack of data to assess what the cumulative impacts of oil and gas development are (see National Research Council Report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska’s North Slope (2003)). Standards for effectiveness monitoring need to be defined in stipulations or there needs to be a stipulation that includes development of



an effectiveness monitoring plan (and centralized publicly accessible database) that would be prepared in consultation with the USFWS and implemented by lessee/operator/contractor. At a minimum the following requirement should be met for all effectiveness monitoring programs: statistically valid sampling designs with clearly defined levels of inference and change detection capabilities. Without a properly designed long-term effectiveness monitoring program and publicly accessible database, there is no way to detect impacts and employ adaptive management techniques. When pre-development monitoring will not occur, general methods for selecting control sites using a statistically valid approach is necessary. Requirements for a research and monitoring program need to be clearly defined in this EIS.

## **Section 2: Resource-specific comments**

- **Subsistence and Section 810 Analysis**

**Section 810 Analysis Comments, Appendix E:**

- Conclusions of no positive findings for Alternatives B, C, and D are not justified, particularly in light of a positive finding for the cumulative case. The potential impacts on caribou abundance, distribution, and movements are far more likely to affect availability of caribou to subsistence users throughout the PCH range than the relatively minor, local effects of limiting access by Kaktovik residents to some areas on the coastal plain. Statements such as “Potential impacts on subsistence resources and access from future oil and gas exploration, development, and production would be minimal or would be adequately mitigated by stipulations or ROPs...” (page E-10) are extremely optimistic, given that these recommendations were mostly developed for oilfields farther west, and have not been tested for the PCH. Perhaps they will be effective, but there is substantial uncertainty regarding their effectiveness or adequacy in this situation. This means that there is a significant chance that abundance and/or movements of the PCH could be substantially affected, with resultant effects on availability of caribou to subsistence hunters throughout the herd’s range. This uncertainty should be acknowledged by a positive determination for all the action alternatives.

- Caribou migration, habituation, and access (Joshua Ream)

Section E.3-22. page E-7 states : “In general, caribou responses to aircraft adhering to effective stipulation measures tend to be short-lived (Fullman et al. 2017).” In reality, the jury is still out on this point and Fullman et al. (2017) has been frequently mischaracterized in the literature. These authors used a limited dataset on take-offs and landings and did not consider flight altitude and patterns near the herd, distance from lead caribou, private aircraft, disturbance near narrow mountain corridors or any number of potentially



important factors. They do however indicate that their results are limited to movements within the Noatak River valley. I would argue that this paper does not lend itself to the broad application suggested in the 810. Additionally, it should be highlighted that the short-term effects of aircraft activity on caribou movements and resultant hunter success may be critical to subsistence opportunity and food security.

Section E.3-22. page E-7 states: “Low-level flights or maneuvering in the presence of unhabituated caribou can elicit increased speed and abrupt direction change. Alternatively, caribou can become habituated to aircraft, particularly when aircraft pilots maintain altitudes greater than 500 feet above ground level and do not haze or harass the caribou (Valkenburg and Davis 1983).” Habituation and avoidance behavior may take quite some time and this should be pointed out in the 810. A recent OSM analysis included the following:

Studies [of caribou] have also reported reduction in the use of areas within 5 km from infrastructure and human activity (including aircraft) by 50–95% for weeks, months, or years (Vistnes and Nellemann 2008, Flydal et al. 2002).

Section E.3-22. page E-7 states : “Caribou crossing success would vary by season, behavioral motivation, level of habituation, and activity levels” but also on p. E-6 “Caribou abundance or availability and the subsistence use thereof would not likely be affected as a result of direct habitat loss.” These seem incongruent as there are too many unknowns about the short/long-term changes to migration patterns that may result. These changes could be catastrophic, if even temporary, if caribou move further from communities and traditional hunting grounds. Caribou migration patterns are very complex and the Fullman et al. (2017) paper, though a useful starting point, should not be considered definitive evidence of minimal effect. As mentioned in previous comment, habituation can take months or years.

- Meaningful Subsistence Experience (Joshua Ream)

P. 3-121 of the draft EIS includes the following:

In addition to affecting resource availability, future noise, traffic, and human activity may also affect user access by deterring subsistence users from their usual harvesting areas. Avoidance of subsistence use areas due to development has been documented in Nuiqsut (SRB&A 2017) and would likely occur for some Kaktovik harvesters if development occurs in their harvesting area. Residents may experience discomfort hunting in the presence of outsiders; may avoid hunting near areas of high air or ground traffic because of a perceived or actual reduction in the availability of subsistence resources; may avoid hunting near activity due to safety concerns; or may consider noise pollution and increased human activity to degrade the subsistence experience.

While I was happy to see some language included on the potentiality for degradation of a meaningful subsistence experience in the EIS, nowhere is this included in the 810. ANILCA

WORKING DRAFT FOR INTERNAL USE ONLY



protects and recognizes many values associated with subsistence, far beyond the nutritional value. In fact, in *Quinhagak vs. United States* in 1994, the 9th Circuit Court of Appeals rules the the defendant “accorded insufficient weight to the Villages’ evidence of harm to their culture and way of life.” The cultural values associated with the subsistence “experience” need to be explicitly stated. In one example, noise pollution may affect these experiences as was noted in Chapter 3. Halas (2015) reports important factors affecting the subsistence experience and has not yet been cited in the draft EIS.

One potentially relevant quote from this paper:

Whether the aircraft intentionally or unintentionally may be ‘influencing’ caribou movement, observing ‘scared’ caribou can be a powerful experience for hunters. Observations of caribou disturbance may impact the quality of a good hunting experience for a subsistence hunter. Respondents who perceived that caribou are impacted by the behavior of aircraft may evaluate their own harvest success to the interaction between aircraft and movement of caribou.

- **River corridors determined to be suitable additions to the NWSRS**

Section 3.4.7, page 3-210 under Wild and Scenic Rivers, third paragraph: In order to better align this section with interim management guidance, the statement “...however, where practicable and where it does not conflict with the purposes of PL 115-97, stipulations...” should be changed to “...however, USFWS interim management guidance requires that river values and recommended wild river classifications must be maintained using existing management authorities (see CCP, Appendix I: Wild and Scenic River Review; and consistent with both 1982 National Wild and Scenic Rivers System Guidelines; and 1999 IWSRCC Study Process Technical Report). Stipulations...”.

Section 3.4.7, page 3-210 under Wild and Scenic Rivers, fourth paragraph: In order to address interim management guidance for suitable rivers affected by proposed activities (whether the rivers lie inside or outside the project area), we recommend that you change first sentence to: “The Marsh Fork-Canning, Hulahula, and Kongakut Rivers are north-flowing waterways found to be...”. Change last sentence of paragraph to: The Marsh Fork-Canning (Recreational ORV) and Kongakut (Recreational, Scenic, and Geologic ORVs) Rivers are not within the project area, but stipulations and ROPS would be applied to protect their WSR characteristics (e.g.: the scenic ORV for the Kongakut River may necessitate modeling and additional setbacks within the project area to insure infrastructure is not visible from any point within the Kongakut River corridor; or the sport fishing opportunities described as part of the Marsh Fork-Canning recreational ORV may be preserved by stipulating program actions within the downstream project area) (see Section 5.7.2 of CCP, Appendix I: Wild and Scenic River Review).

Section 3.4.7, page 3-214, under Impacts Common to all Action Alternatives: In order to address interim management guidance for suitable rivers affected by proposed activities



(whether the rivers lie inside or outside the project area), we recommend that you change the sentence beginning with “General impacts...which could affect cultural, fish, geologic, recreation, and wildlife ORVs.” to also include the scenic ORV.

- **Fish and Aquatic Species**

- Regarding section 3.3.2 Fish and Aquatic Species, Affected Environment, Page 3-80, last two sentences of last paragraph in section on Direct Habitat Loss or Alteration. The last two sentences in the paragraph suggest that placing gravel mines in river beds and subsequently creating deep water reservoirs could be seen as a long-term benefit for fish in the area. These alterations should be viewed as an anthropogenic alteration of the natural habitat rather than an enhancement. Recommend the last sentence be deleted and the second to last sentence be edited to read, “Following gravel extraction, the excavation can then serve as a water reservoir for industrial activities, which is common practice in other North Slope gravel mines farther west (BLM 2012).”

- **Polar Bears:**

- Page 3-127: The DEIS states that critical denning habitat for polar bears only occurs in those areas with topography sufficient to capture enough snow for dens to be constructed. However, the actual critical habitat designation covers a much larger area and includes not only the microhabitat features (i.e., those where snow can accumulate), but also the macro-habitat features that allow bears to access those features and move back to the sea ice post emergence. This should be corrected in the final EIS.
- Page 3-133: The DEIS states that post-lease activities could include seismic, but fails to consider the fact that due to the future leasing activities analyzed in the DEIS, seismic surveys could occur prior to leasing. We recommend correcting this in the final EIS.
- Page 3-137: The DEIS states “If dens are detected within a 1-mile buffer zone around the proposed locations of roads and pads, then the facility locations would be moved outside of that radius to avoid dens, as required by ITRs, to reduce the effects on occupied dens to a negligible level.” While that is currently true, if new data emerged that suggested bears could be disturbed at distances >1 mile, then a larger buffer would be required. Similarly, if data supported a smaller area, a smaller buffer could be required. So, the language should be changed to reflect that this no disturbance buffer is subject to change.
- Page 3-141: The discussion of the potential effects of an oil spill on polar bears is not sufficient. While it’s true that a spill associated with an accident involving a barge would likely be smaller than that modeled for an offshore oil well, sufficient volume of oil could still be released that could harm polar bears. This is especially true depending on where and when barges are likely to land. If barge landings are in the vicinity of Kaktovik, they could coincide with large aggregations of bears during the open water period. A spill adjacent to those waters could expose a large number of polar bears.
- Page 3-146: The DEIS states, “The highest number of documented historical polar bear dens and the greatest area of potential maternal denning habitat occur in the high- and medium-potential hydrocarbon zones, where the least restrictive development



activities would be most likely to occur.” This statement reinforces our concerns over the level of protection afforded to polar bears under Alternatives B and C, and highlights the need to provide the level of protections for polar bears found in Alternative D.

- Page 3-146: The DEIS states, “Under ROP 10, the pre-activity surveys required to locate dens, plus the 0.5-mile and 1-mile buffers for seismic and heavy equipment operation around occupied dens of grizzly and polar bears, respectively, would help to reduce the impacts of behavioral disturbance on denning bears (as well as birth lairs of ringed seals on landfast ice along the coast) throughout the entire program area.” However, Alternatives B and C do not require such surveys, just a requirement to avoid known dens. We recommend changing the ROP under Alternatives B and C to reflect this language.
- Map 3-24: The map legend is mislabeled. It states that the stars are potential denning habitat when in reality they depict sites of known polar bear dens observed over the years. Additionally, those data are wrongly attributed to Durner et al. (2006) rather than to the USGS den catalogue. Similarly, the yellow lines depicting potential denning habitat should be cited as Durner et al. (2006) rather than just “Durner data” and should be labeled as “polar bear denning habitat” rather than just “polar bear habitat”.

## ● Terrestrial Mammals

### Caribou

- Page 3-115: The DEIS states that, “Similar delays have not been observed in caribou in the existing North Slope oil fields, ...” Recommend modifying this statement to state: “Although CAH caribou have been observed to cross roads and pipelines in the existing North Slope oil fields during the summer insect season, fine-scale studies of CAH movements like those of caribou near the Red Dog mine road have not been conducted.” As currently worded, it implies that a study has looked at this and not documented a delay. To our knowledge, there has not been a study looking at caribou movements at the spatial/temporal scales required to detect an effect for caribou in the oil fields.
- Page 3-120: The DEIS states that under Alternative D, Lease Stipulation 5 would prohibit winter activity within 1 mile of polar bear denning habitat. This is not accurate, as the stipulation states activity within a mile of denning habitat in particular regions of the Coastal Plain would be restricted, but not the entire region. Recommend correcting the statement to better reflect what Lease Stipulation 5 requires.

### Muskox:

- Page 3-108: Recommend adding the following information to the discussion of muskox: “Another group of approximately 24 muskoxen inhabits the northwestern Yukon Territory, is commonly found near the Alaska-Yukon border and frequently wanders into the Refuge. They have been found as far west as the Aichilik River, on the boundary of the program area.”



**Moose:**

- Page 3-108: Recommend including the following information in the discussion of moose on the coastal plain: Moose numbers east of the Canning watershed are currently low, but numbers in tributaries of the Canning (both east and west sides) are greater; some of these would be in the project area and other moose just outside the area to the west could be affected by equipment moving into/out of the area. Moose aggregate in brushy habitat along streams during winter, but then disperse across the ACP during summer (particularly pregnant cows). Moose are an important subsistence species for Kaktovik hunters, who are extremely interested in seeing moose populations recover to previous levels that will allow additional hunting opportunities. It would be helpful to provide maps of current moose winter habitat and locations of moose found on spring surveys (available from FWS).

**Wildlife Direct and Indirect Impacts:**

- Recommend providing a quantitative analysis of direct and indirect impacts to wildlife where possible or summarizing the results of quantitative studies that have been completed. For example, the following study is an example of where a quantitative analysis was completed for the PCH and should be incorporated into the description of impacts: *Russell, D., and A. Gunn. 2019. Vulnerability analysis of the Porcupine Caribou Herd to potential development of the 1002 lands in the Arctic National Wildlife Refuge, Alaska. Report prepared for: Environment Yukon, Canadian Wildlife Service, and GNWT Department of Environment and Natural Resources. 143 pp.*
- Given the importance of moose as a subsistence species to local communities, we recommend adding a description of potential impacts of development on moose, including: disturbance of cows during calving and displacement during summer from coastal plain habitats with few predators, impacts to riparian vegetation that may reduce moose winter habitat, displacement of moose from winter habitat, disruption of movements to/from seasonal ranges, changes in predator abundance and distribution as a result of supplemental foods or habituation to humans. Page 3-110: include moose in list of mammals (grizzly bear and muskox) that may be disturbed by winter seismic exploration. (SArthur)
- Page 3-110: Although it is true that only a small proportion of the PCH remains on the ACP during winter, these caribou can number in the hundreds and are an important winter subsistence resource for Kaktovik hunters. Thus, localized disturbance or displacement of caribou during winter could have a significant impact on subsistence hunters. Recommend clarifying that although the number of PCH caribou on the ACP during winter is small, they are still an important subsistence resource for local communities.
- Page 3-113: It is not clear what the supporting evidence is for the sentence “Although some habitat damage would result from the use of ice roads and pads because the ice road is temporary, the long-term impacts would be considerably less than those associated with gravel roads and pads”. Please provide citations if they exist. Ice roads



and snow trails have the potential to delay greenup in affected vegetation, and may retard growth during an entire growing season. This effect could be repeated every year that exploration and development occur. Additionally, these routes are likely to be much wider than a gravel road, with the potential to impact more habitat in a given year resulting in greater impacts to caribou habitat.

- Page 3-114: Recommend revising the sentence that begins “The patterns of CAH demography following development should be applied to the PCH with caution...” to: “Demographic changes exhibited by the CAH during the development period should not be expected to occur with the PCH due to the substantial differences between these herds and the geography of their ranges. For example, the CAH was at an historic low point in the herd’s abundance when development began, whereas, the PCH is currently at an historic high level. In addition, compared to the CAH, the PCH has shown a much lower population growth rate during periods of increase; concentrated calving density of the PCH is much higher; areas surrounding the PCH calving grounds contain less high-quality forage and higher predator densities; and these areas exhibit more topographic relief than do the current PCH calving grounds or areas used by the CAH following displacement from their original calving grounds (Clough et al. 1987; Griffith et al. 2002).”
- Page 3-115, Paragraph 2: The following studies related to caribou should be included in this section: Smith and Cameron, 1985; Curatolo and Murphy, 1986; Murphy and Curatolo, 1987; Murphy, 1988. These studies indicate that large groups of caribou were less successful in crossing roads and pipelines during insect harassment; which is likely to be more of an impact for the much larger groups typical of the PCH during summer.
- Page 3-115, Paragraph 5: It is not clear how the definition of PCH calving area was determined to be the “concentrated calving area during >40% of years”, as the most of the 1002 area is used for calving by either the PCH or CAH, and often both herds. Recommend providing additional discussion and citations as to how this was defined.
- Page 3-116: There is substantial uncertainty that design specifications outlined in ROP 23 will be sufficient to minimize disruptions to caribou movements in the 1002 Area due to substantial differences in geography and herd characteristics. Recommend adding a description of the substantial uncertainty that exists regarding whether these practices will be sufficient, and a statement that additional restrictions may be necessary to maintain the ability of the PCH to continue unrestricted use of the area.

## ● Resident and Migratory Birds

- Section 3.3.3 Birds, Affected Environment, Shorebirds: Only 10 species are fairly common, common, or abundant in the program areas, including American golden-plover, ruddy turnstone, semipalmated sandpiper, red-necked phalarope, red phalarope, Western sandpiper, dunlin, stilt sandpiper, pectoral sandpiper, and long-billed dowitcher. Four additional species are less common, including semipalmated plover, Baird’s sandpiper, whimbrel and buff-breasted sandpiper (based on PRISM surveys reported in Brown et al. 2007). Data from transmitters indicate that some



birds also migrate westward across the ARCP before migrating southwest across Alaska and down either the Pacific Flyway or the East Asian-Australasian Flyway. Recommend correcting the information related to species abundance and including information related to the eastward migration that occurs. Brown et al. (2007) is the best source of data for shorebirds relative to the project area.

- Section 3.3.3 Birds, Affected Environment, Climate Change: Although summer duration may increase due to climate change effects, it is unlikely that the time to breed of insectivores will increase as invertebrate emergence is mediated by snow melt initially, followed cumulative degree days of temperature. The volume of invertebrates may be limited, with the emergence simply occurring earlier. Contrary to the DEIS, avian habitat is changing rapidly, both on the coast and inland tundra areas. Photographic images taken at Prudhoe Bay in the 1980s and presently showing the landscape drying up, with a change from low-centered polygons to high-centered polygons. (see Liljedahl et al. 2016). This in turn is leading to drainage of uplands and creation of larger water bodies that may indeed be good for species of waterfowl and loons. River deltas may also be affected from reduction in glacier melt-off. This change and the storm surges could affect migratory birds through changes in invertebrate distribution and composition (Churchwell et al. 2018). The document does not correctly assess the potential impacts to birds and their habitat resulting from the changing climate. Please address as appropriate throughout the Affected Environment Section.
- Section 3.3.3 Birds, Affected Environment, Direct and Indirect Impacts: The DEIS understates the potential impact from water removal during ice road construction on wildlife. The 1002 Area has relatively few water resources compared to the NPR-A and the use of large volumes of water could negatively affect nesting habitat in the succeeding summer. Breeding grounds are the only place for the birds to increase their numbers, and thus are an essential part of the annual cycle for maintaining bird numbers. Please ensure the document accurately reflects the potential impacts to breeding birds related water removal.
- Page 3-92: The indirect effects of post-leasing oil and gas activities on birds include the indirect effects of increasing contaminant concentrations below levels that would cause mortality should be included in the DEIS. This discussion should include mobilization of contaminants, particularly heavy metals, from climate change (e.g., flood events contributing to increased erosion and release of contaminants from glaciers); earth-disrupting activities contributing to dust, sedimentation, or erosion; and activities that may result in melting permafrost with subsequent mobilization of mercury all have the potential to increase contaminant concentrations in birds of the Arctic Refuge, especially those that eat invertebrates (shorebirds, nesting waterfowl) and fish (loons), and in raptors to levels below those that may cause mortality but which may still result in population-level effects such as decreased productivity.
- Page 3-99: We disagree that “salt-water spills would not be toxic to birds,” especially if spills occurred in waterfowl breeding ponds. Newly hatched ducks have poorly developed salt glands and exposure to elevated salinity can cause impacts including mortality (e.g., DeVink et al. 2005). Additionally, saline spills can kill invertebrate prey.
- Page 3-84, Paragraph 7: Arctic Refuge CCP 4.3.6 states, “In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded”. It appears the species list from Appendix F in the CCP was used here to assign a number of 156 species, but the inclusive areas for these sections is slightly differently between the CCP text and Appendix F. Please change, “According to the USFWS (USFWS 2015a), 156 bird species have been recorded in the Arctic Refuge on



the northern foothills of the Brooks Range, in the ACP (an area inclusive of the program area), and in adjacent marine waters” to “According to the USFWS (USFWS 2015a; Appendix F), 156 bird species have been recorded in the Arctic Refuge Coastal Plain [i.e., the area between the coast and the Brooks Range inclusive of coastal areas (lagoons, barrier islands, and Beaufort Sea) and inland areas (uplands near the foothills of the Brooks Range)]”.

- Page 3-85, Paragraph 1: The statement, “With few exceptions, all birds in the program area are migratory and are present only during the summer breeding season, May to September, depending on species” is incomplete. Several raptor species may occur during the latter part of winter in the Program Area. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most golden eagle nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive during Apr and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Some marine birds occur in the area throughout October and into November and leave with advancing sea ice. In the immediate area offshore, such species groups include larids, murres, puffins, guillemots, seaducks, and sometimes shearwaters (Kuletz et al. 2015; Kuletz and Labunski 2017, Appendix 1; USFWS data). Please change to, “With few exceptions, all birds in the program area are migratory and present February to November, depending on species”. (Kuletz)
- Page 3-85, Paragraph 1: Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Appendix F of the CCP states, “Rock ptarmigan (*Lagopus muta*) – Common permanent resident in all areas of Refuge.” Please change, “Winter residents include small numbers of ravens and ptarmigan, dippers near open running water, and occasional gyrfalcons” to, “Resident birds include ravens, ptarmigan, dippers near open running water, snowy owls, and gyrfalcons”. Cite the CCP and citations below.
- Page 3-85, Paragraph 2: Sentence, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ACP (Liebezeit et al. 2009)” is inadequate. Data on population size is available for the ARCP, so using information for the whole of the ACP seems unnecessary. Also, the cited reference did not conduct extensive surveys across the whole of the ACP for estimating density, therefore this reference doesn’t support the statement as given. Please change to, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ARCP (Bart et al 2012). (Johnson/Latty)
- Page 3-85, Paragraph 3: The Affected Environment coverage here of the “marine vessel route to Dutch Harbor” is inadequate. This route may impact areas used by the ESA listed short-tailed albatross and species of concern such as yellow-billed loon, red-legged kittiwake, Aleutian tern, and Kittlitz’s murrelet. Special consideration should be given to Important Bird Areas and “hotspots” that occur along the route. For examples, the area near the mouth of Barrow Canyon (and around Point Barrow) is a “hotspot” of marine bird and marine mammal activity throughout summer and fall and “hotspots” occur offshore from Wainwright (head of Barrow Canyon) and over Hanna Shoal area (see Kuletz et al. 2015). Any marine vessel route would pass by large seabird colonies at Cape Lisburne (northernmost seabird colony of AMNWR) and Cape Thompson. Vessels would have to go through Barrow Strait, an Important Bird Area (Smith et al. 2017) and recognized “hotspot” for marine birds (Humphries and Huettmann 2014; Kuletz et al. 2015). The Bering Strait region supports mixed-species colonies of millions of birds (Stephensen and Irons 2003), with some of largest seabird



colonies in the world on Diomedes, King Island., St Lawrence Island, and farther south – St Matthew Island. An estimated 12 million seabirds aggregate in the Bering Strait region in summer through early fall (USFWS 2014). There are many “Important Bird Areas” identified along the route to Dutch Harbor and nearby Aleutian passes (Smith et al. 2014; 2017). Please add “waterbirds” and “larids” to the groups discussed in this section.

- Page 3-85, Paragraph 4: The statement, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important nesting, rearing, and migration staging periods” is incomplete. The coastal lagoons and deltas provide important stopover habitat during spring migration/pre-breeding period, as well. Please change to, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important pre-breeding, nesting, rearing, and migration staging periods”.
- Page 3-85, Paragraph 4: The statement, “Prior studies (summarized in USFWS 2015a) have demonstrated that at least several hundred thousand breeding and nonbreeding birds use the ARCP and program area during the short arctic summer” is incomplete. Likely as many or more birds use the ARCP during the fall. Please change to, “Prior studies (summarized in USFWS 2015a, Pearce et al. 2018, USFWS and BLM 2018) have demonstrated that at least several hundred thousand birds use the ARCP during the for breeding in the short arctic summer and fueling and resting during migration in the fall”.
- Page 3-86, Paragraph 1: The unpublished data cited here belongs to USFWS, not Mr. Latty. Also, one nest was included in an unpublished report, (Kendall and Villa 2006). Please change “(Latty, unpublished data)”, to “(Kendall and Villa 2006, USFWS, unpublished data)”.
- Page 3-86, Paragraph 1: The statement “The spectacled eider is an uncommon breeder in the program area, and nests have been documented only on the Canning River delta” only pertains to recent records of known spectacled eider nests found during operations of a primarily shorebird research site on the Canning River Delta is misleading. An exhaustive search for any and all records of spectacled eider nests ever occurring in the program area has not been conducted. This statement should also not be interpreted to mean that all locations within the program area have been searched to determine presence or absence. Rather, it only means that a few spectacled eider nests were found as part of other operations (primarily shorebird research) at a single small site on Canning River delta. There have been NO systematic ground surveys specifically targeting eider nests (outside the barrier islands) anywhere in the program area in the recent past. Please change, to “The spectacled eider is an uncommon breeder in the program area. Nests have been documented on the Canning River delta, but contemporary systematic ground surveys targeting tundra-breeding eider have not been conducted.
- Page 3-86, Paragraph 2: Spectacled eider nest density is expected to be low in the program area where suitable habitat is available. Please change, “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting period, where suitable habitat is available”, to “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting and nesting period, where suitable habitat is available” or “Low numbers of spectacled eiders are expected to occur in the program area where suitable habitat is available”.



- Page 3-86, Paragraph 3: Within the DEIS 'Waterbirds' appears to include mergansers and seaducks. Please include these groups the list of Waterbirds (first line of paragraph).
- Page 3-86, Paragraph 4: In the second sentence, referencing the ACP survey, the text indicates that "prior to 2018 only about a quarter of the area was included..." Insert "program" prior to "area". Without that specificity, the text suggests that only a quarter of the ACP was surveyed, when in fact one quarter of the program area that was surveyed as part of the ACP breeding pair survey.
- Page 3-86, Paragraph 4: In the last sentence, please change "unreliable" to "imprecise". There is a large difference in meanings, and "imprecise" is the correct term here.
- Page 3-86, Paragraph 4: Bart et al. (2012) provides estimates of waterbird population sizes for the ARCP. Please consider including these population estimates here.
- Page 3-87, Paragraph 1: The waterbird classification includes waterfowl like Northern pintail that often nest in dryer habitats. Bart et al. (2012) estimated more than 18,000 Northern pintail breed on the ARCP. Please change, "In addition to water body shorelines and islands, most waterbirds use a variety of wet and moist tundra habitats for nesting, often next to water" to "Most waterbird species nest in association with ponds or in wet and moist tundra habitats, but some species primarily nest in drier habitats".
- Page 3-87, Paragraph 1: A significant portion of the estimated hatch dates for several geese species in the program area in some years occur in June. Please change, "After hatching in July and August, most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands" to, "After hatching in June through August, most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands."
- Page 3-87, Paragraph 1: The following statement is not accurate for most waterbird species occurring in the program area. Please remove, "In the late summer, post-breeding and molting (temporarily flightless) waterbirds use coastal lagoons behind the barrier islands. Waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration" or change to "In the late summer, post-breeding and molting (temporarily flightless) sea ducks (primarily long-tailed ducks) use coastal lagoons. Sea ducks and other waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration."
- Page 3-87, Paragraph 1: The statement, "Most waterfowl (swans, geese, ducks) migrate through the central continent to wintering areas across the continental US" is poorly defined and not correct as written. Please consider changing to, "Most geese, swans, and dabbling ducks migrate through Pacific and Central Flyways after leaving the ARCP".
- Page 3-87, Paragraph 2: Map 3-15, Post-Breeding and Fall Staging Common Eider, in Appendix A, is incorrectly titled. Map 3-15 depicts locations of likely breeding and post-breeding common eiders from two separate surveys conducted to estimate breeding and post-breeding (staging/molting) sea bird distribution and abundance. Please correct as appropriate.
- Page 3-87, Paragraph 2: Language as written is incorrect and no source is provided for 1976 data. Please change "Common eiders have been increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 nests were found", to "Common eiders appear to be increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 active nests were found (Divoky 1978)".



- Page 3-87, Paragraph 2: The statement “Common eiders winter in coastal areas from the Aleutian Islands south to southern Alaska.” is not correct. Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and Chukota peninsula in the Bering Sea (though some also are known to winter in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta). Please change to, “Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and the Chukota peninsula in the Bering Sea, although some also have been documented wintering in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta (Petersen and Flint, 2002). (Latty)
- Page 3-87 Paragraph 2: The statement, “The USFWS conducts annual aerial surveys to estimate the number, distribution, and population trend of breeding common eiders in coastal habitats on the North Slope, including Arctic Refuge lands (summarized in USFWS 2015a)” is not accurate. The USFWS has not conducted aerial surveys of coastal habitats on the North Slope since 2009. Please correct language to recognize aerial surveys are not currently being conducted for common eider on the ACP, and have not in a decade.
- Page 3-87 Paragraph 2: The data referenced in, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 common eider nests were found (Latty, unpublished data)” belongs to USFWS, not Mr. Latty and the language is imprecise. Also, a note should be given of some differences in spatial coverage between these two surveys. Please change to, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 active and inactive common eider nests were found (USFWS, unpublished data). There was some differences in spatial coverage between the 1976 and 2015 surveys, primarily because the islands are constantly being reshaped”.
- Page 3-87 Paragraph 4: The statement, “In aerial surveys of nearshore waters and barrier islands conducted during the early post-breeding period (early July 1999–2009)” does not describe the survey referenced. The latest report on that survey, “Aerial Population Surveys of Common Eiders and Other Waterbirds During the Breeding Season - Northwestern Alaska 2006-2009” by Bollinger et al. 2012 states, “The objectives of this Northwestern Alaska Common Eider Survey were to: 1) Estimate a population index during the breeding season....” (2012). That report also states, “All surveys were flown during the interval from 15 June to 01 July (Table 2). Survey timing was intended to coincide with egg laying and early incubation while pair bonds are still intact and prior to the dispersal of males to molting sites” which does not match the statement in the DEIS. Please change this sentence to, “In aerial surveys of nearshore waters and coastal areas near barrier islands conducted during June and early July 1999–2009.”
- Page 3-88 Paragraph 2: Please provide a citation to support the statement, “It is likely that many of the birds using lagoons along the Arctic Refuge coast during post-breeding nested to the east, particularly in northern Canada” or remove.
- Page 3-88 Paragraph 3 Sentence 1: The 325,000 estimate is 40 years old; the should reference this information in the past tense. The most recent (15 year old) estimates are approximately 185,000 (Kendall 2006).
- Page 3-88 Paragraph 3: Please provide the Arctic Refuge CCP as a citation for the statement, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS and BLM 2018)”. Please change to, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS 2015a).



- Page 3-88 Paragraph 4: The Shorebirds of Conservation Concern in the United States of America – 2016 (U.S. Shorebird Conservation Plan Partnership, 2016) is the most up-to-date conservation status document for North American shorebirds; therefore, this list should be identified in the Affected Environment text, not just in the Appendix.
- Page 3-88 Paragraph 6: The statement, “Shorebirds use a wide range of aquatic, wet, and moist tundra habitats for nesting, often near bodies of water” is not correct as written. While most shorebirds prefer moist tundra, some use drier habitat and riverine areas. For example, whimbrels were only found in upland habitats on previous ARCP shorebird surveys. Please change to, “ARCP shorebirds use a wide range of tundra habitats for nesting. Most species occur in wetland, moist, and riverine habitats, but some species prefer drier upland sites (Brown et al. 2007)”. Alternatively, remove this sentence and incorporate the information in the next sentence that includes the Brown et al. citation.
- Page 3-89 Paragraph 1-3: This section excludes discussion of bald eagles. Although not as abundant as golden eagles, bald eagles also occur on both the coastal plain and in the foothills of the Brooks Range. Please update text to reflect this information.
- Page 3-89 Paragraph 2: Up to several thousand shorebirds at a time may occur on individual river deltas in July and August (Churchwell 2015). Please change, “Most of the deltas are used by large numbers of foraging shorebirds” to “Most of the deltas are used by large numbers of foraging shorebirds. Up to 4,000 shorebirds were counted on daily surveys at Jago and Okpilak River Deltas in 2011. (Churchwell 2015)”
- Page 3-89 Paragraph 4: Line 7. Additional larid species encountered along the vessel route to Dutch Harbor (USFWS survey data, most in Kuletz and Labunski 2017) would include slaty-backed gull, red-legged kittiwake, Aleutian tern; (latter two are breeding birds conservation of concern). These species should be included here. Also, it was difficult to determine the vessel route, and not clear what that route would be used for – or how much vessel traffic the project would generate (especially through the Bering Strait). This information is necessary to adequately assess the affected environment and potential impacts.
- Page 3-89 Paragraph 5: Last line of paragraph. When offshore or over marine waters, jaegers also eat fish (and scavenge or steal those from other seabirds and larids). Please correct this in text.
- Page 3-91 Paragraph 2: Line 1-2. From our USFWS at-sea surveys in the waters off of ARCP, in addition to ones listed in Table J-9, glaucous gull, black-legged kittiwake, Ross’s gull, Sabine’s gull, Kittlitz’s murrelet have also been recorded. (see Kuletz and Labunski 2017, Appendix 1 for maps, or Kuletz et al. 2015 for some species; also USFWS/Kuletz, unpublished data). Please update text to reflect this information.
- Page 3-91 Paragraph 3: The DEIS contains few details regarding the “the marine vessel route to Dutch Harbor”. Vessels traveling through the Chukchi Sea and down length of the Bering Sea to Dutch Harbor could encounter more than 63 species of marine birds. As written, little information is given for the Affected Environment for the vessel route to Dutch Harbor, which reduces the ability to estimate potential impacts or threats. Please clarify the details of the “the marine vessel route to Dutch Harbor”, fully describe the Affected Environment in the appropriate sections in 3.3.3, and then discuss the potential impacts in the Direct and Indirect Impacts section beginning on page 3-92.
- Page 3-91 Paragraph 3: The ESA-listed short-tailed albatross occurs regularly (if not abundantly) in the southern portion of the route, and occurs in the northern portion in



late summer and fall (especially the northwest outer shelf break, near the date International Date Line), and near St. Lawrence Island. The short-tailed albatross and two other albatross species (black-footed and Laysan) have all increased in abundance and shifted distribution northward in the Bering Sea in recent decades (Kuletz et al. 2014), and so would be present enroute to Dutch Harbor. The Aleutian passes, especially Unimak Pass near Dutch Harbor, have the highest risk to seabirds from vessel accidents (Renner and Kuletz 2015, Humphries and Huettmann 2014) and very high densities of albatrosses occur there. The first recorded sighting of a short-tailed albatross in the Chukchi Sea was made in 2011 (Day et al. 2013), thus it could be encountered in that portion of the vessel route as well. Please update text to reflect this. (Kuletz)

- Page 3-91 Paragraph 5: It should be noted here that seabird die offs have occurred in the Bering Strait region in 2017 and 2018 (USFWS 2017, 2018) and were associated with very warm water conditions; die offs in this region were previously very rare (or perhaps never recorded, with exception of the 2013 die off near St. Lawrence Islands). Birds died from starvation, although effects of toxins can not be ruled out. The combined effects of increased vessel traffic, disturbance, noise, and changes in prey and sea ice have potential for large cumulative effects. Please update text to reflect this information.
- Page 3-91 Paragraph 5: Predation is the primary factor affecting productivity for many ARCP breeding birds, but recent work suggests predation is increasing in the Arctic and may be linked to climate-induced shifts in predator-prey relationships. Please add, "Recent work suggests predation is increasing in the Arctic and is linked to climate-induced shifts in predator-prey relationships (Kubelka et al 2018)".
- Page 3-91 Paragraph 5: A climate change vulnerability assessment on Alaska's North Slope identified the barrier island nesting Pacific common eider as the marine bird at highest risk of climate change impacts, including impacts from predicted sea level rise, increasing storm surges, and erosion and/or restructuring of barrier islands (Liebezeit et al. 2013). With the low elevation profiles of barrier islands and preference of low-lying nest sites by common eider, rising sea level and increasing storm surges may have significant effects on nest success of eiders. The intensity and frequency of storm surges in the Beaufort Sea is increasing, and sea levels have been predicted to rise by 0.26-0.98 meters by 2100 (Church et al. 2013). Model predictions suggest that wave heights and storm surges will continue to increase as ice retreats (Church et al. 2013, Lintern et al. 2013, Vermaire et al. 2013). In the future, eiders nesting on barrier islands may be impacted by both the increasing frequency and magnitude of storm surges, and an earlier timing of these events. Please add, "Some species nesting on barrier islands, such as common eiders, could be negatively affected by predicted sea level rise and increasing storm surge. Both could flood nests and decrease productivity (see Liebezeit et al. 2013)" to this section.
- Page 3-91 Paragraph 6: Another potential impact of less sea ice is the bigger, rougher sea conditions, which may impact foraging of marine birds, especially less experienced/smaller juveniles. Please update text to reflect this information.
- Page 3-91 Paragraph 6: Please provide a citation for the statement, "a delay in freeze-up in fall should be advantageous to the slow-growing young of such species as loons and swans, which are not always flight capable by time of freeze-up" or remove.
- Page 3-91 Paragraph 7: The statement, "Some species of insect-feeders (shorebirds and songbirds) can initiate nests earlier with early snowmelt, whereas others (jaegers, common eiders, and raptors) do not; however, it is unclear if birds relying on insects to



feed their young (songbirds and shorebirds) could adapt to hatch at the optimum time as insect hatch continues to advance (Grabowski et al. 2013)” is incomplete for the body of climate-mediated links for some of these species. For example, as discussed in the cited reference (Grabowski et al. 2013), “The lack of response in the common eider to timing of snowmelt is consistent with other studies that have linked both nest initiation and productivity to the area of marine ice cover adjacent to the nesting grounds”. Love et al. (2010) found common eiders nested earlier in warmer years associated with earlier ice-breakup and Chaulk and Mahoney (2012) found spring ice cover was a positive predictor of nest initiation date, but was also linked to smaller clutch sizes. Because climate change is predicted to lead to earlier ice-out along the coast, common eiders breeding on ARCP barrier islands may nest earlier as warming advances, but the advantage or disadvantage of this is yet unclear. For Arctic breeding geese, lower snow cover was also related to earlier egg laying (Dickey et al. 2008). Suggest changing to, “Some species, such as passerines, shorebirds, and waterfowl initiate nests earlier with early ice-breakup and snowmelt, but the overall impact to demography is still unclear (Dickey et al. 2008, Love et al. 2010, Chaulk and Mahoney 2012, Grabowski et al. 2013)”

- Page 3-91 Paragraph 8: Please clarify if this reference is for the terrestrial avian habitat – because higher water temperatures, less sea ice, and lower zooplankton biomass (or smaller species of zooplankton) is already occurring in the marine environment, at least in off-shore waters.
- Page 3-91 Paragraph 8: The statement, “Avian habitat is likely to change slowly with climate change, except for coastal areas subject to erosion and deposition (see below)” appears to be incorrect as written. Most tundra nesting birds in the ARCP prefer wetlands or moist tundra (see Bart et al. 2012). However, Arctic lakes are disappearing (Smith et al. 2005), wetlands depletion is occurring following permafrost disturbance by thermo-erosion (Perreault et al. 2017), and ponds that have been permanent water bodies for millennia, are now completely drying during the polar summer (Smol and Douglas 2007). Therefore, Arctic habitats are already impacted and this loss is predicted to expand in the future [see, “Rapid climate-driven loss of breeding habitat for Arctic migratory birds” (Wauchope et al. 2016) for further discussion]. Please consider removing this sentence.
- Page 3-92 Paragraph 3: Please add a paragraph specific to marine habitat after this coastal habitat paragraph.
- Page 3-92 Paragraph 4: The citation (Flint et al. 2003) doesn’t appear to support the statement, “Erosion of coastal shorelines could increase inundation of tundra by salt water; the resulting salt-killed tundra may be colonized by salt-tolerant species and develop into salt marsh, a rare but important post-breeding habitat for geese”. Please correct or remove.
- Page 3-92 Paragraph 5: Line 7. If post-lease activities include transportation of oil, please address potential impacts to the marine environment. If oil transport includes any marine areas, it is not fully addressed in the draft EIS. Please update this section if oil may be transported in marine areas.
- Page 3-92 Paragraph 6: The statement, “Winter activities would affect few species and low numbers of year-round residents” is incomplete. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May,



with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Based on this information, please change to, “Winter activities would affect few species and relatively low numbers of winter, spring, and year-round residents”.

- Page 3-92 Paragraph 6: Potential impacts of oil development on birds are listed as four primary categories, including “injury and mortality, and attraction of predators and scavengers (including both mammals and birds) to human activity or facilities, with subsequent changes in predator abundance”, but all are not discussed in the paragraphs that follow. Please consider adding, “Changes in predator abundance and diversity could occur in all phases. For example, studies demonstrated low winter movement rates and high densities of habituated Arctic foxes in the Prudhoe Bay oilfields compared to more remote sites during winter (Pamperin, 2008; Lehner, 2012). Once uncommon red foxes now occupy more den sites in Prudhoe Bay than arctic foxes and this shift has been linked to red foxes preference to den near facilities (Stickney et al. 2014). Injury and mortality from collisions with vehicles, structures, and wires and from contaminant exposure (including oil spills) could also occur at all phases, but would likely peak during drilling and operations.” to paragraph 1, page 3-93.
- Page 3-92 Paragraph 7: The statement, “Exploration occurs during winter and would have little direct effect on birds” may be incomplete if any cleanup activities would occur during the snow-free season in relation to exploration. If cleanup would occur during that period that should be addressed and discussed here.
- Page 3-94 Paragraph 6: The statement, “Drawdowns may cause fish mortality, and lack of fish would make such lakes unsuitable for breeding loons” is incomplete. Most birds using aquatic habitats in the program area feed on aquatic invertebrates. The sentence before states, “Withdrawing water from under ice could ... possibly result in some ... impacts on aquatic invertebrate communities”; therefore, the effects to species that feed on invertebrates should be discussed. Please change to, “Lack of fish would make such lakes unsuitable foraging habitat for some loons. Lower invertebrate abundance, or a shift in invertebrate diversity, may affect the quality of ponds as a food source for birds in general, particularly waterbirds and shorebirds.”
- Page 3-94 Paragraph 6: The statement, “The long-term loss of nesting lakes would have potential population consequences for loons, primarily for Pacific and red-throated loons; yellow-billed loons in the Arctic Refuge nest primarily in the northern foothills of the Brooks Range and outside of the program area” is unclear, and may be incorrect depending on how interpreted. Yellow-billed loons are considered a rare breeder on larger lakes in the Brooks Range. Unlike other loons, red-throated loons leave breeding territories to forage during incubation and while rearing chicks. On the Arctic Coastal Plain, these birds generally forage in the marine environment (See Barr et al. 2000, Uher-Koch 2017). In addition, the limiting factors of loons breeding in the program area is unclear, therefore the statement that the loss of a few nesting lakes could have broad population consequences seems somewhat unfounded. It is also unclear if the intention of this sentence is in regards to the loss of fish from lakes or from loss of nesting habitat through drying of lakes. Please consider providing citations to support, or change to, “The loss of nesting lakes by drying could have potential local population impacts for Pacific and red-throated loons”. If the sentence is only meant to convey the effects to loons of loss of fish from breeding ponds, please also remove the reference to red-throated loons because they generally feed in the marine environment during the breeding period.



- Page 3-95 Paragraph 1: The statement, “the impact [of gravel mining] on birds would be long term and somewhat ameliorated by reclamation plans (i.e., terrestrial breeding habitats could be replaced by aquatic habitats)” is incomplete as the species groups that are likely to use gravel pits filled with water will be different from those originally displaced. Suggest changing to, “the impact on birds would be long-term. Reclamation may reduce habitat loss if pits are fully transferred back to tundra, but reclaimed tundra is of lower value to breeding shorebirds and passerines compared to unaltered habitat (Bentzen et al 2018). If pits fill with water, habitat loss may be permanent for the species originally inhabiting the site, but could provide new habitats for waterbirds (i.e., terrestrial breeding habitats could be replaced by aquatic habitats)”.
- Page 3-95 Paragraph 2: The statement “Future construction of gravel pads and roads would result in potential; long-term direct loss of habitat and indirect alteration of habitat. Direct losses from gravel coverage (up to 2,000 acres allowable) would last as long as development projects are active, or until gravel is partially removed from retired roads and pads to restore some habitat features; this is estimated to be 85 years after the first lease sale before all facilities described in the hypothetical development scenarios are abandoned and reclaimed” may be incorrect as written. Gravel pads would always lead to direct loss and potential indirect alteration of adjacent habitat. The above states habitat losses would only occur as long as the project is “active”, but this term is undefined and direct loss from gravel coverage would last until gravel is removed. Also, reclaimed sites in Prudhoe Bay do not provide shorebird and passerine habitat comparable to that found prior to development (Bentzen et al. 2018). Please consider changing to, “Gravel pads and roads would result in long-term direct loss of habitat and potential indirect alteration of habitat. Direct losses from gravel coverage would last until gravel is removed. In the hypothetical development scenarios, the gravel is predicted to be removed from all facilities 85 years after the first lease sale. Shorebird and passerine habitat quality is expected to be lower for at least 10 years for reclaimed sites (Bentzen et al. 2018).”
- Page 3-95 Paragraph 5: The statement “Potential effects on waterbirds would be minimized by using the shortest road routes and smallest pads” is incomplete as written. Densities of waterbirds and shorebirds is generally greatest in wetlands on the ARCP (Bart et al. 2012). Because here we are comparing the effects of 2000 acre development scenario as described by the Tax Act, making pads smaller wouldn't minimize the effect (i.e. 2000 acres would always be affected). The statement would only be accurate if applied specifically to minimizing footprints in wetlands. Please change to, “Potential effects to waterbirds and shorebirds would be minimized by minimizing footprints in wetlands where densities are generally highest (Bart et al. 2012)”.
- Page 3-95 Paragraph 5: The statement, “Such habitats support higher densities of landbirds and impacts on these species could be greater as a result” is incomplete. Some species of waterfowl and shorebirds occur in higher densities in uplands and well-drained habitats composed of moist and shrub tundra on the ARCP (Bart et al. 2012). Also, lapland longspurs, the most abundant passerine breeding in the ARCP, occur at somewhat higher densities during the breeding season in wetlands on the ARCP (Bart et al. 2012). Please change to, “Such habitats are important to landbirds and some species of other guilds. Impacts to these species may be greater as a result”.
- Page 3-95 Paragraph 7: Sea duck densities in coastal areas during the non-breeding season are related to habitat features including wind and wave exposure and substrate



type (Esler et al. 2000). Common eider seek foraging habitats where food was most abundant, therefore not all habitat is of equal value (Larsen and Guillemette 2000). Sea ducks also deplete preferred foods when concentrated (i.e., as occurs during molt), causing birds to seek out new foraging sites (Guillemette et al. 1996). Given these, please provide citations to support the statement, “Although high numbers of birds use the lagoons, they are highly mobile and likely would be able to move to adjacent similar areas if necessary” or remove. Additional references to consider include Jesper & Magella 2000 and Larson & Guillemette 2000.

- Page 3-95 Paragraph 7: ARCP mudflats are used by a large number of post-breeding shorebirds with up to 4,000 semipalmated sandpipers documented at some deltas in late July-mid-August (Brown et al. 2012, Churchwell 2018). If barging and screeding or other nearshore activities may affect habitat availability or quality into the late summer, large numbers of shorebirds may be affected. Please address this if it is applicable for the proposed activities.
- Page 3-95 Paragraph 8: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Alaska Beaufort and Chukchi Seas, as well as the program area. Please remove, “Long-tailed ducks made up 80 percent of the birds on surveys during late summer and fall in nearshore waters of the Beaufort Sea (Fischer et al. 2002). Other species included many of those potentially breeding in the program area, plus common eiders and scoters” and replace with, “Lagoon and near-shore surveys of post-breeding and molting waterbirds were conducted across the Alaska Arctic coast during fall 2002-2003 (Lysne et al. 2004). Up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Arctic Refuge coast. Over 28,000 Long-tailed Ducks were counted in the lagoons and nearshore waters along the Refuge coast in some years.”
- Page 3-96 Paragraph 3: This paragraph is incomplete. It discusses a variety of winter work that may impact resident birds, but doesn’t consider that some cleanup from wintertime travel and construction is generally necessary during the snow-free season. If any summer or fall cleanup will occur because of seismic, construction, or winter travel, please discuss any potential effects of it here.
- Page 3-97 Paragraph 3: Impacts to bird densities from chronic disturbance s are poorly studied in Arctic Alaska. Studies outside the Arctic found bird densities increased for some species and decreased for others in relation to oil and gas infrastructure (Walker et al. 2007, Bayne et al. 2008, Dale et al. 2009, Gilbert and Chalfoun 2011, Kalyn Bogard and Davis 2014, Ludlow et al. 2015). Please provide citations to support the statement, “Potential impacts of disturbance and displacement ... are unlikely to affect ... nesting densities of breeding birds”, or remove the reference about impacts to bird densities. Please consider changing sentence to, “Potential impacts of disturbance and displacement by summertime construction and operations on the tundra would be long-term and may affect nesting success for some birds near facilities; however, they are unlikely to significantly affect regional or global population sizes”.
- Page 3-97 Paragraph 5: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Beaufort and Chukchi Seas in Alaska, as well as the program area. Please change the latter two sentences in this paragraph to, “Common eider are the predominant species nesting on



barrier islands and using associated nearshore areas during breeding (Kendall 2005). In aerial surveys of the lagoons and nearshore areas, surf scoters were the predominant species encountered in June and early July and long-tailed ducks in late July and August (Bollinger and Platte 2012, Lysne et al. 2004, Pearce et al. 2018). Long-tailed ducks use the lagoons during their flightless feather molt (Lysne et al. 2004)."

- Page 3-98 Paragraph 3: This paragraph primarily discusses how development of the ARCP may lead to increased air traffic in Deadhorse for transport of personnel. Although increased traffic through Deadhorse seems likely, moving personnel by fixed wing aircraft may also impact other sites. Airports at Barter Island and Kavik may also experience more flights since these airports would place staff closer to the Refuge (although still not within the ARCP). In order to move these staff during the snow-free season to duty stations within the program area, some additional means of transportation would be needed. Airports and roads may need to be built within the ARCP, and/or thousands of helicopter flights might be needed, all of which may impact birds. Please consider changing this paragraph to, "All types of air traffic could disturb and displace both breeding and non-breeding birds. Air traffic would include fixed-wing aircraft into Deadhorse, Kavik, and Barter Island airports; helicopters to move people and supplies from airports to sites within the program area, and potentially fixed-wing aircraft traveling in the program area if new airports are built on the ARCP. Potential impacts on birds would be both short- and long-term".
- Page 3-98 Paragraph 6: The statement "Vehicle and aircraft traffic and tall structures, including communication towers and drill rigs, pose collision hazards that could kill or injure birds" is incomplete. Transmission and guy wires are an equal or greater collision risk (Manville 2005). Also, there is limited data to support the hypothesis that structure height is a significant predictor of collision risk in the treeless tundra ecosystem of the Arctic. Please change to, "Vehicle and aircraft traffic; structures, including communication towers and drill rigs; and wires, pose collision hazards that could kill or injure breeding, staging, or migrating birds".
- Page 3-99 Paragraph 2: The statement, "Collisions with tall structures increase with tower height, bright lighting, and the presence of guy wires (Manville 2005; Gehring et al. 2011)" is incomplete. Perhaps the most important results in the citations provided is that risk of tower collisions is greatest when near wetlands or in migration corridors, but this is not included in the current text. Please change to, "Collisions with structures increase with height, bright lighting, guy wires, and when structures occur near wetlands or in migratory corridors (Manville 2005; Gehring et al. 2011)"
- Page 3-99 Paragraph 3: The statement, "Collisions would be expected to occur annually in small numbers, but mortalities could be serious if flocks of birds of conservation concern are involved" doesn't appear to be well supported. Collisions with towers are estimated to kill millions of birds annually (see Manville 2005). Please provide citations to support that collisions are expected to occur in small numbers, or change to, "Collisions are expected to occur annually and the number of birds likely injured or killed is unknown".
- Page 3-99 Paragraph 3: The statement "The potential impacts of collisions are short term, infrequent, and seasonal in but would occur throughout the life of any development project and would be restricted to roads and facilities" is unclear. The effects of collisions are often permanent and result in death. Frequency of collisions would depend on a host of factors including season, number of birds moving through an area, and weather. In some situations, dozens or more collisions occur in any given day. Collisions may also occur with aircraft anywhere in the program area. Please



consider changing to, "Collisions would vary by season and occur throughout the life of any development project".

- Page 3-99 Paragraph 6: The statement, "Potential salt-water spills would not be toxic to birds but would likely kill vegetation in the spill zone and thus alter habitat" is incorrect. Many species of birds are not tolerant of ingestion of saltwater and others are not tolerant to its ingestion for extended periods or during certain parts of their life history. For example, despite their ecology, plovers and sandpipers lost weight when provided 0.3 M NaCl for drinking water, half the concentration of normal sea water (Purdue and Haines 1977). Even species that spend most of the lives at sea, like common eider, risk mortality if provided only saltwater during the during the brooding period (Devink et al. 2005). Please change to, "Potential salt-water spills would likely kill vegetation and invertebrates, and could be toxic to birds".
- Page 3-101 Paragraph 3: The statement, "Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds in tundra habitats could occur over about 2 percent of the area available for leasing" may not completely describe the potential areas impacted if large portions of the 2000-acre footprint are linear features. Please consider changing to, "Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds would depend on the orientation of the footprint and amount of linear features".
- Page 3-101 Paragraph 5: The statement, "Fall staging snow geese are an important exception, as the area closed to leasing overlaps extensively with areas historically used by the largest numbers of fall staging snow geese in the program area" is inaccurate. There are no areas closed to leasing in Alternative C. Also, a substantial portion of area heavily used by snow geese in the 2000s occurs in areas with standard terms and conditions (Kendall 2006). . Please change to, "Fall staging snow geese are an exception, as the area of NSO overlaps with many areas used by the large numbers of fall staging snow geese that use the program area (Kendall 2006).
- Page 3-101 Paragraph 7: The statement, "With Alternative C, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would be similar to Alternative B" is incomplete. An important feature of Alternative C, compared to B, is that more wetlands and moist tundra would be afforded protections through NSO along the coast and from increased buffers around those the rivers most important to breeding waterbirds and shorebirds (e.g. see Brown et al 2007). Please consider changing to, "With Alternative C, potential long-term loss and alteration of the most heavily used bird habitats (wetland and moist tundra) from direct and indirect effects of gravel deposition would be somewhat less than Alternative B (the entire area is available for leasing) and would occur over approximately 1 percent of the program area; disturbance and displacement could occur over about 2 percent or more of the program area".
- Page 3-102 Paragraph 1: Oil spills in riverine, deltaic, and lagoon habitats has the greatest likelihood of high impact to waterbirds. For this reason, Alternative D that includes the highest setbacks from waterways for refueling operations and that maximize no surface occupancy for these habitats, will provide some protections for migratory birds. Please update the text to reflect this information.
- Page 3-102 Paragraph 2: The statement, "Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, somewhat more protective of avian habitats in riparian areas" is incomplete. The larger river setbacks in Alternative D would also provide some protections for habitats adjacent to riparian



areas, such as wetlands. Please consider changing to, “Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, more protective of avian habitats in riparian areas and other important adjacent habitats such as wetlands”.

- Page 3-102 Paragraph 3: The statement, “however, the various NSO areas with Alternative D would be protective to many important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, and coastal habitats” is incomplete. During the breeding season, shorebird, waterfowl, loon, and larid densities are highest in wetlands (Brown et al. 2007, Bart et al. 2012). Even lapland longspurs, the most abundant passerine in the ARCP, occur at somewhat higher densities in wetlands compared to drier sites (Bart et al. 2012). Within the ARCP, wetlands are generally most abundant along rivers and river buffers are largest for Alternative D. Therefore, Alternative D provides more NSO coverage of wetlands adjacent to rivers than Alternative B or C. Please change to, “however, the various NSO areas with Alternative D would be protective to the most important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, river deltas, wetlands associated with rivers, and coastal habitats”.
- Page 3-102 Paragraph 3: The statement, “All these no lease areas, NSO areas, and CSU areas would potentially reduce impacts on birds. As with Alternative C, nearly all of the area closed to leasing are in the area of low HCP and in inland and drier habitats” is incorrect. No areas are closed to leasing in Alternative C. Please change to, “All these no lease areas, NSO areas, and CSU areas would likely reduce impacts on birds. Nearly all of the area closed to leasing is in the area of low HCP and in inland and drier habitats”.
- Page 3-102 Paragraph 6: The DEIS provides a percentage of the area available for leasing that would be affected by alteration of habitat. While Alternative D has a higher percent altered relative to Alternative C, this result is only due to the fact that a smaller area is available to lease under Alternative D, thus the comparison does not provide the reader an accurate portrayal of acreage of habitat altered. Recommend the comparison be the percent of the project area, not the leased area, that would be affected by each alternative. Another way to present this is the total number of acres potentially altered under each alternative.
- Page 3-102 Paragraph 6: The statement, “Under Alternative D, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would occur over approximately 1.6 percent of the area available for leasing (1,037,200 acres). Disturbance and displacement could occur over about 3 percent of the area available for leasing” is confusing and makes it difficult to compare potential impacts for the various Alternatives. Recommend deleting this paragraph or maintaining a consistent denominator (ie. the program area) for all Alternatives. .

- **Wilderness**

- Recommend under Oil and Gas Field Abandonment, all alternatives specify that before final abandonment, all impacted areas should be reclaimed to a point where the area is again eligible for designation as Wilderness. This is a higher standard than the one currently described in the document as “restore general wilderness characteristics.” This standard would not conflict with any provisions of the Tax Act and would serve the



intent of the Refuge's Comprehensive Conservation Plan (CCP) and the Presidential Recommendation for Wilderness designation.

- On page 3-211, The statement about Wilderness recommendation beginning with "In the Arctic Refuge CCP..." should read: "... the USFWS recommended and the President recommended the lands in the program area for wilderness designation."
- On page 3-216, recommend changing the first sentence of second paragraph to read "... naturalness, wildness, and symbolic values of an area that may be affected ..."
- On page 3-216, recommend changing 3rd sentence under Alternative A to read: "Current USFWS management focuses on no or minimal manipulation of the environment, wildness, and promoting ..."
- On page 3-216, 3rd full paragraph, last sentence, recommend changing to read "... and, therefore, would affect an area's ..."
- On page 3-216, under Alternative B, line 7, recommend changing "...would likely retain its overall wilderness character to "... would likely retain some of its overall wilderness character", as the wilderness character would be lost to some degree.
- Public Land Order 2214 which created the Arctic National Wildlife Refuge has not been superseded and believe that that action's wilderness purpose should be recognized to the extent and where it is not inconsistent with provisions of the Tax Act of 2017 .

- **Water Quality and Quantity and the Diversity of Aquatic Habitats and Species:**

- F-18, F.4.10: Recommend the types of impacts under drilling and operation be expanded to include reinjection of waste/hazardous waste. Impact indicators should include ground water quality.
- F-18, F.4.10: Recommend the types of impacts under barge docks and seawater treatment plant construction and operation include alterations of water temperature, salinity, and currents, as well as sediment deposition.
- F-17, F.4.10: Construction and maintenance of gravel pads, roads and air access facilities can alter wetland area and extent, and can lead to inundation and starvation of tundra. Recommend these impacts be listed under impact indicators.
- F-18, F.4.10: It cannot be assumed that impacts would be similar to those described in Greater Moose's Tooth 2 and other North Slope EISs. The 1002 area of the Arctic Refuge is very different than developed areas of the NPR-A where the extent and volume of water is much greater and the terrain is not as steep. Recommend removing language related to the assumption of impacts where appropriate.
- Page 3-51, 3.2.10: Tiering the impacts on water resources to BLM's documents (NPR-A 2013, NPRA 2004a, BLM 2018) is inappropriate in many cases as impacts in the Arctic Refuge 1002 Area will be different due to the many differences between the 1002 Area and the developed areas in the NPR-A. For example, in the Arctic Refuge 1002 Area, water is relatively scarce, the terrain is steeper, and major groundwater-fed springs are extremely important.
- Page 3-51, Affected Environment: Please add "topography" to controlling forces
- Page 3-51, Affected Environment: Add "Annual total precipitation averages a little greater than 6 inches of liquid equivalent." Source: WRCC 2018a. Historical Climate Summaries. <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak0558>. This is directly from Section 3.2.1, and is relevant in this section because the precipitation in the Arctic is that of a desert.



- Page 3-51, Affected Environment: Hydrology, freeze-up and break-up are described repeatedly, but there is little discussion of summer streamflow conditions. Streamflow diminishes after break-up. Many streams and rivers become discontinuous due to limited summer precipitation and/or distribution of channels as they cross the coastal plain. Recommend the Affected Environment be expanded to include a robust discussion of summer streamflow and hydrologic conditions.
- Page 3-52, Watersheds, Rivers and Streams: The overview of freeze-up and break-up are of a general nature for north slope rivers and streams covering timing of annual flow, but lacks site specific knowledge of the coastal plain rivers and streams in which the topography, springs, and aufies are significant to the hydrology. For example, as the Hulahula River flows north from Fishhole 1, the single channel distributes into several braided channels. Often the flow within the braided channels goes subsurface or is intermittent. The data in table H-5 indicate that streamflow in several rivers diminishes significantly after break-up, but does not show that flow in several of the gaged rivers becomes intermittent (West Fork Tamayariak, West Fork Iktilyariak and Sikrelurak would be examples). The topography of the coastal plain and morphology of rivers and streams of the coastal plain differ from that of the NPRA. Many river channels distribute into many channels as the flow north from the mountains or foothills. As a result surface flow during the summer months diminishes and maybe intermittent at times or in specific locations (Table H-5). Recommend including a map that highlights the hydrology of the coastal plain.
- Page 3-52, Lakes and Wetlands: Insert "due to the topography" before the statement, "lakes are very scarce..."
- Page 3-53: Insert a comma in the heading between "Groundwater" and "Springs and Aufies". Springs (groundwater) provide significant year round habitat for aquatic resources.
- Page 3-5: Flow paths of groundwater and spring recharge within and adjacent to the coastal plain are poorly understood. We recommend the EIS consider the effects of reasonably foreseeable development activities on groundwater flow paths, evaluate the risks associated with reinjection of hazardous wastes into subsurface aquifers, and develop stipulations for leasing to eliminate the potential of contamination to springs. For additional information on subject see Kane et al. 2013.
- Page 3-53: Add: "Tamayariak and Okerokovik" to the spring identified in this section.
- Page 3-54, Water Rights: Text incorrectly states, "...and over 360 Instream Reservations completed and pending under the USFWS. While the Instream Reservations have not been issued as a water rights permit, those applications would have seniority over any new applications received by ADNR." Please correct and replace the portion of the text in quotation marks with the following, "...the Service has applied for 152 Instream flow Reservations within the Refuge and project area to ensure the protection of aquatic habitats and wildlife. These reservations have been pending ADNR adjudication since 1994 and have seniority over any new application for water use."
- Page 3-55: Edit the header of the first bullet list to include "ground water quality".
- Page 3-55: Add the following to the list of activities that will affect the hydrology and water quality: injection/reinjection of waste, drilling muds, and other contaminants.
- While Map 3-12 includes streams in which anadromous fish presence has been documented, and springs that contain resident Dolly Varden and Arctic Grayling, it needs to more clearly indicate that the Canning River supports the greatest diversity of anadromous and freshwater resident fish species in the area: it is not clear from the icons used.



- The caption for Table 3-17 suggests that this list of streams includes all fish habitat in the Program Area, yet it only identifies rivers that are classified as anadromous waters and ignores springs such as Sadlerochit Spring that supports resident Dolly Varden and Arctic Grayling but is not directly associated with any anadromous river. If this table is intended to be a comprehensive list of fish habitat, as the caption suggests, it should identify the rivers, springs, and lakes in the program area that support fish. The associated map (Map 3-13) does not convey much meaningful information. Please consider presenting a figure that illustrates stream monitoring locations.
- General to mapping, spring, fishery resources, and water resources: Sadlerochit Springs is not a direct tributary to the Sadlerochit River. It originates west of the Sadlerochit River and is a tributary to the Itkilyariak River. Recommend correcting this information where appropriate.
- Page 3-58: Under “Changes to Surface Water Quality,” change to “...dust fallout from vehicle traffic could increase turbidity *and contaminant loads* in ponds....”
- Page 3-58: The reference to BLM 2012 4.5.4.2 is not relevant to the 1002 area and does not present an analysis or discussion, as it simply states that impacts are not long-term and provides no supporting data. Recommend deleting the statement or providing a more appropriate reference if the statement is retained.
- Page 3-58, Last paragraph: It should be stated that erosion and thermokarst related to development activities will have long-term impacts on surface water quality.
- Page 3-59: Under “Changes to Marine Waters” and elsewhere in document, we disagree that the effects of an oil spill would be “short-term and localized.” Effects and damages from an oil spill depend entirely upon the circumstances of the spill, including material type, volume, spill response capability, weather, and sensitive resources in the area of the spill. Remove this statement.
- Page 3-59: It cannot be assumed that water will be recharged during snowmelt because of stipulations in place. Adequate recharge depends on several factors including connectivity, watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not be fully recharged during snowmelt after water withdrawal, especially during low snow years. For more information on “recharge vulnerable” lakes in the NPRA see Figure 6 in Jones et al. (2017). More than 50% of the lakes presented in this study are considered recharge vulnerable. An even greater proportion of the lakes in the 1002 Area of the Arctic Refuge are likely recharge vulnerable. Recommend this information be incorporated in the document as appropriate.
  - Citation: Jones et al. 2017. A lake-centric geospatial database to guide research and inform management decisions in an Arctic watershed in northern Alaska experiencing climate and land-use changes. *Ambio*. Volume 46
  - Benjamin M. Jones, Christopher D. Arp, Matthew S. Whitman, Debora Nigro,
  - Ingmar Nitze, John Beaver, Anne Gaˆrdeke, Callie Zuck, Anna Liljedahl,
  - Ronald Daanen, Eric Torvinen, Stacey Fritz, Guido Grosse
- Page 3-59: Insert: “Infrastructure and operations will result in permanent changes to permafrost resulting in thermokarst and irreversible impacts to overland flow and shallow groundwater.
- Page 3-59: In the impacts analysis section, the discussion on impacts to groundwater is limited to gravel mining impacts to subsurface flows. The potential impacts to deep groundwater flowpaths that support perennial springs are not mentioned. Deep groundwater sources and perennial springs are very important in the 1002 Area.



Perennial springs have very different chemistry, thermal regimes, and ice phenology compared to other water bodies in the Refuge (See the Arctic Refuge Comprehensive Conservation Plan 2015 or papers by Alex Huryn for more information). Recommend the discussion on impacts to groundwater be expanded to include deep groundwater flowpaths and their influence on perennial springs.

- Page 3-59: In the impacts analysis section, note that contamination related to injection of hazardous wastes in subsurface areas and fracking could have major irreversible impacts to the ground and surface water quantity and quality and could impact major spring-fed systems that are important for wildlife and subsistence users. This is an important piece of information for subsistence hunters and should not be overlooked.
- General Analysis Comments:
  - Be explicit about what offshore actions are planned so that these can be considered in the range of effects.
  - Total projected ice road use should be presented under development scenarios. It is expected that ice road use could increase greatly under Alternative B. Without assessments of ice road use under all alternatives, it is not possible to adequately conduct analyses of the impacts of development on vegetation, fish, other aquatic species, birds, soils, and water.
  - There is a need for a more rigorous analyses of potential development scenarios that include a much better assessment of the feasibility of using freshwater resources versus using groundwater versus using an STP. This information is necessary to develop an appropriate analysis of the impacts of development on water resources, fish, other aquatic species.

- **Air quality:**

**DEIS Comments: Section 3.2.2 (p.3-10 to 3-17) and Appendix F.2.4 Air Quality (p. F-12 to 13):**

- The DEIS states that the location, timing, and level of future oil and gas development on the Coastal Plain is unknown at this time and that a qualitative air analysis is being performed. In the other Alaska projects mentioned in this section, quantitative analyses have been performed using a low, medium, and high projected level of development. This type of air analysis has provided informative data to the decision makers and the public. Additionally, further project specific air analysis can tier off of the quantitative air analysis. Recommend Appendix B., Reasonably Foreseeable Development Scenario for Oil and Gas Resources, which quantifies the most likely unconstrained projected oil and gas baseline development scenario for the Coastal Plain and be used as a basis for the qualitative air analysis and to serve as a general estimate to determine the air quality impacts due to leasing and development.
- Ensure that the correct ROP for Air Quality is referenced in this section should the ROP numbering change as suggested above.

- **Hazardous materials:**

- F-18, F.4.11 Actions affecting the resource should include injection of hazardous fluids.



- Section 3.2.1, Page 3-5, first two lines: The DEIS states, “For example, a significant fraction of CO<sub>2</sub> emitted by human sources each year is taken up by the biosphere, which is gaining mass in response to the emissions.” Remove this line. A significant fraction of human-sourced CO<sub>2</sub> is also not sequestered by the biosphere, resulting in increasing CO<sub>2</sub> atmospheric concentrations and increasingly obvious patterns of climate change effects, particularly in the Arctic.
  - In multiple DEIS sections (e.g., Water Resources, Terrestrial Environment), description of impacts from “dust,” “fugitive dust,” “erosion,” “scour,” and “sedimentation” need to include the potential for exposure of terrestrial and aquatic biological communities, and subsistence users that rely on those, to contaminants of concern including heavy metals. Such exposure may occur through earth-disturbing activities (depending on the underlying geology) and along roadsides (from vehicle traffic).
  - Thawing permafrost may also mobilize previously-sequestered contaminants, including mercury (Schuster et al. 2018, Ryder et al. 2010). Additionally, wetlands created through thawing of permafrost add to the mercury methylation potential of watersheds. Throughout the DEIS, many post-leasing activities are described as having the potential to thaw permafrost without mentioning these significant related potential effects. Please correct as appropriate throughout the document.
  - Page 3-61, first bullet list: Clearly list other hazardous materials by chemical name, as has been done for methanol, propylene glycol, and ethylene glycol. Include the constituents of the industrial product types that are currently listed.
  - Page 3-62, Paragraph 1. This analysis should use all of the most recent information to describe past spill frequency and volume, not just information in BLM 2014, Section 4.5.2, including all information in the National Response Center (NRC) database (at <http://nrc.uscg.mil/>).
  - Oil or other hazardous spills within the Arctic National Wildlife Refuge Coastal Plain are low probability, but high consequence, events. We agree that the probability for a large oil or other hazardous material spill is low, as discussed on page 362. However, the consequences of even small (pages 3-61–3-62) spills in the otherwise pristine environment of site, and the biological consequences, would result in significant changes from the environment as it is currently managed for non-extractive Refuge purposes. Except for areas outside the area boundaries (e.g., DEW Line sites, Kaktovik), the Coastal Plain of the Arctic Refuge is perhaps the only Arctic region on the planet that has not experienced industrial activity and subsequent contamination, as demonstrated by baseline contaminants data (Snyder-Conn and Lubinski 1993, Vols. 2 and 3). Therefore, this EIS should discuss the consequences of an oil or hazardous material spill due to post-lease activities within the unimpacted portion of the action area, on all potentially impacted resources (water, soil and sediments, biota including microbes, invertebrates, plants, fish, and FWS trust resource birds and mammals).
  - The DEIS does not clearly discuss the risk of spills in the marine shipping lanes, from Unalaska to Kaktovik, which were identified as part of the project area. Recommend expanding the discussion of spill risk to all identified parts of the project area, see Ryder et al. 2010; Schuster et al. 2018; Snyder-Conn & Lubinski 1993a & 1993b.
- **Terrestrial Environment (Vegetation, Wetlands, Soils and Permafrost)**  
Vegetation



- Page 3-71: Long-term impacts (>20 years) of ice roads and snow trails are described, but there is not a similar discussion describing the short-term impacts. Impacts lasting even one or two years will have effects on wildlife and visitors, and perhaps more significant indirect impacts on soils, hydrology, etc. Short-term impacts need to be identified and addressed in the document as appropriate.
- Page 3-65-66: Overall this section is very difficult to follow or interpret. The headings in the discussion section do not match those in the map. For example, in the text there is a section heading “Moist Herbaceous Meadow”, and there is no corresponding heading in the map legend. It appears this may be the “Herbaceous (mesic; northern and western Alaska)” on the map but there is no discussion that allows the reader to understand how the text translates to figure 3-10. Appendix J states the information was pulled from Boggs et al. (2016). Recommend rewriting Appendix J and Section 3.3.1 pages 3-65 and 3-66 to reflect the structure in Boggs et al. (2016) and provide descriptions in Appendix J of the “Fine Scale” cover classes in the original source. See the text below as an example:
  - Herbaceous (mesic; Northern and Western Alaska)
    - Text describing this cover class.
  - Fine Scale cover classes
    - Herbaceous – Dwarf Shrub
      - Vegetation description and relevant information
    - Leymus
      - Vegetation description and relevant information
    - Herbaceous Mesic
      - Vegetation description and relevant information
- Page 3-67 and 3-68: Recommend using 1:63,000 map to assess wetlands instead of coarse scale analysis. At a minimum there should be definitions included in Appendix J for each wetland class. “National Wetlands Inventory Notes to the Users for North Slope 1:63,000” information sheet has definitions and a key for map codes.
- Page 3-39, Wetland Functions and Values: The entire section should be removed or revised. The section makes one statement at the beginning relative to the affected environment in the first line of the first paragraph. The remainder of the section refers to mitigation and wetland functional assessments that are a part of that mitigation and not the affected environment. Any statements as to the value of functional value of wetlands in the context of Berkowitz et al. (2017) should be stricken since that reference states, “This method does not identify the importance of wetlands within a watershed, measure specific wetland functions, or determine sufficiency for mitigation on its own. This methodology can be used to inform project alternatives, assess unavoidable impacts, and aid in the determination of sufficiency for mitigation.” Suggest author rewrite this section to describe the influence wetlands currently have on the system in general or cite specific papers that evaluate Arctic wetland functions and their role in Arctic systems. This will need to be done at a very high/coarse level given there was no analysis of the finer scale National Wetland Inventory products available at the 1:63,000 mapping scale.



- Page 3-69 Paragraph 6: “Relative to wetlands in temperate regions, North Slope wetlands tend to have low function for most of the hydrologic, biogeochemical, or social functions.” This statement needs a citation. Additionally, this is an inappropriate comparison as functional assessments are completed at the local scale and functional values are not comparable. If one uses the hydrogeomorphic classification (Brinson, 1993) a wetland is compared against another wetland characteristic of the same class so comparison with temperate regions would also be inappropriate.
- Page 3-72, Rare and Invasive Plants: For both the impact to rare plants and the probability of introduction of invasive plants, impacts might be equal across all alternatives for the actual disturbance footprint; however, the analysis should take into account the scale of each alternative. For example, under Alternative B there may be an equal probability across the entire program area for the introduction of invasive plants and destruction of rare plants, however, under Alternative D there is an extremely low probability in the no lease sale area for the introduction or destruction of plants because there will be no disturbance in this area.
- Page 3-72, Alternative B: “...Alternative B is herbaceous (mesic) tundra, ranging from 16.4 percent in high HCP to 39.9 percent in low HCP areas...” Maximum value is 42.5 under Medium HCP TL section of Appendix J table J-3. Please correct in the Table and text as appropriate.
- Page 3-73, Alternative B, Paragraph 4: “The NSO protections preferentially preserve wetter more vulnerable vegetation common to riparian areas ...” This statement runs contrary to “Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree...” from the impacts common to all alternative section above. It is not clear where the author argued that wetter sites/riparian area were “more vulnerable”. Given that riparian areas tend to be high disturbance environments, a description of those vulnerabilities should be provided. There also needs to be further explanation of why and, or how NSOs preferentially preserve these areas.
- Page 3-73, Alternative B, Paragraph 5: The document states, “Because of the higher incidence of low shrub vegetation ...” but fails to provide any points of comparison. Suggest rewording to “... higher incidence of low shrub vegetation in the central and eastern portion of the project area...” or something similar.
- Page 3-73, Alternative B, Paragraph 6: “The wetter types occurring in the broad freshwater emergent class are often higher functioning wetlands but were not delineated separately in the NWI mapping used in this analysis.” Because “higher functioning” is not defined restating as “more productive” if that is what the author intended. Additionally, it is likely many of these habitats are delineated by using the ATTRIBUTE designation instead of the WETLAND\_TY (type) in the NWI data layer. Also see comment previous comment on page 3-69, paragraph 6 regarding the use of “functioning” for wetland value.
- Page 3-73, Alternative C: The source of the following statement is unclear: “...herbaceous (mesic), ranging from less than 0.1 percent to 37.4 percent of the areas open for leasing, and tussock tundra, ranging from less than 0.1 percent to 41.1 percent ...”. Appendix J table J-5 has Herbaceous (mesic) values ranging from 20.9 to 56.3 and Tussock tundra ranging from 4.7 to 44.2. Please correct if the values are inaccurate or provide a citation if values are from some other data source.
- Page 3-74, Alternative C, Paragraph 2: “The vulnerable wet tundra types in the NSO riparian areas under Alternative C are protected to a limited extent, depending on the specific design of an anchor oil field development and whether stream crossings are



approved.” The document needs to cite a specific stipulation for the statement provided above given that Alternative B states, “This restriction, however, would not preserve vulnerable vegetation or wetland types because construction would be permitted outside the TL period and would still affect vegetation and wetlands” and it does not appear that any of the stipulations in Alternative C completely prevent development.

- Page 3-74, Alternative C, Paragraph 3: “The NSO requirements for Alternative C effectively protect high-value estuarine wetlands (see discussion under *Affected Environment* and *Alternative B* above).” Contradicts Alternative B “*Impacts Common to All Action Alternatives*” would likely occur throughout the NSO/high HCP areas but to a lesser extent than in the standard terms and conditions or TL areas.” Additionally, neither of these statements address what “effectively protect” means and it is not defined in the Affected Environment section. Suggest removing this statement or providing specific examples of how this protection is “effective”.
- Page 3-74, Alternative D, Paragraphs 4-6: Multiple references to high and low-value wetlands and habitats, however, these terms or the method with which the value was determine is not stated. Recommend elaborating on the methods for determining value of habitats.
- The type descriptions on page J-2 are incomplete. Within each of the four types described, not all subtypes (e.g., those show on the tables) are described. The descriptions should include ecological information, for example ‘commonly occurs of low-centered polygons’, or ‘with lots of permafrost features such as frost boils’. Refer to the vegetation type descriptions in the Arctic Refuge CCP for examples.
- Tables J-1 to J-7 need to be redone. The table needs to be arranged in a hierarchy, with land cover types divided into shrub-dominated, moist herbaceous, wet herbaceous, and other (barren, sparse and water), following the style of most vegetation classification systems, including The Alaska Vegetation Classification (Vioreck et al. 1992) rather than listed in alphabetical order. For example, under wet herbaceous meadow would be listed 3 types: ‘herbaceous (wet), herbaceous (marsh), and herbaceous (wet-marsh)’. It is typical to list the most common land cover type first. Then on page J-2, under the heading ‘wet herbaceous meadow’, all 3 types would be described, with the most common one described first. Right now, that paragraph on page J-2 describes only the 2 types that cover <1% of the study area. The third type that fits in this category (herbaceous (wet)), which covers 16% of the area as mapped, is currently not described. It includes large areas of wet tundra that are not in lakes or on edges of lakes or coast. It should be described first, followed by the two less common types.
- The category ‘moist herbaceous meadow’ includes moist tussock sedge tundra (26% of area) and ‘herbaceous (mesic)’, (31% of area). In the description on page J-2, the first two sentences describe the herbaceous (mesic), but most readers would not know that. Given that the type covers almost a third of the study area, it should be described in more detail.
- Appendix F, Section F.4.12, Vegetation Information: Information in the “Impact Indicator” column is treated differently than in other sections. It is not consistent with how the same problem of quantifying habitat changes is dealt with for other items,



such as bird or caribou habitat. Tables starting on page F-19 repeatedly state that “no indicator available to assess possible plant community changes”. Compare that wording to the wording under bird habitat on page F-26. It is the same issue with difficulty quantifying habitat changes, but they use completely different wording there. For example “habitat affected (qualitative)”, “describe extent of effect in qualitative terms”, and “potential impacts on bird populations”. And then treated differently again for caribou habitat, such as “qualitative assessment”. These should be rewritten and standardized. In addition, when “no indicator available”, is stated in the document, recommend indicators be developed when practicable For example, plant community composition can be quantified with field work.

#### Soil Resources:

- Here and throughout, the DEIS does not mention the importance of intact soil and sediment microbial communities, which form the ultimate base of the food chain. As an example, during cleanup of oil spills (especially to land) natural remediation of unrecovered petroleum products is dependent upon soil microbes. We recommend that the DEIS evaluate practices that affect soil microbes, including compaction, gravel and sand extraction, and any intentional (chlorinated domestic water) or unintentional (hazardous material) spills that affects the soil microbial biome and could diminish recovery processes.
- Recommend including “Massive Ice” map from Jorgenson et al. (2015).

#### Physiography

- There is no discussion about the difference in gradient and terrain between the 1002 and NPR-A and we recommend this information be included in the document. Differences in physiography are highly relevant given that the area is to be managed in a manner similar to the NPR-A yet the physiography is significantly different. Additionally, a comparative discussion between the two areas is appropriate given that there is significant comparison of water availability in section 3.2.10

#### ● **Invasive Species**

#### ● **Cultural Resources**

#### ● **Visitor use**

Section 3.4.6: Distinct impacts to recreational access should be further evaluated for direct and indirect, as well as cumulative impacts. Preservation of unique recreational values and opportunities to recreate, *characterized by freedom from management restrictions on visitor behavior*, is an original purpose of the Arctic Refuge. In order to understand to what



degree visitor use will be affected, Stipulations and ROPs directly specifying when, where, and how public access will be prohibited after lease sales are made; as well as before, during, and after leasing surface activity; need to be evaluated for indirect, as well as cumulative impacts.

- **Visual resources**

Appendix A: Maps and figures do not adequately depict visual resources of the area. Maps and figures should model foreseeable potential effects of typical layouts by showing expected changes in viewshed form, line, color, and texture of landform, vegetation, and water through GIS modeling from 1) suitable river corridors (including the Kongakut River, which is outside the project area, but which was found to have a scenic ORV), 2) Kaktovik, and 3) popular recreation areas. These models should identify the distances from which vertical structures could be detected (i.e. maximum perceptible visible distances (e.g. how far an individual person would be able to see from any place inside a river buffer); or above heights that an individual person (spatially) is likely to be able see). Maps modeling foreseeable areas where changes to dark skies and wildlife abundance/distribution are foreseeable should also be provided.

- **Acoustic environment**

- Within the Acoustic environment, recommend that the effects to natural quiet and the attempts to maintain natural quiet are discussed wherever natural sounds and noise are addressed.

- **Connected, cumulative, or similar actions:**

- **Appendix B: Reasonably Foreseeable Development Scenario**

- **Fish and aquatic communities**

The following corrections should be made to Table K-1, Appendix K-4 and K-5:

- Arctic Cisco habitat use description should delete the words "...freshwater and...", it is extremely rare to find an Arctic Cisco in freshwater at any time except during their spawning runs up the Mackenzie River. Here, it appears to read that one would be equally likely to find them in freshwater or marine environments and that is not true.
- Arctic Grayling spawn in the program area. While, they have rarely been encountered in the fyke net sampling programs that have been operated along the coast, all life stages are abundant in the freshwater drainages that support overwintering fish, Canning, Hulahula, and Sadlerochit, as well as in some lakes in the program area.
- Arctic Grayling habitat use section should clarify that they live during all seasons in the program area. There are some streams such as the Tamayariak and Okpilak that they occupy during summer only, but those are rivers that share deltas with the Canning and Hulahula rivers, respectively.
- Burbot likely spawn in the program area. It is true that burbot have never been captured in the fyke net sampling programs that have been operated for more than seven years in the lagoon habitats of the program area and we are not aware of them



being captured in the long-term fyke netting programs in Prudhoe Bay. However, they are present in the Canning River and large rivers to the west. Therefore, it is highly likely they spawn in the Canning River. They may spawn upstream from the 1002 Area boundary, but if that uncertainty is a concern here, then the answer should be “probably” as to whether burbot spawn in the program area.

- Burbot habitat use description should indicate that as a freshwater fish they are present during all seasons in the Canning River but not elsewhere in the program area. They do not migrate anywhere else for the winter as the column in the table currently reads.
- Chinook Salmon lifespan should be modified to read “4–7”, and age at maturity should be the same. They do not mature at age-1 or age-2, a small fraction may mature at age-3, but for the purposes of this general life history table, maturity at “4–7” would be appropriate.
- Chum Salmon lifespan and age at maturity should both read “3–6”. Age-4 and age-5 are the most common ages at maturity, but ages 3–6 are almost always represented as well in spawning runs.
- Chum Salmon habitat use section should be modified by deleting the words “...and foraging...”. Similar to Chinook Salmon, Chum Salmon might forage a little in coastal marine water as they approach a spawning stream, but they would not be feeding if they were migrating upstream in freshwater.
- Dolly Varden habitat use section reads as though Dolly Varden are common during summer and winter months in coastal and marine waters. This should be reworded to indicate that they are only found in coastal and marine waters during summer months.
- Least Cisco likely do not spawn in the program area. They occur only rarely in fyke net catches in the region and no lake bound or riverine populations have been discovered in the area.
- Ninespine Stickleback habitat use section: the wording suggests that they are common during summer and winter months in both marine and freshwaters, this is not likely. They are classified as anadromous and do venture into coastal and nearshore marine water during summer but they overwinter in freshwater ponds and if available, the lower reaches of rivers. However, none of the rivers in the program area provide brackish interfaces with the sea. They are capable of spawning in both freshwater ponds and in brackish areas.
- Pink Salmon habitat use section should be modified by deleting the words “...and foraging...”. See related comments on Chum Salmon habitat use above.
- Round Whitefish likely spawn in the program area. Round Whitefish is a freshwater species found only in the Canning River within the program area, and both adults and juveniles are found there. We have not captured them in the coastal lagoons and bays of the area, but they do spawn in the Canning River. They may spawn in the Canning River upstream from the 1002 Area boundary, but if that uncertainty is a concern here, then the answer should be “probably” as to whether Round Whitefish spawn in the program area.



- Round Whitefish habitat use section should reflect that Round Whitefish is common in the Canning River throughout the year but not found elsewhere in the program area.

## Maps

- Page 2-30: Map references aerial observations as coming from “North Slope Eider aerial survey and Arctic Coastal Plain breeding waterbird aerial survey; however, the point location to northeast (Beaufort Lagoon) and in the northwest (Brownlow Point) are not within the sampled area of the aerial breeding surveys. Instead, the Brownlow Point observation came from the Common Eider breeding pair survey in 2000 (referenced in Maps 3-15 through 3-20. The eastern point in Map 3-14 (Beaufort Lagoon) is misplaced and should be near Demarcation Point, which is outside of the project area. The map should also indicate that the area in white was not sampled in the aerial breeding pair surveys.
- Page 2-30: Upper panel of each of these maps should be labeled breeding survey, not post-breeding survey. The survey was timed for early incubation of common eiders. Birds observed during this survey may also include non-breeding or failed breeding birds.



## REFERENCES

Need to format

- Avian Power Line Interaction Committee. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Unpublished report, Edison Electric Institute and APLIC, Washington, DC 2012.
- Barr, J. F., C. Eberl, and J. W. McIntyre. 2000. Red-throated Loon (*Gavia stellata*), version 2.0. In *The Birds of North America* (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.513>
- Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. *Arctic shorebirds in north America: a decade of monitoring*. University of California Press.
- Bayne, E. M., L. Habib, And S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology* 22:1186-1193.
- Becker, M.S., and W.H. Pollard. 2016. Sixty-year legacy of human impacts on a high Arctic ecosystem. *Journal of Applied Ecology* 53(3):876-884.
- Bentzen, R., J. Liebezeit, M. Robards, B. Streever, S. Strindberg, and S. Zack. 2018. Bird Use of Northern Alaska Oilfield Rehabilitation Sites. *Arctic* 71:422-430.
- Bollinger K. S. and R. M. Platte. Aerial population surveys of common eiders and other waterbirds during the breeding season - Northwest Alaska, 2006–2009. U. S. Fish and Wildlife Service, Fairbanks, Alaska, 2012.
- Brown, S., J. Bart, R. B. Lancot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the arctic national wildlife refuge. *The Condor* 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. *Waterbirds* 35:546-554.
- Chaulk, K. G., and M. L. Mahoney. 2012. Does spring ice cover influence nest initiation date and clutch size in common eiders? *Polar Biology* 35:645-653.
- Church J .A., Clark P. U., Cazenave A, Gregory JM, Jevrejeva S, Levermann A, et al. 2013: Sea Level Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, J. Boschung, et al., editors. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013, pp. 1137-1216.
- Churchwell, R. T. 2015. Stopover ecology of Semipalmated Sandpipers (*Calidris pusilla*) at coastal deltas of the Beaufort Sea, Alaska. University of Alaska Fairbanks, Fairbanks, Alaska.
- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of beaufort sea deltas by hatch-year semipalmated sandpipers. *Estuaries and Coasts* 41:280-292.

WORKING DRAFT FOR INTERNAL USE ONLY



Curatolo, J. A., and Murphy, S.M. 1986. The effects of pipelines, roads, and traffic on movements of caribou, Rangifer tarandus. Canadian Field-Naturalist 100:218 –224.

Dale, B. C., T. S. Wiens, and L. E. Hamilton. Abundance of three grassland songbirds in an area of natural gas infill drilling in Alberta, Canada. 2009.

Day, R.H., Gall, A.E., Morgan, T.C., Rose, J.R., Plissner, J.H., Sanzenbacher, P.M., Fenneman, J.D., Kuletz, K.J., Watts, B.A., 2013. Seabirds new to the Chukchi and Beaufort seas, Alaska: response to a changing climate? Western Birds 44, 174–182.

Devink, J. M. A., H. G. Gilchrist, and A. W. Diamond. 2005. Effects of water salinity on growth and survival of common eider (Somateria mollissima) ducklings. Auk 122:523-529.

Dickey, M.-H., G. Gauthier, And M.-C. Cadieux. 2008. Climatic effects on the breeding phenology and reproductive success of an arctic-nesting goose species. Global Change Biology 14:1973-1985.

Divoky G., Breeding bird use of barrier islands in the northern Chukchi and Beaufort seas. Partial Final Report. Environmental Assessment of the Alaskan Continental Shelf, Annual Reports. 1, 1978, pp. 482-569

Esler, D., T. D. Bowman, T. A. Dean, C. E. O'Clair, S. C. Jewett, and L. L. McDonald. 2000. Correlates of harlequin duck densities during winter in prince william sound, alaska. Volume 102.SPIE.

Flydal K, P. Jordhoy, C. Nellemann, E. Reimers, O. Strand, and I Vistnes. 2002. Rapport fra REIN-posjektet. The Research Council of Norway.

Frost, G., Christopherson, T., Jorgenson, M., Liljedahl, A., Macander, M., Walker, D., & Wells, A. (2018). Regional Patterns and Asynchronous Onset of Ice-Wedge Degradation since the Mid-20th Century in Arctic Alaska. Remote Sensing, 10(8), 1312

GAO (General Accounting Office). 2002. Alaska's North Slope: requirements for restoring lands after oil production ceases. Washington, D.C.: U.S. General Accounting Office; Resources, Community, and Economics Development GAO/RCED-02-357.

Gilbert, M. M., and A. D. Chalfoun. 2011. Energy Development Affects Populations of Sagebrush Songbirds in Wyoming. Volume 75.SPIE.

Guillemette, M., A. Reed, and J. H. Himmelman. 1996. Availability and consumption of food by common eiders wintering in the Gulf of St Lawrence: Evidence of prey depletion. Canadian Journal of Zoology-Revue Canadienne De Zoologie 74:32-38.

Halas, Gabriela. *Caribou migration, subsistence hunting, and user group conflicts in northwest Alaska: a traditional knowledge perspective*. University of Alaska Fairbanks, 2015.

Hjort, J., Karjalainen, O., Aalto, J., Westermann, S., Romanovsky, V. E., Nelson, F. E., ... & Luoto, M. (2018). Degradation permafrost puts Arctic infrastructure at risk by mid-century. Nature communications, 9(1), 5147.



Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*). in P. G. Rodewald, editor. *The Birds of North America*. Cornell Lab of Ornithology, Ithaca, NY, USA.

Humphries, G.R.W., Huettmann, F., 2014. Putting models to a good use: a rapid assessment of Arctic seabird biodiversity indicates potential conflicts with shipping lanes and human activity. *Diversity and Distributions*, 1–13.

Jorgenson, M. T., Kanevskiy, M., Shur, Y., Grunblatt, J., Ping, C.-L., & Michaelson, G. 2015. *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>

Kalyn Bogard, H. J., and S. K. Davis. 2014. Grassland songbirds exhibit variable responses to the proximity and density of natural gas wells. *The Journal of Wildlife Management* 78:471-482.

Kane, D.I., K. Yoshikawa, J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrology Journal* 21:41-52.

Kanevskiy, M., Shur, Y., Jorgenson, T., Brown, D. R., Moskalenko, N., Brown, J., ... & Buchhorn, M. (2017). Degradation and stabilization of ice wedges: Implications for assessing risk of thermokarst in northern Alaska. *Geomorphology*, 297, 20-42.

Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, 2003-2004. U. S. Fish and Wildlife Service, Arctic National Wildlife Refuge.

Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the arctic national wildlife refuge, alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.

Kendall, S., and C. Villa. 2006. Nesting ecology of tundra-nesting birds at the Canning River Delta, Arctic National Wildlife Refuge, Alaska, June-July 2005. Pages 57 in Arctic National Wildlife Refuge, US Fish and Wildlife Service, Unpublished Report.

Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). in A. F. Poole, and F. B. Gil, editors. *The Birds of North America*. Cornell Lab of Ornithology, Ithaca, NY, USA.

Kubelka V, Šálek M, Tomkovich P, Végvári Z, Freckleton RP, Székely T. Global pattern of nest predation is disrupted by climate change in shorebirds. *Science* 2018; 362: 680-683.

Kuletz, K.J., M. Renner, E.A. Labunski, and G.L. Hunt. 2014. Changes in the Distribution and Abundance of Albatrosses in the Eastern Bering Sea: 1975-2010. *Deep Sea Research II* 109: 282 – 292.

Kuletz, K., M. Ferguson, A. Gall, B. Hurley, E. Labunski, T. Morgan. 2015. Seasonal spatial patterns in seabird and marine mammal distribution in the eastern Chukchi and western Beaufort Seas: Identifying biologically important pelagic areas. *Progress in Oceanography* 136: 175-200.

Kuletz, K.J. and E.A. Labunski. 2017. Seabird Distribution and Abundance in the Offshore Environment, Final Report. US Dept. of the Interior, Bureau of Ocean Energy Management,

WORKING DRAFT FOR INTERNAL USE ONLY



Alaska OCS Region. OCS Study BOEM 2017-004. Provided to BOEM by the U.S. Fish and Wildlife Service, 59 pp, plus 400 pages of Appendices. Available at: <https://www.boem.gov/2017-004/>

Liebezeit J., Rowland E., Cross M., Zack S. Assessing climate change vulnerability of breeding birds in arctic alaska. a report prepared for the arctic landscape conservation cooperative. Wildlife Conservation Society, North America Program, Bozeman, MT., 2013, pp. 167.

Liljedahl, A. K., Boike, J., Daanen, R. P., Fedorov, A. N., Frost, G. V., Grosse, G., ... & Necsoiu, M. (2016). Pan-Arctic ice-wedge degradation in warming permafrost and its influence on tundra hydrology. *Nature Geoscience*, 9(4), 312.

Lintern DG, Macdonald RW, Solomon SM, Jakes H. Beaufort Sea storm and resuspension modeling. *Journal of Marine Systems* 2013; 127: 14-25.

Love, O. P., H. G. Gilchrist, S. Descamps, C. A. D. Semeniuk, and J. Bêty. 2010. Pre-laying climatic cues can time reproduction to optimally match offspring hatching and ice conditions in an Arctic marine bird. *Oecologia* 164:277-286.

Ludlow, S. M., R. M. Brigham, and S. K. Davis. 2015. Oil and natural gas development has mixed effects on the density and reproductive success of grassland songbirds. *The Condor* 117:64-75.

Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.

Manville II, A. M. Bird strike and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science-next steps toward mitigation. 2005.

Murphy, S. M. 1988. Caribou behavior and movements in the Kuparuk oil field: Implications for energetic and impact analyses. *Proceedings of the Third North American Caribou Workshop*. Alaska Department of Fish and Game, Juneau, Alaska. *Wildlife Technical Bulletin* 8:196 – 210.

Murphy, S. M., and Curatolo, J. A. 1987. Activity budgets and movement rates of caribou encountering pipelines, roads, and traffic in northern Alaska. *Canadian Journal of Zoology* 65:122–128

National Research Council. 2003. *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*. Washington, DC: The National Academies Press.  
<https://doi.org/10.17226/10639>.

Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.

Perreault, N., E. Lévesque, D. Fortier, D. Gratton, and L. J. Lamarque. 2017. Remote sensing evaluation of High Arctic wetland depletion following permafrost disturbance by thermo-erosion gully processes. *Arctic Science* 3:237-253.

Petersen M. R. and P. L. Flint. Population structure of Pacific common eiders breeding in Alaska. *Condor* 2002; 104: 780-787.



Purdue, J. R., and H. Haines. 1977. Salt Water Tolerance and Water Turnover in the Snowy Plover. *The Auk* 94:248-255.

Raynolds, M. K., Walker, D. A., Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., ... & Webber, P. J. (2014). Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global change biology*, 20(4), 1211-1224.

Renner, M. and K. Kuletz. 2015. A spatial-seasonal analysis of the oiling risk from shipping traffic to seabirds in the Aleutian Archipelago. *Marine Pollution Bulletin* 101: 127-136. <http://dx.doi.org/10.1016/j.marpolbul.2015.11.007>

Rode, K. D., J. W. Olson, D. L. Eggett, D. C. Douglas, G. M. Durner, T. C. Atwood, E. V. Regehr, R. R. Wilson, T. S. Smith, and M. St. Martin. 2018. Den phenology and reproductive success of polar bears in a changing climate. *Journal of Mammalogy* 99(1):16-26. doi:[10.1093/jmammal/gyx181](https://doi.org/10.1093/jmammal/gyx181)

Smith, L. C., Y. Sheng, G. M. MacDonald, and L. D. Hinzman. 2005. Disappearing Arctic Lakes. *Science* 308:1429-1429.

Smith, M. A., M. S. Goldman, E. J. Knight, and J. J. Warrenchuk eds. 2017. *Ecological Atlas of the Bering, Chukchi, and Beaufort Seas*, 2nd edn. Audubon Alaska, Anchorage, AK.

Smith, M. A., N. J. Walker, C. M. Free, M. J. Kirchhoff, G. S. Drew, N. Warnock, and I. J. Stenhouse. 2014. Identifying marine Important Bird Areas using at-sea survey data. *Biological Conservation* 172:180-189.

Smith, W. T., and Cameron, R.D. 1983. Responses of caribou to industrial development on Alaska's Arctic Slope. *Acta Zoologica Fennica* 175:43 – 45.

Smol, J. P., and M. S. V. Douglas. 2007. Crossing the final ecological threshold in high Arctic ponds. *Proceedings of the National Academy of Sciences* 104:12395-12397.

Stephensen, S.W., Irons, D.B., 2003. A comparison of colonial breeding seabirds in the eastern Bering Sea and Gulf of Alaska. *Marine Ornithology* 31, 167-173.

Uher-Koch, B. D., 2017, Satellite Telemetry Data of Red-throated Loons (*Gavia stellata*) breeding on the Copper River Delta, Yukon-Kuskokwim Delta, Seward Peninsula, and Arctic Coastal Plain of Alaska, 2000-2011: U.S. Geological Survey data release, <https://doi.org/10.5066/F7TH8KVH>.

USGS Alaska Science Center, Polar Bear Research Program., 2018, Denning Phenology, Den Substrate, and Reproductive Success of Female Polar Bears (*Ursus maritimus*) in the southern Beaufort Sea 1986-2013 and the Chukchi Sea 1987-1994: U.S. Geological Survey data release, <https://doi.org/10.5066/F7DF6PC9>.

USFWS (U.S. Fish and Wildlife Service). 2014. North Pacific Seabird Colony Database. <<http://axiom.seabirds.net/maps/north-pacific-seabirds>> (accessed 08/05/14).

USFWS (U.S. Fish and Wildlife Service). 2015. Arctic National Wildlife Refuge, Alaska; revised Comprehensive Conservation Plan and Final Environmental Impact Statement. US Fish and Wildlife Service, Anchorage, Alaska, 2015.

WORKING DRAFT FOR INTERNAL USE ONLY



USFWS (U.S. Fish and Wildlife Service). 2017. Alaska Seabird Die off Fact Sheet, U.S. Fish and Wildlife Service. Available at: [www.fws.gov/alaska/pdf/BeringSea\\_DieOff\\_Info\\_September2017Update.pdf](http://www.fws.gov/alaska/pdf/BeringSea_DieOff_Info_September2017Update.pdf)

USFWS (U.S. Fish and Wildlife Service). 2018. Alaska Seabird Die off Fact Sheet, U.S. Fish and Wildlife Service. Available at: [www.fws.gov/alaska/pdf/Alaska\\_2018\\_Seabird\\_Die-off\\_1Pager\\_VerAUG2018\\_FINAL.pdf](http://www.fws.gov/alaska/pdf/Alaska_2018_Seabird_Die-off_1Pager_VerAUG2018_FINAL.pdf)

USFWS and BLM (U.S. Fish and Wildlife Service and Bureau of Land Management). 2018. Rapid-Response Resource Assessments and Select References for the 1002 Area of the Arctic National Wildlife Refuge in Anticipation of an Oil and Gas Exploration, Leasing and Development Program, per the Tax Act of 2017, Title II Sec. 20001. Prepared for Alaska Regions of the US Fish and Wildlife Service and Bureau of Land Management, Anchorage, Alaska.

U.S. Shorebird Conservation Plan Partnership. Shorebirds of Conservation Concern in the United States of America – 2016. In: Andres B, editor. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2016, pp. 12.

Vermaire JC, Pisaric MFJ, Thienpont JR, Mustaphi CJC, Kokelj SV, Smol JP. Arctic climate warming and sea ice declines lead to increased storm surge activity. *Geophysical Research Letters* 2013; 40.

Viereck, L.A.; Dyrness, C.T.; Batten, A.R.; Wenzlick, K.J. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 p.

Vistnes, I. and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology*, 31(4):399-407.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater Sage-Grouse Population Response to Energy Development and Habitat Loss. Volume 71. SPIE.

Walker, D. A., M. T. Jorgenson, M. Kanevskiy, A. K. Liljedahl, M. Nolan, M. K. Reynolds, and M. Sturm. 2019. Likely impacts of proposed 3D-seismic surveys to the terrain, permafrost, hydrology, and vegetation in the 1002 Area, Arctic National Wildlife Refuge, Alaska. Alaska Geobotany Center Publication AGC 19-01. University of Alaska Fairbanks, Fairbanks, Alaska, USA.

Wauchope, H. S., J. D. Shaw, Ø. Varpe, E. G. Lappo, D. Boertmann, R. B. Lanctot, and R. A. Fuller. 2017. Rapid climate-driven loss of breeding habitat for Arctic migratory birds. *Global Change Biology* 23:1085-1094.

Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.

U.S. Shorebird Conservation Plan Partnership. Shorebirds of Conservation Concern in the United States of America – 2016. In: Andres B, editor. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2016, pp. 12.



Ryder, J., J. Klaminder, P. Rosen, R. Bindler. 2010. Climate driven release of carbon and mercury from permafrost mires increases mercury loading to sub-arctic lakes. *Sci Tot Environ* 408:4778-4783

- Schuster, PF, KM Schaefer, GR Aiken, RC Antweiler, JF Gryziec, ..... T Zhang. 2018. Permafrost stores a globally significant amount of mercury. *Geophysical Research Letters* 45:1463-1471.
- Snyder-Conn and Lubinski 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 2. Raw Data. NAES-TR-93-03. 305pp.
- Snyder-Conn and Lubinski 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 3. Quality Assurance / Quality Control Statistics. NAES-TR-93-03. 109pp.

Page 46. Need to verify...

Esler, D., T. D. Bowman, T. A. Dean, C. E. O'Clair, S. C. Jewett, and L. L. McDonald. 2000. Correlates of harlequin duck densities during winter in prince william sound, alaska. Volume 102.SPIE.

Guillemette, M., A. Reed, and J. H. Himmelman. 1996. Availability and consumption of food by common eiders wintering in the Gulf of St Lawrence: Evidence of prey depletion. *Canadian Journal of Zoology-Revue Canadienne De Zoologie* 74:32-38.

Jesper, K. L., and G. Magella. 2000. Influence of annual variation in food supply on abundance of wintering common eiders *Somateria mollissima*. *Marine Ecology Progress Series* 201:301-309.

Citations removed from text by Wendy during final edits that can be included in citation list:

- Citations: Lehner, N. S. 2012. Arctic fox winter movement and diet in relation to industrial development on Alaska's North Slope. University of Alaska Fairbanks.
- Pamperin, N. J. 2008. Winter movements of arctic foxes in northern Alaska measured by satellite telemetry. University of Alaska Fairbanks
- Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. *Arctic* 67:196-202.
- Citations: Lehner, N. S. 2012. Arctic fox winter movement and diet in relation to industrial development on Alaska's North Slope. University of Alaska Fairbanks.
- Pamperin, N. J. 2008. Winter movements of arctic foxes in northern Alaska measured by satellite telemetry. University of Alaska Fairbanks
- Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. *Arctic* 67:196-202.
- Citations: Ryder, J., J. Klaminder, P. Rosen, R. Bindler. 2010. Climate driven release of carbon and mercury from permafrost mires increases mercury loading to sub-arctic lakes. *Sci Tot Environ* 408:4778-4783

WORKING DRAFT FOR INTERNAL USE ONLY



- Schuster, PF, KM Schaefer, GR Aiken, RC Antweiler, JF Gryziec, ..... T Zhang. 2018. Permafrost stores a globally significant amount of mercury. *Geophysical Research Letters* 45:1463-1471.
- Snyder-Conn and Lubinski 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 2. Raw Data. NAES-TR-93-03. 305pp.
- Snyder-Conn and Lubinski 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 3. Quality Assurance / Quality Control Statistics. NAES-TR-93-03. 109pp.
- Jorgenson, M. T., Shur, Y. L., & Pullman, E. R. (2006). Abrupt increase in permafrost degradation in Arctic Alaska. *Geophysical Research Letters*, 33(2).
- Jesper, K. L., and G. Magella. 2000. Influence of annual variation in food supply on abundance of wintering common eiders *Somateria mollissima*. *Marine Ecology Progress Series* 201:301-309.
- Larsen, J. K., and M. Guillemette. 2000. Influence of annual variation in food supply on abundance of wintering common eiders *Somateria mollissima*. *Marine Ecology Progress Series* 201:301-309.
- Citation: U.S. Shorebird Conservation Plan Partnership. Shorebirds of Conservation Concern in the United States of America – 2016. In: Andres B, editor. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2016, pp. 12.
- Citation: Manville II, A. M. Bird strike and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science-next steps toward mitigation. 2005.
- Citation: Bentzen, R., J. Liebezeit, M. Robards, B. Streever, S. Strindberg, and S. Zack. 2018. Bird Use of Northern Alaska Oilfield Rehabilitation Sites. *Arctic* 71:422-430

Full author list in unformatted 2nd citation:

Jones et al. 2017. A lake-centric geospatial database to guide research and inform management decisions in an Arctic watershed in northern Alaska experiencing climate and land-use changes. *Ambio*. Volume 46. <https://link.springer.com/article/10.1007/s13280-017-0915-9>

Jones, B. M., C. D. Arp, M. S. Whitman, D. Nigro, I. Nitze, J. Beaver, A. Gädeke, et al. 2017. "A Lake-Centric Geospatial Database to Guide Research and Inform Management Decisions in an Arctic Watershed in Northern Alaska Experiencing Climate and Land-Use Changes." *Ambio* 46 (7): 769–786. doi:10.1007/s13280-017-0915-9.



**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Clark, Karen  
**Sent:** 2019-03-05T15:45:06-05:00  
**Importance:** Normal  
**Subject:** Fwd: 1002 Docs in DTS  
**Received:** 2019-03-05T15:45:49-05:00  
[DRAFT\\_USFWS Cover Letter to BLM\\_Coastal Plain DEIS.docx](#)  
[DRAFT\\_USFWS Comments to BLM\\_Coastal Plain DEIS.docx](#)

Karen P. Clark  
Deputy Regional Director  
U.S. Fish & Wildlife Service- Alaska Region  
1011 E Tudor Rd, MS 374  
Anchorage, AK 99503  
[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)  
907.786.3542 office  
907.786.3493 direct  
907.786.3306 fax

----- Forwarded message -----

**From:** Frerich, Lucille <[lucille\\_frerich@fws.gov](mailto:lucille_frerich@fws.gov)>  
**Date:** Tue, Mar 5, 2019 at 11:37 AM  
**Subject:** 1002 Docs in DTS  
**To:** Karen Clark <[karen\\_clark@fws.gov](mailto:karen_clark@fws.gov)>

Lucille Frerich  
Executive Secretary, Regional Directors Office - Alaska Region  
U.S. Fish & Wildlife Service  
1011 E. Tudor Rd MS-381  
Anchorage, AK 99503  
907 786-3542 Fax: 907 786-3306



# **U.S. Fish and Wildlife Service Cooperating Agency Review, Arctic National Wildlife Coastal Plain Oil and Gas Leasing Program Draft Environmental Impact Statement**

## **Section 1: General Comments**

Many issues identified during scoping have been included in the Draft Environmental Impact Statement (Draft EIS or DEIS), which improves the analysis of potential resource impacts. However, there are several aspects of the analysis that with additional attention can help ensure the adequacy of the final Environmental Impact Statement (EIS). Our key general concerns for the project are described below:

- As the land and surface estate manager, the Service would like to be considered as a co-lead in implementing the oil and gas program given these activities may affect the resources managed by the USFWS Arctic National Wildlife Refuge. We recommend that relationship be defined in Section 1.7 and throughout Section 2. While there is a statement describing the coordinating relationship between BLM and FWS at the bottom of Table 2-2 on page 2-4, we believe this consensus warrants being included in the text. The table should be revised where it states that exceptions could be made by the Authorized Officer to indicate that exceptions would be made by consensus of the BLM Authorizing Officer and the USFWS designated Officer.
- Given the overlap of potential lease blocks and polar bear denning habitat, we recommend ensuring that surveys of polar bear denning habitat are required under all alternatives and development scenarios. We also emphasize that it would be important to ensure that all potential lessees are aware that they will have to consider the need to avoid disturbance of denning polar bears when they consider the temporal and spatial aspects of their operations. The impact of those temporal and spatial considerations on their operations will depend on the degree of overlap of specific lease blocks with denning habitat and the location of detected dens in any given year.
- The analysis and area estimates for 3-D seismic used in the Reasonably Foreseeable Development Scenario are now based on the incorrect assumption that area-wide seismic would occur prior to the Record of Decision. This affects the impact analysis throughout the document. Further, the analysis evaluates the assumption that only about 35% of the project area (900 sq. miles) will be surveyed using 3-D seismic. This estimate originates from typical 3-D survey operations in the NPR-A. However, it is unlikely these efforts are comparable with proposed seismic plans in the project area. For example, Walker et. al (2019) assumed the entire project area would be explored and estimated a total of 37,800 miles of seismic lines could impact an estimated 235 sq. miles with long-term impacts. The document mentions that seismic exploration will be further detailed in the seismic Environmental Analysis, but the assumed timing presented in Table B-3 is highly uncertain. Details and analysis regarding seismic exploration in the program area should be evaluated and revised in this document.
- The Introduction, Overview, states that the issuance of an oil and gas lease does not have any direct effects on the environment since it does not authorize drilling, or any other ground disturbing activities; however, a lease does grant the lessee certain rights to drill for and extract oil and gas subject to reasonable regulation, including applicable laws, terms, conditions and stipulations of the lease. Given our recent experience examining a proposal to conduct seismic operations in the 1002 Coastal Plain, we believe it is important that lessees understand that there may need to be significant temporal and spatial conditions placed on activities that overlap in time and space with polar bear denning habitat. Such conditions are necessary to ensure compliance with the ESA and MMPA. We



believe this information should influence BLM's decision of which tracts of land should be offered for lease and the terms and conditions to be applied to such leases and subsequent authorizations for oil and gas activities.

- USGS (Attanasi 2005) resource assessment of the 1002 Area delineates a high and low resource potential area. According to the values from the USGS reproduced in the Draft EIS as Appendix B Table B-1, the highest probability oil resource is believed to be in the Topset Play, accounting for a mean of 4.325 BBO of Oil, or nearly 67% of the mean total undiscovered oil in the refuge and about 34% of the gas. The next highest potential is believed to be the Turbidite Play, with approximately 20% of the mean estimated oil and 32% of the gas. Thus, these two formations should be made as fully available for leasing to meet the requirement of the Tax Act that no less than 400,000 acres be made available through 2 lease sales in the next 8 years. The Draft EIS goes beyond the USGS assessment to identify the Thin-Skinned Thrust Belt Play as an area of moderate oil potential, potentially accounting for 13% of the total mean undiscovered oil resources (7.687 BBO in total when the estimated mean resources in the Undeformed Area are combined with estimated mean resources in the Deformed Area; see Tables B-1 and B-2). This play, which the DEIS describes as "Alaska Native allotment lands and Alaska Native lands that are patented or interim conveyed" (page B-1) does not therefore meet the criteria of the highest resource potential, and should only be made available outside of the program area.
- The DEIS could better address strategies to prevent introduction and spread of invasive species. To address invasive terrestrial plants, the Required Operating Procedures (ROPs) should recognize the use of, and include additional information about, certified weed-free gravel and supplies for road corridor construction and pipeline construction. Additionally, the document does not adequately address the threat of introduced aquatic invasive species (e.g., Elodea), invasive terrestrial invertebrates, or invasive terrestrial vertebrates (e.g., rodents). The DEIS should also describe how the proponent will respond to an introduction of nonnative species.
- We recommend adding a ROP under all alternatives the requirement for development of spill response plans. This is currently only found under Stipulation 4, Alternative D, Standard iv. Our recommended standard/requirement is as follows: Operators would be responsible for developing comprehensive spill prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans as well as to maintain adequate oil spill response capability to effectively respond during periods of ice, broken ice, or open water. Plans should be based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM and USFWS.
- The effects of a changing arctic environment should be further addressed within the EIS. There is a large body of literature that describes the potential landscape level changes on the North Slope, including changes in permafrost, hydrology, land cover and infrastructure stability. For example, a recent study by Hjort et al. 2018 indicates that the effects of permafrost melt will be an engineering hazard to infrastructure by mid-century. Additionally, there are specific effects related to environmental change such as ice wedge degradation leading to subsidence and changes in hydrology, snow accumulation and plant communities (Jorgenson, M. T., Shur, Y. L., & Pullman, E. R. 2006; Raynolds et al. 2014). Effects of these changes have been shown to be more severe in areas with topographic complexity such as the 1002 coastal plain (Liljedahl et al. 2016). We recommend that studies like these be included in the analysis of potential impacts to various development



scenarios. Additional information on this topic can also be found in Jorgenson et al. 2016, Frost et al. 2018 and Kanevskiy et al. 2017.

- The Reasonably Foreseeable Development Scenario and associated analyses used in alternatives development does not provide any differentiation between jobs creation, employment income, revenue to communities or government entities, or recovery/production of oil and gas resources. As such, the assumption is that these factors are held constant regardless of the alternative selected. Therefore, the BLM should primarily base their decision on the differing environmental consequences identified in the analyses under the action alternatives. The Service's preference for Alternative D2 as the Environmentally Preferred Alternative is supported by the analyses provided in the DEIS.
- The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be eligible and suitable for inclusion in the National Wild and Scenic River System, as noted in the DEIS. All Stipulations and ROPs should strive to not affect the Wild and Scenic characteristics and values of these rivers. We have noted specific suggestions in the following sections.
- Because of the complexity and length of NEPA documents, we recommend including information referred to in other NEPA documents (e.g. Greater Mooses Tooth-2 FEIS, National Petroleum Reserve Area (NPRA) Integrated Activity Plan/EIS) in the appendices so that when information found within these documents is used or referenced within the EIS, it is easily accessible. We also suggest that all references to other regulatory documents include chapter or page numbers to guide the reader to the appropriate information.
- Throughout the DEIS there are requirements that applicants will need to fulfill to monitor, assess, and evaluate the effects of development activities on the resources of the Arctic Refuge. In all of these instances, the data and analysis information should be provided to the USFWS and BLM for their records. Data should be provided in electronic format and be accompanied by complete metadata and information about collection and analysis methodology.
- Arctic Refuge Special Use Permits authorize private businesses to operate commercial hunting, fishing, recreation, polar bear viewing, and general visitor access to the 1002 coastal plain area. All alternatives should address impacts to the operations of these private businesses and their continued viability.



## Section 2: Comments on Stipulations and ROPs

### Stipulation 1: Rivers and Streams

- The Marsh Fork-Canning and Hulahula Rivers were found to be eligible and suitable for inclusion in the National Wild and Scenic River System, as noted in the DEIS. We recommended that river setbacks be used to meet the objectives stated in Stipulation 1, which include the other Refuge purposes. Alternative D reflects the FWS recommended minimum of 0.5 mi setback for all identified rivers. Larger setbacks are identified for larger rivers and are necessary and appropriate to protect Wild and Scenic River values. Overlaying river setbacks on the viewshed study submitted by TrueNorth GIS suggests that Alternative D would condition approximately 25% more land with NSO than the other alternatives, better protecting the species, habitats and activities identified in the Refuge purposes while allowing for oil and gas development through subsurface leasing. We recommend that all rivers have minimum setbacks of 0.5 mi under Alternatives B and C, except for spring-fed rivers, which should have minimum setbacks of 1 mile. We believe this change is necessary to ensure that Alternatives B and C are compatible with the purposes of the Arctic Refuge as stated in ANILCA.
- Given the high use of the Coastal Plain for denning by polar bears, especially when compared to the rest of northern Alaska, ensuring bears have access to preferred areas of denning habitat is important. This is highlighted by the fact that terrestrial denning is likely to continue increasing as sea ice conditions deteriorate further in future years. While Alternatives B and C provide some protection of high use polar bear denning habitat under Lease Stipulation 1, there are large areas where numerous polar bears dens have been recorded (Map 3-24) that do not have restrictions on surface occupancy under these alternatives. Even if surveys were conducted under MMPA Incidental Take Regulations with the intention of reducing the potential to disturb denning bears in those areas, Incidental Take Regulations (and hence Stipulation 5 for Alts B and C) would offer no protections against behavioral avoidance of those areas once developed. This could effectively lead to a loss of preferred denning habitat. Stipulation 1 under Alternative D protects a much broader area of important, and highly used denning habitat than the other alternatives, especially in the central portion of the Coastal Plain. We believe application of this Stipulation across alternatives B and C would be more consistent with all of the purposes of the Arctic Refuge, the MMPA and BLM's responsibility under Section 7(a)(1) of the ESA.
- We recommend that appropriate Stipulations and ROPs to minimize impacts to Wild and Scenic River characteristics (e.g., maintaining water quality, free-flowing condition, identified ORVs, and wild classifications) be applied whenever activities may affect a river's Wild and Scenic River characteristics.
- Requirement/standard(s) should be added that prohibits infrastructure within maximum perceptible visible distances (e.g: how far an individual person would be able to see from any place inside a river buffer); or above heights that an individual person (spatially) is likely to be able see. Additional analysis should be completed to determine the area extent of the infrastructure prohibitions/height limitations.
- Analysis by Service staff, using available viewshed information conducted by True North GIS and submitted to the BLM for consideration in the DEIS, shows most infrastructure with a maximum of 15m height would be visible if built within any of the setbacks for the six rivers as described currently in Alternatives B-D. Our analysis shows Alternative D (with approximately 750 km of the Coastal Plain protected by NSO setbacks on the six named rivers) provides complete viewshed protections for just under 12% of the project area (where infrastructure of any height would otherwise be visible from the rivers). Further, an additional 23% of the viewsheds from these six



river corridors are protected when infrastructure is modeled to be at or below 15m in height, as specified in Alternative D. (see personal communication Paul Leonard, “Re-analysis of Viewshed Modelling for the Arctic Refuge’s Coastal Plain Major Rivers.”)

- Protecting natural quiet (as well as natural sounds and noise) is inherent to preserving river values for suitable rivers classified as wild and possessing recreational and cultural ORVs. We recommend that Requirement/Standard(s) should be added across alternatives B-D that provides acoustic protections for natural quiet from within suitable river corridors.
- We recommend adding a Requirement/Standard(s) under Oil and Gas Field Abandonment, across alternatives B-D that specifies before final abandonment, if a suitable river corridor’s eligibility characteristics have been impacted by leasing and production activities, all eligibility findings and suitability factors as specified in the Arctic Refuge wild and scenic river review should be restored to a point where the area is again qualified for inclusion in the NWSRS.
- We recommend adding an additional Requirement/Standard(s) that reads: Before activities affecting suitable NWRS river corridors can occur, collection of baseline data that documents current suitable river characteristics will be completed as prescribed by the Authorizing Officer and in consensus with the USFWS as the surface management agency. This information will be used to monitor impacts, detect when NWRS values are threatened, and identify needs for changes in practices. The lessee is to provide support for these efforts to help monitor and analyze effects on suitable river values and wild classification.
- The Requirement/Standard(s) should be designed to specifically maintain characteristics of the recreation and scenic ORVs for the Kongakut River, even though it is outside the project area. GIS modeling should be completed to determine whether/to what extent a setback within the eastern boundary of the project area would be needed to maintain viewshed characteristics of the scenic ORV for the Kongakut River.
- Lease Stipulation #1: Alternatives B-D prohibit permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines) within certain river corridors; and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. We recommend changing requirement/standard wording for Canning and Hulahula rivers under all alternatives to include the following language: “(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances to protect Wild and Scenic River characteristics.” Alternatives B-D seek to “minimize the disruption of free flow” but language should specify that *maintaining* free flow is required to meet Service interim management requirements for suitable rivers.
- Preservation of recreational hunting, fishing, hiking and boating values and opportunities is an original purpose of the Arctic Refuge, and the majority of visitors recreate within the project area. In order to meet the original purpose of this area, an objective for Alternatives B and C should be to minimize impacts on recreation.
- The Canning, Marsh Fork-Canning (main tributary of the Canning), Hulahula, and Kongakut Rivers are highly valued and/or used by the public for recreation. The objective of this stipulation should develop a ROP identifying how Recreational Outstandingly Remarkable Values as described for the Marsh Fork-Canning, Hulahula and Kongakut Rivers shall be maintained, consistent with USFWS interim management prescriptions for suitable rivers.



- We recommend deleting the last sentence in the objective “Protect the water quality, quantity....across the coastal plain”, and include “springs and aufeis” in the first sentence following “riparian areas”.
- While Sadlerochit Springs appears to be within the Sadlerochit River, it is actually west of the Sadlerochit River and is a tributary to the Iteklyariak River. We recommend that Sadlerochit Springs and Creek, and Iteklyariak Creek-complex have a 3-mile setback in all alternatives in Leasing Stipulation 1 due to its cultural significance and unique terrestrial and aquatic communities. The Sadlerochit Spring Creek and Iteklyariak Creek complex have a unique endemic population of dwarf Dolly Varden and is an important subsistence use area. For more information see Arctic Refuge CCP (2015).
- To meet the objective for Stipulation 1 and meet the other identified Refuge purposes, gravel mining sites should not be allowed in areas designated No Surface Occupancy.
- It is difficult to address the adequacy of a standard that allows case-by-case approvals for development in nearshore waters when the objective is to protect habitat. The standard's adequacy will remain unknown until we know more about what will be approved and how those developments will fare over time. The standard states "exploratory drill pads, production pads, or CPFs are not allowed unless they're approved" which imparts significant subjectivity. We recommend the EIS provide additional clarity on how case-by-case approvals may occur and how they will be decided. Additionally, we recommend including a requirement that approvals will be reached by consensus between the BLM Administrative Officer and an authorized Service representative.

#### **Stipulation 2: Canning River Delta and Lakes**

- Water resources in the Canning River Delta, including lakes, represent some of the highest quality wetland habitat within the Refuge. Unlike the coastal plain ecosystems to the west of the Refuge, the Refuge Coastal Plain has considerably fewer lakes. Therefore, lakes in the Canning River delta provide important habitat for fish and waterbirds that is not widespread in the project area. Protection of these habitats from disturbance is required to conserve fish and wildlife populations and habitats in their natural diversity and ensure water quality and quantity within the refuge is maintained. We previously recommended No Surface Occupancy be allowed in this area except for essential infrastructure approved by the BLM and with consensus from the Service. This requirement is currently supported in Alternative D, and should be applied to alternatives B and C to help maintain the other ANILCA purposes of the Refuge.

#### **Stipulation 3: Springs/Aufeis**

- We recommend adding NSO buffers and no lease setbacks described in Alternative D to all alternatives as Alternatives B and C may not meet the other purposes of the refuge without this requirement. Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters, and rivers without springs have no fish. All Arctic Grayling and Dolly Varden are major subsistence resources in the Arctic Refuge, and their survival depends on approximately twenty springs found within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations, requiring special recognition. Subsurface flow paths to perennial springs are unknown and could potentially be disturbed by drilling or fracking activity. This universal stipulation is needed to ensure that these important and unique habitats and water resources are protected per ANILCA



purposes of the Refuge, while accounting for uncertainty regarding sources and flowpaths of groundwater in the Coastal Plain.

- Specific protective setback distances from springs and aufeis should exist, but not be defined until studies of spring flows and sources are completed, as flow to springs may originate outside of a 3-mile setback. Flows to springs likely traverse or originate in groundwater beneath permafrost; this groundwater is identified as the recipient water body for potentially toxic drilling wastes via injection wells. Studies of springwater flows, including sources, should accurately identify and delineate surface water and groundwater flow to and from springs; these flow patterns may be linear (channels) or large areas (aquifers) that require differently shaped buffers. Delineating specific protective buffers prior to these studies are completed may result in buffers that are insufficient to protect these important aquatic habitats. To help ensure the other purposes of the refuge are met, we recommend that the Requirement/Standard for Stipulation 3 be changed under all alternatives to: “Before exploratory or production drilling, the lessee/operator/owner would conduct studies to ensure drilling would not disrupt flow to or from, and waste injection wells will not contaminate any perennial springs. Study plans would be developed in consultation with the BLM, USFWS, and other agencies, as appropriate.” Under all alternatives, the following phrase should be added after all delineated buffers referring to “above” springs: “or to a distance that sufficiently protects groundwater sources and flows of (the named spring), whichever is greater.”

#### **Stipulation 4: Nearshore Marine, Lagoon, and Barrier Island Habitats of the Southern Beaufort Sea within the Boundary of the Arctic Refuge (Map 2-2 and Map 2-4)**

- Due to the abundance, diversity and accessibility of subsistence resources in the nearshore area, this zone is a significant subsistence hunting area. Alternative D requirements to coordinate with local users represents best-practices developed for NPRA and the Chukchi Sea leasing programs and should be applied consistently when subsistence resources may be impacted.
- As polar bear use of the onshore environment increases in summer/autumn due to sea ice loss, it will become increasingly important to reduce human-polar bear conflict, ultimately leading to reductions in polar bears killed in defense of life. While all alternatives provide good protections for polar bears on barrier islands, Alternatives B and C are insufficient to minimize human/bear conflict when bears are active on the mainland coast. Bears move up and down the coastline during summer and autumn as they search for beach-cast marine mammal carcasses or subsistence whale remains. As such, the coastline provides an important movement corridor and habitat for resting for bears during summer and autumn. Alternatives B and C do not provide temporal restrictions on activities which could lead to unnecessary conflict with polar bears. Alternative D restricts activities in this area to the time of year when polar bears are less likely to be moving along the coast, thus providing a good mechanism for reducing conflicts, and potential lethal removal of bears. We recommend that the requirements/standards from D be applied across all alternatives to ensure requirements of the MMPA and ESA are met.
- We recommend altering the Objective in this stipulation to better describe the diversity of avian species. ‘Waterfowl’ is used, but should be ‘waterbirds’, and include ‘sea birds and larids’, since larids and seabirds are not covered by definition of ‘waterbirds’ on p. 3-86, or in Table J-9. Please change to “Objective: Protect fish and wildlife habitat, including that for waterbirds, larids, sea birds, and shorebirds, caribou insect relief”

#### **Lease Stipulation 5: Coastal Polar Bear Denning River Habitat**

- Alternatives B and C do not provide protections for the possible behavioral avoidance of important polar bear denning habitat even with a small development footprint. Alternative D allows polar



bears unhindered access to large areas of their preferred denning areas in the Coastal Plain. This will become increasingly important as the density of land-based dens increases in future years due to sea ice loss. We recommend that the requirements/standards from Alternative D be applied to Alternatives B and C. This would be most consistent with the Refuge purposes as outlined in ANILCA, the ESA and the MMPA.

- The language in Alternative D, Requirements/Standard subparts (a) and (b) allow the BLM Authorizing Officer to approve alternative protective measures. We recommend any such approvals be granted only in the case of consensus by the Service, given the need to ensure compliance with the ESA and MMPA.
- Changes in denning and/or disturbance should be monitored and evaluated over time. We recommend adding a requirement that a study of a minimum of 5 years be conducted to detect polar bear dens in all active lease blocks that overlap with polar bear designated critical habitat. If changes and/or disturbance are identified, then corrective measures may be applied.

#### **Lease Stipulation 6: Caribou Summer Habitat**

- As shown in Maps 3-21 and 3-22, the entire Coastal Plain of the Refuge is high value caribou calving and/or insect relief habitat used by the Porcupine and Central Arctic herds. Female caribou with calves are sensitive to disturbance during the summer periods when they inhabit the coastal plain. We recommended timing limitations described under Alternative D in order to minimize impacts on this internationally important herd and subsistence resource. Importantly, Alternative D2 allows for exceptions to the timing limitations if approved by the Authorized Officer in consensus with the Service as the surface management agency, to account for variability in herd distribution. Recognizing the uncertainty about how much development will occur when and where, Alternative D2 provides managers with the ability to regulate development activity if needed.
- Recommend ROP be revised as: “Objective: Reduce disturbance of caribou and hindrance or alteration of caribou movements during periods when caribou are sensitive to disturbance.”
- Recommend that the monitoring plan required in Requirement/Standard “g.” in ROP 23 be expanded beyond vehicle use management to all potential activities that may disrupt caribou, and that allows for adaptive management to ensure ROP 23 is effective.

#### **Lease Stipulation 7: Porcupine Caribou Primary Calving Habitat Area (Map 2-2)**

- A significant number of scoping comments called for protection of the Porcupine Caribou herd calving grounds, as has been done for the Teshekpuk and Western Arctic herds in NPRA. In the absence of delineated Special Areas identified for NPRA, the Draft EIS uses high density calving habitat to delineate the area where disturbance should be minimized during calving. Requirements found in Alternative D are designed to minimize impacts on caribou and their calves and protect the spring and fall primary migration corridor for the entire herd. The No Leasing restrictions occur in the area of lowest resource potential, while still allowing sufficient acreage to meet the requirements of PL 115-97. The timing limitations under Alternative B to minimize construction activity during the calving period would only be effective during the 1-2 years of an individual well pad construction, but would not minimize disturbance during exploration or during 30+ years of operations. Alternative C would allow for exploration, which includes disturbance during summer for studies, “stick-picking” and other activities.



- Recommend that the “Note” in this section be reworded as: “For the purposes of this document, the Porcupine Caribou Herd (PCH) primary calving habitat area was defined as the area with a higher-than-average density of cows about to give birth during more than 40 percent of the years surveyed. It is recognized that locations of important calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”
- Recommend revision of the Objective for this stipulation to: “Reduce the possibility of disturbance of caribou or hindrance or alteration of their movements in the south-southeast portion of the Coastal Plain, which has been identified as important caribou calving habitat during many years.”
- Recommend that the monitoring plan required in Requirement/Standard “a.i.” be expanded beyond vehicle use management to all potential activities that may disrupt caribou, and that allows for adaptive management to ensure Lease Stipulation 7 is effective.

#### **Lease Stipulation 8: Porcupine Caribou Post-Calving Habitat Area**

- Because of the level of activity, noise and larger footprint associated with Central Processing Facilities, we recommended that they be prohibited from the lands identified as calving and post-calving habitat in Maps 3-22 and 3-23 for the PCH and Central Arctic Herd (CAH), as described in Alternative D. The footprint limits recommended in Alternative D are intended to avoid high-density infrastructure in this area and ensure that caribou can move freely and undisturbed through the area per the requirements of ROP 23.
- Recommend revision: “Note: For the purposes of this document, the PCH post-calving area was defined as the area with a higher-than-average density of cows during the post-calving period for more than 40 percent of the years studied. This includes and extends beyond the primary calving area. It is recognized that locations of important post-calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”
- Recommend the following revision of the Objective for this stipulation: “To protect key surface resources and subsistence resources/activities from disturbance resulting from permanent oil and gas development and associated activities in areas used by caribou during post-calving and insect-relief periods.”

#### **Lease Stipulation 9: Coastal Area (Map 2-2)**

- Recommend revising the Requirement Standard under Alternative B as follows: “...lessee/operator/contractor would develop and implement a *Service-approved Polar Bear* impact and conflict avoidance and monitoring plan.”
- While an impact and conflict avoidance plan as identified in Requirement/Standard of Alternative B would help reduce conflict with polar bears, it is an insufficient protection for bears on shore in summer and autumn for the following reasons:
  - It would not account for the potential behavioral avoidance of polar bears seeking maternal denning habitat.
  - While polar bears have been observed traversing oil facilities along the coast during summer/autumn, by not restricting infrastructure along the coast, there is an increased risk of human-polar bear conflict that could lead to more bears being killed in defense of life, or that come into contact with hazardous materials.

We are concerned that under Alternative B we could not successfully manage human-polar bear conflicts and ensure compliance with the MMPA and ESA, as Alternative B does not provide



sufficient protections for polar bear coastal habitat. Alternative C begins to make meaningful progress towards minimizing effects to coastal denning habitat and reducing the probability of human-polar bear conflict. However, we recommend the protections for polar bears and their habitat as outlined in Alternative D be adopted to help ensure compliance with MMPA and ESA.

#### **Lease Stipulation 10: Wilderness Boundary**

- We recommend that a setback be stipulated in order to protect wilderness values of the Mollie Beattie Wilderness Area from visual and acoustic disturbance associated with oil and gas exploration and development. The NSO setback should be based off viewshed and soundscape analysis. Lacking these data during alternative development, we recommended a 3 mile buffer to provide a degree of protection, and thus support Alternative D or a variation as refined by further viewshed and soundscape modeling.

#### **ROP 1:**

- To meet all purposes of the Refuge, the Requirement/Standard for this ROP should read: “Areas of operation would be left clean of all debris, residual soil contamination, surface water contamination, and groundwater contamination where groundwater is hydrologically connected to springs.”

#### **ROP 2:**

- Recommend adjusting the wording in the Requirement /Standard as follows:
  - The plan would be submitted to the BLM Authorized Officer ~~for approval~~, in consultation with federal, State, and NSB regulatory and resource agencies *for approval*, as appropriate.
  - b. Lessees/operators/contractors would have *an approved* a written procedure.
  - c. To protect the water quality standard inherent to the wild river classification, add: “i. within setbacks for all suitable rivers, no pumpable, solid, liquid, and sludge waste shall be disposed of by injection (as is the standard elsewhere). Rather, ADEC approved storage for backhaul shall be the standard method for disposal of pumpable waste products.”
- Under disposal of rotting waste (b), recommend requiring exclusionary devices (e.g., grating, mesh, fence) be installed at all incineration sites to preclude access by wildlife.

#### **ROP 3:**

- Recommended revision: The BLM Authorized Officer may allow storage and operations at areas closer than the stated distances if properly designed *and contained* to account for local hydrologic conditions.
- Under all alternatives, recommend adding language to the Requirement/Standard that requires secondary containment and spill response equipment for all fuel equipment and caches.
- For Alternatives B-D: To protect the water quality standard inherent to the wild river classification, recommend inserting a Requirement/Standard specific to suitable rivers: “Refueling equipment within setbacks for all suitable rivers is prohibited. Fuel storage stations would be located outside the setbacks except for small caches (up to 210 gallons) for motor boats, float planes, and ski planes, and for small equipment such as portable generators and water pumps, which would be located at least 100 feet from the active floodplain of suitable rivers.”



#### **ROP 5:**

- The Requirements/Standard section under ROP 6 should be moved in its entirety to ROP 5 and added to the current ROP 5 Requirement/Standard.

#### **ROP 6:**

- Consistent with the mandate for habitat protection within the project area(s), environmental damage and unnecessary or undue degradation of the lands should be avoided and minimized to the greatest extent practicable, including that which may be caused by vehicular traffic.
- Paragraphs “b.” and “e.”: In order to determine air impacts to the Arctic National Wildlife Refuge, we recommend adding “and Class II” after Class I areas.
- Paragraph “g.”: Ambient monitoring data can be used to determine impacts to Air Quality Related Values (AQRVs). This paragraph should include the following language: “or shows impacts above specific levels of concern for AQRVs”.

#### **ROP 8:**

- This Requirement/Standard as currently worded does not meet the stated Objective or ANILCA purposes for the refuge. We recommend editing the objective to read: “In flowing waters (rivers, streams and springs) ensure water of sufficient quality and quantity to conserve fish, waterbirds, and wildlife populations and habitats in their natural diversity.”
- We recommend the Requirement/Standard be edited to read:
  - a. Withdrawal of unfrozen water from springs, rivers and streams during winter (onset of freeze-up to break-up) is prohibited. The removal of ice aggregate from grounded areas 4 feet deep or less may be authorized from rivers on a site-specific basis.
  - b. Water withdrawal is prohibited year round from the following rivers, streams and springs: Canning, Hulahula, and Sadlerochit rivers including Itkilyariak Creek, a tributary of the Sadlerochit River that drains the Sadlerochit Spring, and perennial springs on the Tamayariak, Sadlerochit (the spring is located just west of the main stem in a tributary of the Sadlerochit River), Fishhole 1 Spring on the Hulahula River, and the perennial spring on the Okerokovik River, which is a tributary to the Jago River.
  - c. Water withdrawal from other rivers and streams, outside of the winter, may be approved by the BLM Authorized Officer, in consensus with the Service, with adequate protection of hydrologic regimes, water quality and fish and wildlife habitats and populations.”
- We recommend the ROP identify who will monitor these requirements/standards and how the operator will determine the best approach to achieve required percentages and depths.

#### **ROP 9:**

- Recommend providing additional explanation in the body of the document as to how water withdrawal amounts were determined within the Requirement/Standard and whether these withdrawal amounts ensure water volumes will remain sufficient to support fish communities found within the affected water bodies.
- We recommend adding the following requirement to this ROP as it currently does not contain requirements for determining fish presence prior to activities that could impact fish: “Sensitive and



non-sensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.”

- We recommend adding the phrase “connectivity to adjacent bird nesting sites” under the Requirement/Standard. Additionally, we recommend changing the rest of the Requirement/Standard to read: “Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas 4 feet deep or less during winter and withdrawal of water from lakes during the summer may be authorized on a site-specific basis, depending on water volume and depth, the fish community, and connectivity to other lakes or streams and adjacent bird nesting sites.”
- Under Alternative D: This ROP is applicable to all birds. Please change “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds” to “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for birds.”

#### **ROP 10:**

- This ROP currently states that these restrictions do not apply to the use of equipment on ice roads after they are constructed. This is inconsistent with the language below and also with standards promulgated in ITRs for polar bears. If an ice road is constructed and a polar bear den is later detected within 1 mile of it, industry will likely have to reroute the road. While it is true that ITRs will likely have requirements about detecting dens, this ROP does not provide enough detail on how dens will be detected. Without a survey, there would be no known dens, and therefore no need to modify activity. Section b under Alternative D should be included in Alternatives B and C as well, given there is a requirement that all known dens be avoided and surveys are necessary to locate dens.
- Recommend modifying the date range in Section b to end on April 18th, as this is the upper tail of den emergence for land-based denning for bears in the Southern Beaufort Sea as calculated from data published in Rode et al. (2018) and summarized in USGS Alaska Science Center, Polar Bear Research Program (2018). The text should clarify that if an aerial infrared survey is to be conducted, it should be conducted between December 15 and January 31 of any given year.
- Requirement/standard (a) states that use of vehicles and other equipment is prohibited within 0.5 miles of grizzly bear dens identified by ADFG, however ADFG does not currently identify grizzly bear dens in the Refuge. Revise this to state that grizzly bear dens will be identified by the Service, and if the data are not available then the lessee will work with the Service to develop or conduct studies to model habitat use (including denning, foraging and travel) by grizzlies in and around 1002.

#### **ROP 11:**

- The program area is steeper, more incised, and includes more river systems compared to flat areas in NPRA where extensive 3D-seismic surveys have been conducted. Topography strongly affects snow, hydrology and permafrost regimes of this generally hilly region and increases the potential for significant impacts to vegetation. Detailed microtopographic transects across existing 3D seismic trails show that there is compression of the tundra vegetation mat that is up to 20 cm in depth. These changes to microtopography within the track cause other changes to snow, hydrology, and thermal regimes, which make the tracks visible from the air and create conditions in some areas favorable to thermokarst and thermal erosion. Changes in the microtopography and compression of the vegetation mat also would have likely consequences to habitats of many species of plants, insects, small mammals, and birds (Walker et al. 2019). In order to minimize these effects, we suggest the following:



- For Alternatives B-D, change requirement/standard h. to “...overland travel *will* be monitored, and the operator will accommodate representative(s) during operations.”
- In Alternatives B-D, recommend including a snow monitoring plan that outlines measurement protocols (occurring before and during operation) to be submitted to BLM for review in conjunction with FWS prior to work being conducted to ensure habitat impacts are minimized.
- Under Requirement/Standard “a,” all Alternatives, indicate that the exact dates are determined annually.
- Change Requirement/Standard “b,” second sentence, under all Alternatives to read: “These vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra *caused by* shearing, scraping, ....”
- Alternatives A-D treat physiographic regions across the program area as homogenous. Suggest a delineation of regions with tundra travel opening criteria based on terrain ruggedness, elevation, and landforms (e.g., Map 3-1).
- Alternative D (standard a) mentions measurements should be made “over the highest tussocks”. No features are mentioned in alternatives A-C leaving the question open from where measurements can originate. Suggest standardizing across alternatives (e.g., above tussock tops).
- Under Requirement/Standard h. Seismic operations and winter overland travel will be monitored by agency representatives, and the operator will accommodate the representative during operations.
- Requirement/standard (a) for alternative D should be changed to the following to help ensure protection: “Snow depth and density and vegetation data should be collected where ground operations will actually be occurring. There is a great deal of evidence that shows how variable these conditions are even within the same watershed. The exact dates should be determined by the BLM authorized officer in coordination with the USFWS.”
- For all Requirements/Standards that need to be approved by the BLM authorized official, the decision of approval should be made in coordination with the Service project officer. Winter ground operations are known to have negative impacts on the tundra. These impacts can have cascading effects on water quantity, water flow paths, and habitat quality for fish and wildlife.

#### **ROP 15:**

- The Requirement/Standard listed here may be conflicting with ROP 11, standard G. We recommend reviewing these two requirements for compatibility.

#### **ROP 16:**

- To avoid impacts in the floodplains of fish bearing streams, we recommend removing the 2nd statement in the Requirement/Standard (e.g. on a case by case basis) and require in these areas that only directional drilling be allowed for exploratory purposes.
- Non-fish bearing systems provide important habitat that supports invertebrates, migratory birds and other wildlife. We recommend adding the following requirement to help ensure protection of fish,



invertebrates, riparian vegetation and water resources: “Exploratory drilling is prohibited upon or within 100-year flood plains of streams and rivers, on or within 2,000 feet of the ordinary high water mark of potential fish-bearing lakes, and 1,000 feet as measured from the ordinary high water mark of non-fish-bearing water bodies unless further setbacks are stipulated under Lease Stipulations.”

#### **ROP 19:**

- Recommend changing the Requirement/Standard “a”. to read: “...unless further setbacks are stipulated under lease stipulations 1, 2, and 3.”
- Requirement/Standard “a.” and “c.”: Alternatives B-D allow for non-permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines), and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. We recommend changing the Requirement/Standard wording to: “(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances outlined to protect Wild and Scenic River characteristics.”
- Recommend changing the Requirement/Standard “c.” to read, “Siting temporary winter exploration and construction camps on river sand and gravel bars is allowed and encouraged, *except on suitable river setbacks.*”

#### **ROP 21:**

- For any gravel-related work, where that gravel is brought in from off the Refuge, we recommend a condition requiring the use of Certified Weed-Free Gravel to lessen chances of introducing invasive plants.
- Recommend editing “e.” to read, “Using approved impermeable liners under gravel infrastructure to minimize the potential for hydrocarbon and other hazardous materials spills to migrate to underlying ground or adjacent water resources.”
- In order to address the topography/gradient difference of the Arctic Refuge as compared to the NPRA, we recommend adding the following: “j. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow.”

#### **ROP 22:**

- Recommend the following changes to the Requirement/Standard:
  - a. To allow for sheet flow and floodplain dynamics and to ensure passage of fish and other organisms, *single* span bridges are preferred.....
  - Add “d. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow.”
  - Add the following to requirements: e) we recommend adequate data on stream flow, seasonal patterns in lake connectivity, and sheet flow be collected prior to planning bridges and culverts. Data will be stored in a centralized database and available to the general public.



**ROP 23:**

- These recommendations were developed for the Central Arctic Caribou Herd . Given the differences in herd and range characteristics, they may or may not be appropriate or effective at mitigating impacts to the Porcupine Caribou Herd. We recommend that the monitoring plan noted in Requirement/Standard “g.” be expanded beyond vehicle use management to monitor the effectiveness of these requirements on the PCH. The plan should allow for adaptive management to ensure effectiveness.
- We recommend approval on the adequacy of any caribou studies be granted only in the case of consensus by the Service and in consultation with the Porcupine Caribou Management Board. Additionally, we recommend that any development proposal should include studies of caribou movements before, during and after completion.

**ROP 24:**

- For Alternatives B and C, in Requirement/Standard, suggest deleting “c. Potential use of the site for enhancing fish and wildlife habitat.” It may be that fish will eventually find gravel pit water reservoirs and use them, but it would not be in keeping with Refuge purposes to promote this. Additionally, any impoundments affecting suitable rivers would threaten the interim management responsibilities of the Service to maintain free-flowing condition.
- Requirement/Standard “a” in Alternative D should be modified to read “...floodplains of the three rivers...” and remove the Aichilik River from the list of major fish bearing rivers because it is outside of the 1002 Area.
- Requirement/Standard “a.”: Alternatives B-C: Recommend changing gravel mine site language to “Locate outside the active floodplain; *except where further setbacks are stipulated under Lease Stipulation 1.*” Alternative D: insert additional requirement: “Construction of gravel mine sites or water reservoirs may not be considered within the setbacks stipulated for suitable rivers under Lease Stipulation 1.”
- In order to promote development of mining restoration plans (see 2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003), we recommend adding the following requirement to each alternative: “Each proposed mine site shall have a Service-approved restoration plan and effectiveness monitoring plan prior to site approval and construction.”

**ROP 25:**

- Recommend adding that the Service be involved in the development and approval of a plan to help prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes as well as assist in monitoring during on-going activities.
- Recommend correcting the language in the Objective. Change “...populations of ground-nesting birds” to, “populations on ground-nesting birds.”

**ROP 27:**

- The Service recommends the use of lattice towers and avoidance of guy wires which pose a significant collision risk for birds.



- Page 2-29 ROP: Under Requirement/Standard: The Avian Power Line Interaction Committee (APLIC) produced a document in 2012 with guidance for reducing bird collisions with power lines. We recommend the Requirement/Standard include complying with the most up-to-date, suggested practices as published in the 2012 APLIC document, “Reducing Avian Collisions With Power Lines: The State Of The Art In 2012” and future updates to this guidance to minimize collisions and subsequent unauthorized take of eagles, other protected species, and birds in general.
- Under Requirement/Standard: If exceptions are granted to the requirement/standard, wires would pose a risk to birds, but mitigation measures are available. Recommend changing the language in this section read: “If exceptions are granted allowing overhead wires, overhead wires would be clearly marked along their entire length to improve visibility to low-flying birds. Such markings would be developed through consultation with the USFWS”, after items "i." through "iii."

#### **ROP 28:**

- Current plans for developing an Ecological map does not specify including information on habitat needs of priority birds and mammals to help determine *a priori* which land is most likely important for these animals. Information currently available on habitat suitability should be part of the ecological mapping process. Further, more than one year of surveys is needed to understand wildlife values, particularly for species showing large variation in numbers from year to year (e.g., opportunistic shorebirds such as pectoral sandpipers, red and red-necked phalaropes, buff-breasted sandpipers). The number of years of surveys necessary would be species dependent.
- The proposed “*ecological land classification map of the area*” would likely not be able to address the stated objective. We recommend the development of a database, map, and models of likelihood of use need for targeted species within the program area.
- The requirement should include cooperation with the Service to assess the information necessary for planning of ground-based wildlife surveys.

#### **ROP 29:**

- Recommend adding to Requirement/Standard: “Cultural Outstandingly Remarkable Values as described for the Hulahula River shall be maintained.”
- Recommend including the following language, “If the Permittee discovers any historic, prehistoric, or archaeological sites or artifacts during the course of field operations, all activity at that site shall cease and the State Historic Preservation Office in conjunction with BLM and USFWS shall be contacted immediately but not more than 24 hours after the incident occurs.”

#### **ROP 30:**

- Under Requirement/Standard: Activities associated with removal of less than 100 cubic yards of bedrock outcrops, sand or gravel from cliffs also have potential to result in raptor mortality and nest/territory abandonment (all of which are prohibited under the Bald and Golden Eagle Protection Act). To avoid unauthorized take of these protected species, project proponents must consult with the Migratory Bird Management Permit Office prior to conducting these activities. The presence of nests may not preclude the work, but an Eagle or Eagle Nest Take Permit may be required before work commences to avoid unauthorized eagle take. Please add a statement that lessee/operator/contractor will consult with the USFWS Migratory Bird Management Permit Office prior to conducting activities that disturb potential eagle habitat.



- Please use metric units in this ROP (e.g. 200 meters rather than 656 feet). This change will ensure consistency and reduce confusion.

#### **ROP 33:**

- In order to monitor and assess and impacts of construction on wildlife movements, we recommend adding that the lessee may need to support studies and monitoring efforts in addition to providing information on locations of new infrastructure.

#### **ROP 34:**

- We recommend adding a Requirement/Standard to address aircraft associated disturbance to denning polar bears, as well as polar bears active on the land during summer and autumn. Minimum altitudes for aircraft should 1,500 feet above ground level (except for takeoffs and landings). This requirement should be applied to all alternatives to ensure requirements under MMPA and ESA are met.
- Under Requirement/Standard, Effects of low-flying aircraft on wildlife: To avoid unauthorized take (including disturbance) of eagles, aircrafts operating within 0.5 mile of any eagle nest should be prohibited below 1,500' regardless of nest substrate. As currently written, the ROP only precludes aircraft activity around nests on cliff substrates. Protected nests may be located on almost any substrate type including the ground (e.g. owls) or in trees (e.g. bald eagle). Any eagle disturbance regardless of activity type (including takeoffs and landings), is prohibited by federal law without a USFWS Eagle or Eagle Nest Take Permit.

#### **ROP 35:**

- The lack of adequate restoration plans and adequate bonds to cover reclamation of areas impacted by oil and gas development on the North Slope is a concern as highlighted in the 2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003). Restoration standards should be set in stipulations in this EIS. It should also be clearly stated what level of restoration will be required before land is no longer considered part of the infrastructure development cap. We also suggest that the EIS include a description of the process that will be used to approve restoration and ultimately remove these acres from the cap. Restoration plans should be required and reviewed prior to issuing a lease. Additional information on this issue can be found in Becker et al. 2016; Walker et al 2019; NRC 2003; GAO 2002.
- Under Alternatives B and C, we recommend the following change: "...would be *adequately* reclaimed to ensure eventual restoration of ecosystem function, *productivity and value*. The leaseholder would develop and implement a BLM *and* USFWS-approved abandonment and reclamation plan.
- Under Alternative D, we recommend the following change: "...would be restored to ensure eventual restoration of ecosystem function, *productivity and value*, and meet *adequate* standards..."
- Under all Alternatives, we recommend changing "...visual, hydrological, and productivity objectives..." to "visual, hydrological, *contamination*, and productivity objectives..."
- Recommend adding the following requirement to this ROP and elsewhere as appropriate: "All survey flagging, stakes, wire, or other debris associated with this program should be removed from the Refuge. However, shot points may remain identified to assist the required summer cleanup crew until that project has been completed."



**ROP 36:**

- Recommend changing Requirement/Standard, line “d” to, “...assess and appropriate range of potential effects on resources and subsistence, *including contamination of those resources*, as determined...”

**ROP 40:**

- Lease Notice 1 provides language regarding ESA Section 7 Consultation. We suggest an additional Lease Notice be included for MMPA, similar to the following:
  - Lease Notice 2: The lease area may now or hereafter contain marine mammals. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved actions that would contribute impacts to marine mammals. The BLM would not approve of any action that may affect marine mammals until it completes its obligations under application requirements of the MMPA.

**ROP 41:**

- Along with approved studies that stipulate individual vehicles, suggest adopting general stipulations similar to guidance from state of AK DNR about summer off-road travel including:
  - Operations shall be restricted to dry uplands whenever possible.
  - Wetland crossing shall be minimized to the extent practical.
  - Multiple passes over the same area shall be kept to a minimum.
  - All operators should be made familiar with arctic vegetation types to ensure compliance.

**ROP 42:**

- Recommend clarifying in the existing Requirement/Standard that chasing wildlife with ground vehicles or *aircraft* is prohibited.
- Recommend adding a Requirement/Standard to avoid and minimize the disturbance to loafing and nesting birds to the extent practicable, unless deemed to be an invasive or invading species that may negatively impact other animals that are deemed to be a priority.
- Recommend adding a statement under Requirement/Standard: “Disturbance to both bald and golden eagles is prohibited under the Bald and Golden Eagle Protection Act (BGEPA). Appropriate spatial buffers around nests may be required to avoid take (including disturbance) by project activities. Buffer distances are both species and activity (e.g. land clearing, vehicle operation, building construction, pile driving, aircraft operation, etc.) specific. Buffer sizes range from 330 feet to 2 miles. To avoid violations of the BGEPA, the USFWS recommends project proponents apply for a USFWS Eagle and/or Eagle Nest Take Permit prior to conducting any activity with potential to take (including disturb) eagles or their nests (occupied or unoccupied).”

**ROP 43:**

- If gravel is to be brought in from off the Refuge it will be clean of invasive species or “weed free”.
- Annual monitoring for nonnative species will likely not allow for adequate eradication and control measures to be implemented. Because most invasive plants are wind-dispersed, if anything is detected, it should be eradicated immediately, not the following year. Therefore, all appropriate NEPA documents, Refuge Pesticide Use Permits, and Certifications must be in place prior to any oil/gas activities occurring on the Refuge, to allow an ADEC-certified chemical applicator to



conduct eradication/control efforts in response to the observance and documenting of invasives during growing season.

- Executive Order 13112 (1999) requires all federal agencies to prevent the introduction of invasive species; provide for their control; and minimize their impacts to the local economy, ecology, and human health. We recommend adding the following language under the Requirement/Standard: “In consultation with the USFWS, the operator/contractor shall develop and implement a long-term monitoring and treatment plan for invasive plant species, in conjunction with the authorized work. This plan shall be developed prior to the start of work, to allow for review and subsequent approval by the USFWS.”
- Recommend changing the Requirement/Standard to read: “...detailing the methods for cleaning equipment and vehicles, *including off-site disposal of cleaning fluids or materials and detected organisms*, and monitoring...”
- Erosion waddles and similar have been identified as vectors for invasive species. Therefore, these should be certified weed-free prior to allowing their use on the Refuge.
- There are so few invasives that have been documented north of the Brooks Range that it is imperative a project of this magnitude implement a higher standard of care when addressing the potential for the spread of invasives. Therefore, all equipment must be thoroughly washed at the point of departure to ensure invasives are not brought onto the Refuge. If being transported on trailers up the haul road, by barge or plane, all equipment should be cleaned at the point of departure and not cleaned in Deadhorse, Kaktovik, etc. Additionally, an approved Invasive Plant Management and Response Plan should be in place that addresses all approved chemicals for use on the Refuge, certifications of those who will be applying those chemicals and how often those chemicals can be used.

#### **Additional Recommended Stipulations and ROPS**

- Under all alternatives, we recommend adding the requirement for development of spill response plans, which is currently only under Stipulation 4, Alternative D, Standard iv (with *these edits*): “Operators would be responsible for developing comprehensive *spill* prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans and maintain adequate oil spill response capability to effectively respond during periods of *ice*, broken ice, *or* open water, based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM *and USFWS*.” Alternatively, we recommend creating a Stipulation or ROP to address this requirement, which is then required across all habitats. Any requirement for development of spill response plans should reference water quality standards for a suitable river’s preliminary classification.
- A concern with oil development on the North Slope has been the lack of data to assess cumulative impacts of oil and gas development (see National Research Council Report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska’s North Slope (2003)). Therefore, we recommend a long-term monitoring program be developed that analyzes the effectiveness of the Lease Stipulations and ROPs. Statistically valid sampling designs with clearly defined levels of inference and change detection capabilities should be included in the design. Development of this program would help detect impacts and employ adaptive management techniques as necessary.



### Section 3: Resource Specific Comments

#### Subsistence and Section 810 Analysis, Appendix E

- Conclusions of no positive findings for Alternatives B, C, and D within the DEIS (e.g., the DEIS concludes that Alternatives B, C, and D will not result in a significant restriction in subsistence uses) are not justified, particularly in light of a positive finding for the cumulative case. The potential impacts on caribou abundance, distribution, and movements are far more likely to affect availability of caribou to subsistence users throughout the PCH range than the relatively minor, local effects of limiting access by Kaktovik residents to some areas on the coastal plain. Statements such as “Potential impacts on subsistence resources and access from future oil and gas exploration, development, and production would be minimal or would be adequately mitigated by stipulations or ROPs...” (page E-10) may be overly optimistic given that these recommendations were mostly developed for oilfields farther west, and have not been tested for the PCH. Given the lack of testing for the PCH, there is uncertainty regarding the effectiveness or adequacy of the mitigation measures in this situation. This means that abundance and, or movements of the PCH could be substantially affected, with resultant effects on availability of caribou to subsistence hunters throughout the herd’s range. Recommend this uncertainty be acknowledged by a positive determination for all the action alternatives.
- Section E.3-22, Page E-7: The DEIS states, “In general, caribou responses to aircraft adhering to effective stipulation measures tend to be short-lived (Fullman et al. 2017).” Fullman et al. (2017) has been frequently mischaracterized in the literature. These authors used a limited dataset on take-offs and landings and did not consider flight altitude and patterns near the herd, distance from lead caribou, private aircraft, disturbance near narrow mountain corridors, or any number of other potentially important factors. The authors do, however, indicate that their results are limited to movements within the Noatak River valley. Given that, this paper does not lend itself to the broad application suggested in the 810 analysis. Additionally, it should be highlighted that the short-term effects of aircraft activity on caribou movements and resultant hunter success may be critical to subsistence opportunity and food security. This concern is frequently voiced by subsistence hunters of the coastal plain.
- Section E.3-22, Page E-7: The DEIS states, “Low-level flights or maneuvering in the presence of unhabituated caribou can elicit increased speed and abrupt direction change. Alternatively, caribou can become habituated to aircraft, particularly when aircraft pilots maintain altitudes greater than 500 feet above ground level and do not haze or harass the caribou (Valkenburg and Davis 1983).” Habituation and avoidance behavior may take quite some time and this should be pointed out in the 810 analysis. A recent analysis by the Office of Subsistence Management included the following information: studies [of caribou] have also reported reduction in the use of areas within 5 km from infrastructure and human activity (including aircraft) by 50–95% for weeks, months, or years (Vistnes and Nellemann 2008, Flydal et al. 2002). We recommend the potential for reduced use of areas in proximity to infrastructure be fully disclosed.
- Section E.3-22, Page E-7: The DEIS states, “Caribou crossing success would vary by season, behavioral motivation, level of habituation, and activity levels” but also states on page E-6, “Caribou abundance or availability and the subsistence use thereof would not likely be affected as a result of direct habitat loss.” These statements seem incongruent as there are too many unknowns about the short and long-term changes to migration patterns that may result. Minor changes, even if temporary, may have major impacts to subsistence if caribou move further from communities and traditional hunting grounds. Caribou migration patterns are very complex and the Fullman et al.



(2017) paper, though a useful starting point, should not be considered definitive evidence of minimal effect. As mentioned in previous comment, habituation can take months or years.

- With regards to ensuring a meaningful subsistence experience, page 3-121 of the DEIS includes the following:

*In addition to affecting resource availability, future noise, traffic, and human activity may also affect user access by deterring subsistence users from their usual harvesting areas. Avoidance of subsistence use areas due to development has been documented in Nuiqsut (SRB&A 2017) and would likely occur for some Kaktovik harvesters if development occurs in their harvesting area. Residents may experience discomfort hunting in the presence of outsiders; may avoid hunting near areas of high air or ground traffic because of a perceived or actual reduction in the availability of subsistence resources; may avoid hunting near activity due to safety concerns; or may consider noise pollution and increased human activity to degrade the subsistence experience.*

We recommend the above language also be included in the 810 analysis. The ANILCA protects and recognizes many values associated with subsistence, far beyond the nutritional value. The cultural values associated with the subsistence “experience” need to be explicitly stated. In one example, noise pollution may affect these experiences as was noted in Chapter 3. We recommend including factors discussed in Halas (2015) as important factors affecting the subsistence experience. One potentially relevant quote from this paper:

*Whether the aircraft intentionally or unintentionally may be ‘influencing’ caribou movement, observing ‘scared’ caribou can be a powerful experience for hunters. Observations of caribou disturbance may impact the quality of a good hunting experience for a subsistence hunter. Respondents who perceived that caribou are impacted by the behavior of aircraft may evaluate their own harvest success to the interaction between aircraft and movement of caribou.*

### **River Corridors Determined to be Suitable Additions to the NWSRS**

- Section 3.4.7, Page 3-210, Wild and Scenic Rivers, Paragraph 4: In order to address interim management guidance for suitable rivers affected by proposed activities (whether the rivers lie inside or outside the project area), we recommend that the first sentence be changed to: “The Marsh Fork-Canning, Hulahula, and Kongakut Rivers are north-flowing waterways found to be...”. Change last sentence of paragraph to: The Marsh Fork-Canning (Recreational ORV) and Kongakut (Recreational, Scenic, and Geologic ORVs) Rivers are not within the project area, but stipulations and ROPS would be applied to protect their WSR characteristics (e.g.: the scenic ORV for the Kongakut River may necessitate modeling and additional setbacks within the project area to insure infrastructure is not visible from any point within the Kongakut River corridor; or the sport fishing opportunities described as part of the Marsh Fork-Canning recreational ORV may be preserved by stipulating program actions within the downstream project area) (see Section 5.7.2 of CCP, Appendix I: Wild and Scenic River Review).
- Section 3.4.7, Page 3-214, Impacts Common to all Action Alternatives: In order to address interim management guidance for suitable rivers affected by proposed activities (whether the rivers lie inside or outside the project area), we recommend changing the sentence beginning with “General impacts...which could affect cultural, fish, geologic, recreation, and wildlife ORVs.” to also include the scenic ORV.



- Section 3.4.7, Page 3-214-3-215: We recommend providing additional information on why setback distances are different across alternatives, what the ecological justification for the differences is, and what the relative impact of the different setbacks on the achievement of the stated objectives in Stipulation 1 is.

## **Fish and Aquatic Species**

- Section 3.3.2 Fish and Aquatic Species, Affected Environment, Page 3-80, last two sentences of last paragraph in section on Direct Habitat Loss or Alteration: The last two sentences in the paragraph suggest that placing gravel mines in river beds and subsequently creating deep water reservoirs could be seen as a long-term benefit for fish in the area. These alterations should be viewed as an anthropogenic alteration of the natural habitat rather than an enhancement. Recommend the last sentence be deleted and the second to last sentence be edited to read, "Following gravel extraction, the excavation can then serve as a water reservoir for industrial activities, which is common practice in other North Slope gravel mines farther west (BLM 2012)."
- We recommend adding a description of the seasonal use of the nearshore marine waters and lagoons by fish within Section 3.3.2. This information is important in understanding the seasonal movement of fish and how the proposed activities will affect fish and subsistence users. For instance, as winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.
- We recommend adding a description of the difference between rivers with and without perennial springs. This description would provide helpful background for the proposed protections for perennial springs. It is known that the perennial springs support fish during harsh winters and rivers without springs have no fish. This spring water is believed to be ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic Grayling and Dolly Varden are major subsistence resources in the Arctic Refuge and their survival depends on approximately twenty springs found within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition.

## **Polar Bears**

- Page 3-125: In the second full paragraph, the DEIS confuses incidental take with intentional take. ITRs and associated LOAs are for the incidental take of polar bears as a consequence of an otherwise lawful activity. Independent of that, authorizations are provided to allow intentional take through harassment in order to protect human life.
- Page 3-127: The DEIS states that critical denning habitat for polar bears only occurs in those areas with topography sufficient to capture enough snow for dens to be constructed. However, the actual critical habitat designation covers a much larger area and includes not only the microhabitat features (i.e., those where snow can accumulate), but also the macro-habitat features that allow bears to access those features and move back to the sea ice post emergence. This should be corrected in the final EIS.
- Page 3-133: The DEIS states that post-lease activities could include seismic, but fails to consider the fact that due to the future leasing activities analyzed in the DEIS, seismic surveys could occur prior to leasing. We recommend correcting this in the final EIS.



- Page 3-137: The DEIS states “If dens are detected within a 1-mile buffer zone around the proposed locations of roads and pads, then the facility locations would be moved outside of that radius to avoid dens, as required by ITRs, to reduce the effects on occupied dens to a negligible level.” While that is currently true, if new data emerged that suggests bears could be disturbed at distances >1 mile, then a larger buffer would be required. Similarly, if data supported a smaller area, a smaller buffer could be required. We recommend the language be revised to reflect that this no disturbance buffer is subject to change.
- Page 3-141: The discussion of the potential effects of an oil spill on polar bears is not sufficient. While it’s true that a spill associated with an accident involving a barge would likely be smaller than that modeled for an offshore oil well, sufficient volume of oil could still be released that could harm polar bears. This is especially true depending on where and when barges are likely to land. If barge landings are in the vicinity of Kaktovik, they could coincide with large aggregations of bears during the open water period. A spill adjacent to those waters could expose a large number of polar bears.
- Page 3-146: The DEIS states, “The highest number of documented historical polar bear dens and the greatest area of potential maternal denning habitat occur in the high- and medium-potential hydrocarbon zones, where the least restrictive development activities would be most likely to occur.” This statement reinforces our concerns over the level of protection afforded to polar bears under Alternatives B and C, and highlights the need to provide the level of protections for polar bears found in Alternative D in any and all development scenarios.
- Page 3-146: The DEIS states, “Under ROP 10, the pre-activity surveys required to locate dens, plus the 0.5-mile and 1-mile buffers for seismic and heavy equipment operation around occupied dens of grizzly and polar bears, respectively, would help to reduce the impacts of behavioral disturbance on denning bears (as well as birth lairs of ringed seals on landfast ice along the coast) throughout the entire program area.” However, Alternatives B and C do not require such surveys, just a requirement to avoid known dens. We recommend changing the ROP under Alternatives B and C to require den surveys. Without the requirement for surveys to detect dens, the requirement to avoid known dens carries greatly diminished conservation value.
- Map 3-24: The map legend is mislabeled. It states that the stars are potential denning habitat when in reality they depict sites of known polar bear dens observed over the years. Additionally, those data are wrongly attributed to Durner et al. (2006) rather than to the USGS den catalogue. Similarly, the yellow lines depicting potential denning habitat should be cited as Durner et al. (2006) rather than just “Durner data” and should be labeled as “polar bear denning habitat” rather than just “polar bear habitat”.

## **Terrestrial Mammals**

- Page 3-115: The DEIS states that, “Similar delays have not been observed in caribou in the existing North Slope oil fields, ...” Recommend modifying this statement to state: “Although CAH caribou have been observed to cross roads and pipelines in the existing North Slope oil fields during the summer insect season, fine-scale studies of CAH movements like those of caribou near the Red Dog mine road have not been conducted.” As currently worded, it implies that a study has looked at this and not documented a delay. To our knowledge, there has not been a study looking at caribou movements at the spatial/temporal scales required to detect an effect for caribou in the oil fields.
- Page 3-120: The DEIS states that under Alternative D, Lease Stipulation 5 would prohibit winter activity within 1 mile of polar bear denning habitat. This is not accurate, as the stipulation states activity within a mile of denning habitat in particular regions of the Coastal Plain would be



restricted, but not the entire region. We recommend correcting the statement to better reflect what Lease Stipulation 5 actually requires.

- Page 3-108: Recommend adding the following information to the discussion of muskox: “Another group of approximately 24 muskoxen inhabits the northwestern Yukon Territory, is commonly found near the Alaska-Yukon border and frequently wanders into the Refuge. They have been found as far west as the Aichilik River, on the boundary of the program area.”
- Page 3-108: Recommend including the following information in the discussion of moose on the coastal plain: “Moose numbers east of the Canning watershed are currently low, but numbers in tributaries of the Canning (both east and west sides) are greater; some of these would be in the project area and other moose just outside the area to the west could be affected by equipment moving into/out of the area. Moose aggregate in brushy habitat along streams during winter, but then disperse across the ACP during summer (particularly pregnant cows). Moose are an important subsistence species for Kaktovik hunters, who are extremely interested in seeing moose populations recover to previous levels that will allow additional hunting opportunities.” It would be helpful to provide maps of current moose winter habitat and locations of moose found on spring surveys, which we can provide.

### **Wildlife Direct and Indirect Impacts**

- Recommend providing a quantitative analysis of direct and indirect impacts to wildlife where possible or summarizing the results of quantitative studies that have been completed. For example, the following study is an example of where a quantitative analysis was completed for the PCH and should be incorporated into the description of impacts: *Russell, D., and A. Gunn. 2019. Vulnerability analysis of the Porcupine Caribou Herd to potential development of the 1002 lands in the Arctic National Wildlife Refuge, Alaska. Report prepared for: Environment Yukon, Canadian Wildlife Service, and GNWT Department of Environment and Natural Resources. 143 pp.*
- Given the importance of moose as a subsistence species to local communities, we recommend adding a description of potential impacts of development on moose, including: disturbance of cows during calving and displacement during summer from coastal plain habitats with few predators, impacts to riparian vegetation that may reduce moose winter habitat, displacement of moose from winter habitat, disruption of movements to/from seasonal ranges, changes in predator abundance and distribution as a result of supplemental foods or habituation to humans.
- Page 3-110: Please include moose in the list of mammals (grizzly bear and muskox) that may be disturbed by winter seismic exploration.
- Page 3-110: Although it is true that only a small proportion of the PCH remains on the ACP during winter, these caribou can number in the hundreds and are an important winter subsistence resource for Kaktovik hunters. Thus, localized disturbance or displacement of caribou during winter could have a significant impact on subsistence hunters. Recommend clarifying that although the number of PCH caribou on the ACP during winter is small, they are still an important subsistence resource for local communities.
- Page 3-113: Please provide citations for the sentence “Although some habitat damage would result from the use of ice roads and pads because the ice road is temporary, the long-term impacts would be considerably less than those associated with gravel roads and pads”. Ice roads and snow trails have the potential to delay greenup in affected vegetation, and may retard growth during an entire growing season. This effect could be repeated every year that exploration and development occur.



Additionally, these routes are likely to be much wider than a gravel road, with the potential to impact more habitat in a given year resulting in greater impacts to caribou habitat.

- Page 3-114: Recommend revising the sentence that begins “The patterns of CAH demography following development should be applied to the PCH with caution...” to “Demographic changes exhibited by the CAH during the development period cannot be extrapolated to the PCH due to the substantial differences between these herds and the geography of their ranges.” For example, the CAH was at an historic low point in the herd’s abundance when development began, whereas, the PCH is currently at an historic high level. In addition, compared to the CAH, the PCH has shown a much lower population growth rate during periods of increase; concentrated calving density of the PCH is much higher; areas surrounding the PCH calving grounds contain less high-quality forage and higher predator densities; and these areas exhibit more topographic relief than do the current PCH calving grounds or areas used by the CAH following displacement from their original calving grounds (Clough et al. 1987; Griffith et al. 2002).”
- Page 3-115, Paragraph 2: The following studies related to caribou should be included in this section: Smith and Cameron, 1985; Curatolo and Murphy, 1986; Murphy and Curatolo, 1987; Murphy, 1988. These studies indicate that large groups of caribou were less successful in crossing roads and pipelines during insect harassment; which is likely to be more of an impact for the much larger groups typical of the PCH during summer.
- Page 3-115, Paragraph 5: It is not clear how the definition of PCH calving area was determined to be the “concentrated calving area during >40% of years“, as the most of the 1002 area is used for calving by either the PCH or CAH, and often both herds. Recommend providing additional discussion and citations as to how this was defined.
- Page 3-116: There is substantial uncertainty that design specifications outlined in ROP 23 will be sufficient to minimize disruptions to caribou movements in the 1002 Area due to substantial differences in geography and herd characteristics. Recommend adding a description of the substantial uncertainty that exists regarding whether these practices will be sufficient, and a statement that additional restrictions may be necessary to maintain the ability of the PCH to continue unrestricted use of the area.

## **Resident and Migratory Birds**

- Section 3.3.3 Birds, Affected Environment, Shorebirds: Only the following 10 species are fairly common, common, or abundant in the program areas: American golden-plover, ruddy turnstone, semipalmated sandpiper, red-necked phalarope, red phalarope, Western sandpiper, dunlin, stilt sandpiper, pectoral sandpiper, and long-billed dowitcher. The following four additional species are less common: semipalmated plover, Baird’s sandpiper, whimbrel and buff-breasted sandpiper (based on PRISM surveys reported in Brown et al. 2007). Data from transmitters indicate that some birds also migrate westward across the ARCP before migrating southwest across Alaska and down either the Pacific Flyway or the East Asian-Australasian Flyway. Recommend correcting the information related to species abundance and including information related to the eastward migration that occurs. Brown et al. (2007) is the best source of data for shorebirds relative to the project area.
- Section 3.3.3 Birds, Affected Environment, Climate Change: Although summer duration may increase due to climate change effects, it is unlikely that insectivores will increase as invertebrate emergence is mediated by snow melt initially, followed by cumulative degree days of temperature. The volume of invertebrates may be limited, with the emergence simply occurring earlier. Contrary to what is stated in the DEIS, avian habitat is changing rapidly, both on the coast and inland tundra



areas. Comparison of photographic images taken at Prudhoe Bay in the 1980s and the present show the landscape drying up, with a change from low-centered polygons to high-centered polygons (see Liljedahl et al. 2016). This in turn is leading to drainage of uplands and creation of larger water bodies that may indeed be good for species of waterfowl and loons. River deltas may also be affected from reduction in glacier melt-off. This change and the storm surges could affect migratory birds through changes in invertebrate distribution and composition (Churchwell et al. 2018). The DEIS does not correctly assess the potential impacts to birds and their habitat resulting from the changing climate. Please ensure the EIS accurately assesses the potential impacts to birds and their habitat resulting from a changing climate based on the best available science.

- Section 3.3.3 Birds, Affected Environment, Direct and Indirect Impacts: The DEIS understates the potential impact from water removal during ice road construction on wildlife. The 1002 Area has relatively few water resources compared to the NPR-A and the use of large volumes of water could negatively affect nesting habitat in the succeeding summer. Breeding grounds are the only place for the birds to increase their numbers, and thus are an essential part of the annual cycle for maintaining bird numbers. Please ensure the document more accurately reflects the potential impacts to breeding birds from the project as a result of water removal.
- Page 3-92: The indirect effects of post-leasing oil and gas activities on birds should be included in the DEIS, including the indirect effects of increasing contaminant concentrations below levels that would cause mortality. This discussion should include mobilization of contaminants, particularly heavy metals, from climate change (e.g., flood events contributing to increased erosion and release of contaminants from glaciers); earth-disrupting activities contributing to dust, sedimentation, or erosion; and activities that may result in melting permafrost with subsequent mobilization of mercury. These activities have the potential to increase contaminant concentrations in birds of the Arctic Refuge, especially those that eat invertebrates (shorebirds, nesting waterfowl) and fish (loons), and in raptors to levels below those that may cause mortality, but which may still result in population-level effects such as decreased productivity.
- Page 3-99: We disagree that “salt-water spills would not be toxic to birds,” especially if spills occurred in waterfowl breeding ponds. Newly hatched ducks have poorly developed salt glands and exposure to elevated salinity can cause impacts including mortality (e.g., DeVink et al. 2005). Additionally, saline spills can kill invertebrate prey.
- Page 3-84, Paragraph 7: Arctic Refuge CCP 4.3.6 states, “In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded”. It appears the species list from Appendix F in the CCP was used here to assign a number of 158 species, but the inclusive areas for these sections is slightly differently between the CCP text and Appendix F. Please change, “According to the USFWS (USFWS 2015a), 156 bird species have been recorded in the Arctic Refuge on the northern foothills of the Brooks Range, in the ACP (an area inclusive of the program area), and in adjacent marine waters” to “According to the USFWS (USFWS 2015a; Appendix F), 156 bird species have been recorded in the Arctic Refuge Coastal Plain [i.e., the area between the coast and the Brooks Range inclusive of coastal areas (lagoons, barrier islands, and Beaufort Sea) and inland areas (uplands near the foothills of the Brooks Range)]”.
- Page 3-85, Paragraph 1: The statement, “With few exceptions, all birds in the program area are migratory and are present only during the summer breeding season, May to September, depending on species” is incomplete. Several raptor species may occur during the latter part of winter in the Program Area. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most golden eagle nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive



during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Some marine birds occur in the area throughout October and into November and leave with advancing sea ice. In the immediate area offshore, such species groups include larids, murre, puffins, guillemots, seaducks, and sometimes shearwaters (Kuletz et al. 2015; Kuletz and Labunski 2017, Appendix 1; USFWS data). Please change to, “With few exceptions, all birds in the program area are migratory and present February to November, depending on species”.

- Page 3-85, Paragraph 1: Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Appendix F of the CCP states, “Rock ptarmigan (*Lagopus muta*) – Common permanent resident in all areas of Refuge.” Please change, “Winter residents include small numbers of ravens and ptarmigan, dippers near open running water, and occasional gyrfalcons” to, “Resident birds include ravens, ptarmigan, dippers near open running water, snowy owls, and gyrfalcons”. Cite the CCP and citations below.
- Page 3-85, Paragraph 2: Sentence, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ACP (Liebezeit et al. 2009)” could be more specific. Data on population size is available for the ARCP, so using information for the whole of the ACP seems unnecessary. Also, the cited reference did not conduct extensive surveys across the whole of the ACP for estimating density, therefore this reference doesn’t support the statement as given. Please change to, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ARCP (Bart et al. 2012).”
- Page 3-85, Paragraph 3: The Affected Environment coverage of the “marine vessel route to Dutch Harbor” should be expanded. This route may impact areas used by the ESA listed short-tailed albatross and species of concern such as yellow-billed loon, red-legged kittiwake, Aleutian tern, and Kittlitz’s murrelet. Special consideration should be given to Important Bird Areas and “hotspots” that occur along the route. For examples, the area near the mouth of Barrow Canyon (and around Point Barrow) is a “hotspot” of marine bird and marine mammal activity throughout summer and fall “hotspots” occur offshore from Wainwright (head of Barrow Canyon) and over Hanna Shoal area (see Kuletz et al. 2015). Any marine vessel route would pass by large seabird colonies at Cape Lisburne (northernmost seabird colony of AMNWR) and Cape Thompson. Vessels would have to go through Barrow Strait, an Important Bird Area (Smith et al. 2017) and recognized “hotspot” for marine birds (Humphries and Huettmann 2014; Kuletz et al. 2015). The Bering Strait region supports mixed-species colonies of millions of birds (Stephensen and Irons 2003), with some of the largest seabird colonies in the world on Diomedes, King Island, St. Lawrence Island, and farther south – St. Matthew Island. An estimated 12 million seabirds aggregate in the Bering Strait region in summer through early fall (USFWS 2014). There are many “Important Bird Areas” identified along the route to Dutch Harbor and nearby Aleutian passes (Smith et al. 2014; 2017). Please add “waterbirds” and “larids” to the groups discussed in this section.
- Page 3-85, Paragraph 4: The statement, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important nesting, rearing, and migration staging periods” is incomplete. The coastal lagoons and deltas provide important stopover habitat during spring migration/pre-breeding period, as well. Please change to, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important pre-breeding, nesting, rearing, and migration staging periods.”
- Page 3-85, Paragraph 4: The statement, “Prior studies (summarized in USFWS 2015a) have demonstrated that at least several hundred thousand breeding and nonbreeding birds use the ARCP and program area during the short arctic summer” is incomplete. Likely as many or more birds use



the ARCP during the fall. Please change to, “Prior studies (summarized in USFWS 2015a, Pearce et al. 2018, USFWS and BLM 2018) have demonstrated that at least several hundred thousand birds use the ARCP during for breeding in the short arctic summer and fueling and resting during migration in the fall”.

- Page 3-86, Paragraph 1: The unpublished data cited here belongs to USFWS, not Mr. Latty. Also, one nest was included in an unpublished report, (Kendall and Villa 2006). Please change “(Latty, unpublished data)”, to “(Kendall and Villa 2006, USFWS, unpublished data)”.
- Page 3-86, Paragraph 1: The statement “The spectacled eider is an uncommon breeder in the program area, and nests have been documented only on the Canning River delta” only pertains to recent records of known spectacled eider nests found during operations of a primarily shorebird research site on the Canning River Delta and is therefore misleading. An exhaustive search for all records of spectacled eider nests occurring in the program area has not been conducted. This statement should also not be interpreted to mean that all locations within the program area have been searched to determine presence or absence. Rather, it only means that a few spectacled eider nests were found as part of other operations (primarily shorebird research) at a single small site on Canning River delta. There have been NO systematic ground surveys specifically targeting eider nests (outside the barrier islands) anywhere in the program area in the recent past. Please change to, “The spectacled eider is an uncommon breeder in the program area. Nests have been documented on the Canning River delta, but contemporary systematic ground surveys targeting tundra-breeding eiders have not been conducted.”
- Page 3-86, Paragraph 2: Spectacled eider nest density is expected to be low in the program area where suitable habitat is available. Please change, “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting period, where suitable habitat is available”, to “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting and nesting period, where suitable habitat is available.”
- Page 3-86, Paragraph 3: Within the DEIS ‘Waterbirds’ appears to include mergansers and seaducks. Please include these groups in the list of Waterbirds (first line of paragraph).
- Page 3-86, Paragraph 4: In the second sentence, referencing the ACP survey, the text indicates that “prior to 2018 only about a quarter of the area was included...” Insert “program” prior to “area”. Without that specificity, the text suggests that only a quarter of the ACP was surveyed, when in fact one quarter of the program area that was surveyed as part of the ACP breeding pair survey.
- Page 3-86, Paragraph 4: In the last sentence, please change “unreliable” to “imprecise”. There is a large difference in meanings, and “imprecise” is the correct term here.
- Page 3-86, Paragraph 4: Bart et al. (2012) provides estimates of waterbird population sizes for the ARCP. Please consider including these population estimates here.
- Page 3-87, Paragraph 1: The waterbird classification includes waterfowl like Northern pintail that often nest in dryer habitats. Bart et al. (2012) estimated more than 18,000 Northern pintail breed on the ARCP. Please change, “In addition to water body shorelines and islands, most waterbirds use a variety of wet and moist tundra habitats for nesting, often next to water” to “Most waterbird species nest in association with ponds or in wet and moist tundra habitats, but some species primarily nest in drier habitats”.
- Page 3-87, Paragraph 1: A significant portion of the estimated hatch dates for several geese species in the program area in some years occur in June. Please change, “After hatching in July and August,



most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands” to, “After hatching in June through August, most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands.”

- Page 3-87, Paragraph 1: The following statement is not accurate for most waterbird species occurring in the program area, “In the late summer, post-breeding and molting (temporarily flightless) waterbirds use coastal lagoons behind the barrier islands. Waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration.” Please remove that statement and insert “In the late summer, post-breeding and molting (temporarily flightless) sea ducks (primarily long-tailed ducks) use coastal lagoons. Sea ducks and other waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration.”
- Page 3-87, Paragraph 1: The statement, “Most waterfowl (swans, geese, ducks) migrate through the central continent to wintering areas across the continental US” is poorly defined and not correct as written. Please change to, “Most geese, swans, and dabbling ducks migrate through Pacific and Central Flyways after leaving the ARCP.”
- Page 3-87, Paragraph 2: Map 3-15, Post-Breeding and Fall Staging Common Eider, in Appendix A, is incorrectly titled. Map 3-15 depicts locations of likely breeding and post-breeding common eiders from two separate surveys conducted to estimate breeding and post-breeding (staging/molting) sea bird distribution and abundance. Please correct as appropriate.
- Page 3-87, Paragraph 2: Language as written is incorrect and no source is provided for 1976 data. Please change “Common eiders have been increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 nests were found”, to “Common eiders appear to be increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 active nests were found (Divoky 1978)”.
- Page 3-87, Paragraph 2: The statement “Common eiders winter in coastal areas from the Aleutian Islands south to southern Alaska,” is not correct. Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and Chukota peninsula in the Bering Sea (though some also are known to winter in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta). Please change to, “Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and the Chukota peninsula in the Bering Sea, although some also have been documented wintering in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta (Petersen and Flint, 2002).
- Page 3-87, Paragraph 2: The statement, “The USFWS conducts annual aerial surveys to estimate the number, distribution, and population trend of breeding common eiders in coastal habitats on the North Slope, including Arctic Refuge lands (summarized in USFWS 2015a)” is not accurate. The USFWS has not conducted aerial surveys of coastal habitats on the North Slope since 2009. Please correct language to recognize aerial surveys are not currently being conducted for common eider on the ACP, and have not in a decade.
- Page 3-87, Paragraph 2: The data referenced in, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 common eider nests were found (Latty, unpublished data)” belongs to USFWS, not Mr. Latty and the language is imprecise. Please clarify differences in spatial coverage between these two surveys. Please change to, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 active and inactive common eider nests were found (USFWS, unpublished data). There were differences in spatial coverage between the 1976 and 2015 surveys, primarily because the islands are constantly being reshaped.”



- Page 3-87, Paragraph 4: The statement, “In aerial surveys of nearshore waters and barrier islands conducted during the early post-breeding period (early July 1999–2009)” does not describe the survey referenced. The latest report on that survey, “Aerial Population Surveys of Common Eiders and Other Waterbirds During the Breeding Season - Northwestern Alaska 2006-2009” by Bollinger et al. 2012 states, “The objectives of this Northwestern Alaska Common Eider Survey were to: 1) Estimate a population index during the breeding season...” (2012). That report also states, “All surveys were flown during the interval from 15 June to 01 July (Table 2). Survey timing was intended to coincide with egg laying and early incubation while pair bonds are still intact and prior to the dispersal of males to molting sites” which does not match the statement in the DEIS. Please change this sentence to, “In aerial surveys of nearshore waters and coastal areas near barrier islands conducted during June and early July 1999–2009.”
- Page 3-88, Paragraph 2: Please provide a citation to support the statement, “It is likely that many of the birds using lagoons along the Arctic Refuge coast during post-breeding nested to the east, particularly in northern Canada” or remove.
- Page 3-88, Paragraph 3, Sentence 1: The 325,000 estimate is 40 years old and therefore should be referenced in the past tense. The most recent (15 year old) estimates are approximately 185,000 (Kendall 2006).
- Page 3-88, Paragraph 3: Please provide the Arctic Refuge CCP as a citation for the statement, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS and BLM 2018)”. Please change to, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS 2015a).
- Page 3-88, Paragraph 4: The Shorebirds of Conservation Concern in the United States of America - 2016 (U.S. Shorebird Conservation Plan Partnership, 2016) is the most up-to-date conservation status document for North American shorebirds; therefore, this list should be identified in the Affected Environment text, not just in the Appendix.
- Page 3-88, Paragraph 6: The statement, “Shorebirds use a wide range of aquatic, wet, and moist tundra habitats for nesting, often near bodies of water” is not correct as written. While most shorebirds prefer moist tundra, some use drier habitat and riverine areas. For example, whimbrels were only found in upland habitats on previous ARCP shorebird surveys. Please change to, “ARCP shorebirds use a wide range of tundra habitats for nesting. Most species occur in wetland, moist, and riverine habitats, but some species prefer drier upland sites (Brown et al. 2007).” Alternatively, remove this sentence and incorporate the information in the next sentence that includes the Brown et al. citation.
- Page 3-89, Paragraph 1-3: This section excludes discussion of bald eagles. Although not as abundant as golden eagles, bald eagles also occur on both the coastal plain and in the foothills of the Brooks Range. Please update text to reflect this information.
- Page 3-89, Paragraph 2: Up to several thousand shorebirds at a time may occur on individual river deltas in July and August (Churchwell 2015). Please change, “Most of the deltas are used by large numbers of foraging shorebirds” to “Most of the deltas are used by large numbers of foraging shorebirds. Up to 4,000 shorebirds were counted on daily surveys at Jago and Okpilak River Deltas in 2011 (Churchwell 2015)”
- Page 3-89, Paragraph 4, Line 7: Additional larid species encountered along the vessel route to Dutch Harbor (USFWS survey data, most in Kuletz and Labunski 2017) would include slaty-backed gull, red-legged kittiwake, Aleutian tern; (latter two are breeding birds of conservation of concern). These



species should be included here. Also, it was difficult to determine the vessel route, and not clear what that route would be used for – or how much vessel traffic the project would generate (especially through the Bering Strait). This information is necessary to adequately assess the affected environment and potential impacts.

- Page 3-89, Paragraph 5: Last line of paragraph. When offshore or over marine waters, jaegers also eat fish (and scavenge or steal those from other seabirds and larids). Please correct this in text.
- Page 3-91, Paragraph 2: Line 1-2. From our USFWS at-sea surveys in the waters off of ARCP, in addition to ones listed in Table J-9, glaucous gull, black-legged kittiwake, Ross’s gull, Sabine’s gull, and Kittlitz’s murrelet have also been recorded (see Kuletz and Labunski 2017, Appendix 1 for maps, or Kuletz et al. 2015 for some species; also USFWS/Kuletz, unpublished data). Please update text to reflect this information.
- Page 3-91, Paragraph 3: The DEIS contains few details regarding the “the marine vessel route to Dutch Harbor.” Vessels traveling through the Chukchi Sea and down length of the Bering Sea to Dutch Harbor could encounter more than 63 species of marine birds. As written, little information is given for the Affected Environment for the vessel route to Dutch Harbor, which reduces the ability to estimate potential impacts or threats. Please clarify the details of the “the marine vessel route to Dutch Harbor”, fully describe the Affected Environment in the appropriate sections in 3.3.3, and then discuss the potential impacts in the Direct and Indirect Impacts section beginning on page 3-92.
- Page 3-91, Paragraph 3: The ESA-listed short-tailed albatross occurs regularly (if not abundantly) in the southern portion of the route, and occurs in the northern portion in late summer and fall (especially the northwest outer shelf break, near the International Date Line), and near St. Lawrence Island. The short-tailed albatross and two other albatross species (black-footed and Laysan) have all increased in abundance and shifted distribution northward in the Bering Sea in recent decades (Kuletz et al. 2014), and so would be present enroute to Dutch Harbor. The Aleutian passes, especially Unimak Pass near Dutch Harbor, have the highest risk to seabirds from vessel accidents (Renner and Kuletz 2015, Humphries and Huettmann 2014) and very high densities of albatrosses occur there. The first recorded sighting of a short-tailed albatross in the Chukchi Sea was made in 2011 (Day et al. 2013); thus, it could be encountered in that portion of the vessel route as well. Please update text to reflect this.
- Page 3-91, Paragraph 5: It should be noted here that seabird die offs have occurred in the Bering Strait region in 2017 and 2018 (USFWS 2017, 2018) and were associated with very warm water conditions; die offs in this region were previously very rare (or perhaps never recorded, with exception of the 2013 die off near St. Lawrence Islands). Birds died from starvation, although effects of toxins cannot be ruled out. The combined effects of increased vessel traffic, disturbance, noise, and changes in prey and sea ice have potential for increased cumulative effects. Please update text to reflect this information.
- Page 3-91, Paragraph 5: Predation is the primary factor affecting productivity for many ARCP breeding birds, but recent work suggests predation is increasing in the Arctic and maybe linked to climate-induced shifts in predator-prey relationships. Please add, “Recent work suggests predation is increasing in the Arctic and is linked to climate-induced shifts in predator-prey relationships (Kubelka et al 2018)”.
- Page 3-91, Paragraph 5: A climate change vulnerability assessment on Alaska’s North Slope identified the barrier island nesting Pacific common eider as the marine bird at highest risk of climate change impacts, including impacts from predicted sea level rise, increasing storm surges, and erosion and/or restructuring of barrier islands (Liebezeit et al. 2013). With the low elevation profiles



of barrier islands and preference of low-lying nest sites by common eider, rising sea level and increasing storm surges may have significant effects on nest success of eiders. The intensity and frequency of storm surges in the Beaufort Sea is increasing, and sea levels have been predicted to rise by 0.26-0.98 meters by 2100 (Church et al. 2013). Model predictions suggest that wave heights and storm surges will continue to increase as ice retreats (Church et al. 2013, Lintern et al. 2013, Vermaire et al. 2013). In the future, eiders nesting on barrier islands may be impacted by both the increasing frequency and magnitude of storm surges, and an earlier timing of these events. Please include the following in this section: “Some species nesting on barrier islands, such as common eiders, could be negatively affected by predicted sea level rise and increasing storm surge. Both could flood nests and decrease productivity (see Liebezeit et al. 2013).”

- Page 3-91, Paragraph 6: Another potential impact of less sea ice is bigger, rougher sea conditions, which may impact foraging of marine birds, especially less experienced/smaller juveniles. Please update text to reflect this information.
- Page 3-91, Paragraph 6: Please provide a citation for the statement, “a delay in freeze-up in fall should be advantageous to the slow-growing young of such species as loons and swans, which are not always flight capable by time of freeze-up” or remove.
- Page 3-91, Paragraph 7: The statement, “Some species of insect-feeders (shorebirds and songbirds) can initiate nests earlier with early snowmelt, whereas others (jaegers, common eiders, and raptors) do not; however, it is unclear if birds relying on insects to feed their young (songbirds and shorebirds) could adapt to hatch at the optimum time as insect hatch continues to advance (Grabowski et al. 2013)” is incomplete for the body of climate-mediated links for some of these species. For example, as discussed in the cited reference (Grabowski et al. 2013), “The lack of response in the common eider to timing of snowmelt is consistent with other studies that have linked both nest initiation and productivity to the area of marine ice cover adjacent to the nesting grounds.” Love et al. (2010) found common eiders nested earlier in warmer years associated with earlier ice-breakup and Chaulk and Mahoney (2012) found spring ice cover was a positive predictor of nest initiation date, but was also linked to smaller clutch sizes. Because climate change is predicted to lead to earlier ice-out along the coast, common eiders breeding on ARCP barrier islands may nest earlier as warming advances, but the advantage or disadvantage of this is yet unclear. For Arctic breeding geese, lower snow cover was also related to earlier egg laying (Dickey et al. 2008). Suggest changing to, “Some species, such as passerines, shorebirds, and waterfowl, initiate nests earlier with early ice-breakup and snowmelt, but the overall impact to demography is still unclear (Dickey et al. 2008, Love et al. 2010, Chaulk and Mahoney 2012, Grabowski et al. 2013).”
- Page 3-91, Paragraph 8: The statement, “Avian habitat is likely to change slowly with climate change, except for coastal areas subject to erosion and deposition (see below)” appears to be incorrect as written. Most tundra nesting birds in the ARCP prefer wetlands or moist tundra (see Bart et al. 2012). However, Arctic lakes are disappearing (Smith et al. 2005), wetlands depletion is occurring following permafrost disturbance by thermo-erosion (Perreault et al. 2017), and ponds that have been permanent water bodies for millennia, are now completely drying during the polar summer (Smol and Douglas 2007). Therefore, Arctic habitats are already impacted and this loss is predicted to expand in the future [see, “Rapid climate-driven loss of breeding habitat for Arctic migratory birds” (Wauchope et al. 2016) for further discussion]. We recommend deleting this sentence or clarifying that habitat changes (e.g., higher water temperatures, less sea ice, lower zooplankton biomass, and smaller species of zooplankton) are already occurring in the marine environment.
- Page 3-92, Paragraph 3: Please add a paragraph specific to marine habitat after this coastal habitat paragraph.



- Page 3-92, Paragraph 4: The citation (Flint et al. 2003) does not appear to support the statement, “Erosion of coastal shorelines could increase inundation of tundra by salt water; the resulting salt-killed tundra may be colonized by salt-tolerant species and develop into salt marsh, a rare but important post-breeding habitat for geese.” Please correct or remove.
- Page 3-92, Paragraph 5, Line 7: If post-lease activities include transportation of oil, please address potential impacts to the marine environment. If oil transport includes any marine areas, it is not fully addressed in the draft EIS. Please update this section if oil will be transported in marine areas.
- Page 3-92, Paragraph 6: The statement, “Winter activities would affect few species and low numbers of year-round residents” is incomplete. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Based on this information, please change to, “Winter activities would affect few species and relatively low numbers of winter, spring, and year-round residents.”
- Page 3-92, Paragraph 6: Potential impacts of oil development on birds are listed as four primary categories, including “injury and mortality, and attraction of predators and scavengers (including both mammals and birds) to human activity or facilities, with subsequent changes in predator abundance”, but all are not discussed in the paragraphs that follow. Please consider the following to paragraph 1, page 3-93: “Changes in predator abundance and diversity could occur in all phases. For example, studies demonstrated low winter movement rates and high densities of habituated Arctic foxes in the Prudhoe Bay oil fields compared to more remote sites during winter (Pamperin, 2008; Lehner, 2012). Once uncommon, red foxes now occupy more den sites in Prudhoe Bay than arctic foxes and this shift has been linked to red foxes preference to den near facilities (Stickney et al. 2014). Injury and mortality from collisions with vehicles, structures, and wires and from contaminant exposure (including oil spills) could also occur at all phases, but would likely peak during drilling and operations.”
- Page 3-92, Paragraph 7: The statement, “Exploration occurs during winter and would have little direct effect on birds” may be incomplete if cleanup activities would occur during the snow-free season in relation to exploration. Please address how cleanup operations may impact migratory birds during the snow-free season. These impacts should be acknowledged and the effects should be analyzed
- Page 3-94, Paragraph 6: The statement, “Drawdowns may cause fish mortality, and lack of fish would make such lakes unsuitable for breeding loons” is incomplete. Most birds using aquatic habitats in the program area feed on aquatic invertebrates. The sentence before states, “Withdrawing water from under ice could ... possibly result in some ... impacts on aquatic invertebrate communities”; therefore, the effects to species that feed on invertebrates should be discussed. Please change to, “Lack of fish would make such lakes unsuitable foraging habitat for some loons. Lower invertebrate abundance, or a shift in invertebrate diversity, may affect the quality of ponds as a food source for birds in general, particularly waterbirds and shorebirds.”
- Page 3-94, Paragraph 6: The statement, “The long-term loss of nesting lakes would have potential population consequences for loons, primarily for Pacific and red-throated loons; yellow-billed loons in the Arctic Refuge nest primarily in the northern foothills of the Brooks Range and outside of the program area” is unclear, and may be incorrect depending on how interpreted. Yellow-billed loons are considered a rare breeder on larger lakes in the Brooks Range. Unlike other loons, red-throated loons leave breeding territories to forage during incubation and while rearing chicks. On the Arctic



Coastal Plain, these birds generally forage in the marine environment (See Barr et al. 2000, Uher-Koch 2017). In addition, the limiting factors of loons breeding in the program area is unclear, therefore the statement that the loss of a few nesting lakes could have broad population consequences seems somewhat unfounded. It is also unclear if the intention of this sentence is in regards to the loss of fish from lakes or from loss of nesting habitat through drying of lakes. Please consider providing citations to support, or change to, “The loss of nesting lakes by drying could have potential local population impacts for Pacific and red-throated loons.” If the sentence is only meant to convey the effects to loons of loss of fish from breeding ponds, please also remove the reference to red-throated loons because they generally feed in the marine environment during the breeding period.

- Page 3-95, Paragraph 1: The statement, “the impact [of gravel mining] on birds would be long term and somewhat ameliorated by reclamation plans (i.e., terrestrial breeding habitats could be replaced by aquatic habitats)” is incomplete as the species groups that are likely to use gravel pits filled with water will be different from those originally displaced. Suggest changing to, “the impact on birds would be long-term. Reclamation may reduce habitat loss if pits are fully transferred back to tundra, but reclaimed tundra is of lower value to breeding shorebirds and passerines compared to unaltered habitat (Bentzen et al 2018). If pits fill with water, habitat loss may be permanent for the species originally inhabiting the site, but could provide new habitats for waterbirds (i.e., terrestrial breeding habitats could be replaced by aquatic habitats).”
- Page 3-95, Paragraph 2: The following statement may be incorrect as written: “Future construction of gravel pads and roads would result in potential long-term direct loss of habitat and indirect alteration of habitat. Direct losses from gravel coverage (up to 2,000 acres allowable) would last as long as development projects are active, or until gravel is partially removed from retired roads and pads to restore some habitat features; this is estimated to be 85 years after the first lease sale before all facilities described in the hypothetical development scenarios are abandoned and reclaimed.” Gravel pads would always lead to direct loss and potential indirect alteration of adjacent habitat. The above states habitat losses would only occur as long as the project is “active”, but this term is undefined and direct loss from gravel coverage would last until gravel is removed. Reclaimed sites in Prudhoe Bay do not provide shorebird and passerine habitat comparable to that found prior to development (Bentzen et al. 2018). Please consider changing to, “Gravel pads and roads would result in the long-term direct loss of habitat and potential indirect alteration of habitat. Direct losses from gravel coverage would last until gravel is removed. In the hypothetical development scenarios, the gravel is predicted to be removed from all facilities 85 years after the first lease sale. Shorebird and passerine habitat quality is expected to be lower for at least 10 years for reclaimed sites (Bentzen et al. 2018).”
- Page 3-95, Paragraph 5: The statement “Potential effects on waterbirds would be minimized by using the shortest road routes and smallest pads” is incomplete as written. Densities of waterbirds and shorebirds is generally greatest in wetlands on the ARCP (Bart et al. 2012). Because here we are comparing the effects of 2000 acre development scenario as described by the Tax Act, making pads smaller wouldn't minimize the effect (i.e. 2000 acres would always be affected). The statement would only be accurate if applied specifically to minimizing footprints in wetlands. Please change to, “Potential effects to waterbirds and shorebirds would be minimized by minimizing footprints in wetlands where densities are generally highest (Bart et al. 2012).”
- Page 3-95, Paragraph 5: The statement, “Such habitats support higher densities of landbirds and impacts on these species could be greater as a result” is incomplete. Some species of waterfowl and shorebirds occur in higher densities in uplands and well-drained habitats composed of moist and shrub tundra on the ARCP (Bart et al. 2012). Lapland longspurs, the most abundant passerine



breeding in the ARCP, occur at somewhat higher densities during the breeding season in wetlands on the ARCP (Bart et al. 2012). Please change to, “Such habitats are important to landbirds and some species of other guilds. Impacts to these species may be greater as a result.”

- Page 3-95, Paragraph 7: Sea duck densities in coastal areas during the non-breeding season are related to habitat features including wind and wave exposure and substrate type (Esler et al. 2000). Common eider seek foraging habitats where food was most abundant, therefore not all habitat is of equal value (Larsen and Guillemette 2000). Sea ducks also deplete preferred foods when concentrated (i.e., as occurs during molt), causing birds to seek out new foraging sites (Guillemette et al. 1996). Given this information, please provide citations to support the statement, “Although high numbers of birds use the lagoons, they are highly mobile and likely would be able to move to adjacent similar areas if necessary” or remove.
- Page 3-95, Paragraph 7: ARCP mudflats are used by a large number of post-breeding shorebirds with up to 4,000 semipalmated sandpipers documented at some deltas in late July to mid-August (Brown et al. 2012, Churchwell 2018). If barging and dredging or other nearshore activities may affect habitat availability or quality into the late summer, large numbers of shorebirds may be affected. Please address this if it is applicable for the proposed activities.
- Page 3-95, Paragraph 8: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Alaska Beaufort and Chukchi Seas, as well as the program area. Please remove, “Long-tailed ducks made up 80 percent of the birds on surveys during late summer and fall in nearshore waters of the Beaufort Sea (Fischer et al. 2002). Other species included many of those potentially breeding in the program area, plus common eiders and scoters” and replace with, “Lagoon and near-shore surveys of post-breeding and molting waterbirds were conducted across the Alaska Arctic coast during fall 2002-2003 (Lysne et al. 2004). Up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and Pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Arctic Refuge coast. Over 28,000 long-tailed ducks were counted in the lagoons and nearshore waters along the Refuge coast in some years”.
- Page 3-96, Paragraph 3: This paragraph is incomplete. It discusses a variety of winter work that may impact resident birds, but does not consider that some cleanup from wintertime travel and construction is generally necessary during the snow-free season. If any summer or fall cleanup will occur because of seismic, construction, or winter travel, this section should include a discussion of potential effects here.
- Page 3-97, Paragraph 3: Impacts to bird densities from chronic disturbances are poorly studied in Arctic Alaska. Studies outside the Arctic found bird densities increased for some species and decreased for others in relation to oil and gas infrastructure (Walker et al. 2007, Bayne et al. 2008, Dale et al. 2009, Gilbert and Chalfoun 2011, Kalyn Bogard and Davis 2014, Ludlow et al. 2015). Please provide citations to support the statement, “Potential impacts of disturbance and displacement ... are unlikely to affect ... nesting densities of breeding birds”, or remove the reference about impacts to bird densities. Please consider changing the sentence to, “Potential impacts of disturbance and displacement by summertime construction and operations on the tundra would be long-term and may affect nesting success for some birds near facilities; however, they are unlikely to significantly affect regional or global population sizes.”
- Page 3-97, Paragraph 5: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Beaufort and Chukchi Seas in Alaska, as well as the program



area. Please change the latter two sentences in this paragraph to, “Common eider are the predominant species nesting on barrier islands and using associated nearshore areas during breeding (Kendall 2005). In aerial surveys of the lagoons and nearshore areas, surf scoters were the predominant species encountered in June and early July and long-tailed ducks in late July and August (Bollinger and Platte 2012, Lysne et al. 2004, Pearce et al. 2018). Long-tailed ducks use the lagoons during their flightless feather molt (Lysne et al. 2004).”

- Page 3-98, Paragraph 3: This paragraph primarily discusses how development of the ARCP may lead to increased air traffic in Deadhorse for transport of personnel. Although increased traffic through Deadhorse seems likely, moving personnel by fixed wing aircraft may also impact other sites. Airports at Barter Island and Kavik may also experience more flights since these airports would place staff closer to the Refuge (although still not within the ARCP). In order to move these staff during the snow-free season to duty stations within the program area, some additional means of transportation would be needed. Airports and roads may need to be built within the ARCP, and/or thousands of helicopter flights might be needed, all of which may impact birds. Please consider changing this paragraph to, “All types of air traffic could disturb and displace both breeding and non-breeding birds. Air traffic would include fixed-wing aircraft into Deadhorse, Kavik, and Barter Island airports; helicopters to move people and supplies from airports to sites within the program area, and potentially fixed-wing aircraft traveling in the program area if new airports are built on the ARCP. Potential impacts on birds would be both short- and long-term.”
- Page 3-98, Paragraph 6: The statement “Vehicle and aircraft traffic and tall structures, including communication towers and drill rigs, pose collision hazards that could kill or injure birds” is incomplete. Transmission and guy wires are an equal or greater collision risk (Manville 2005). There are limited data to support the hypothesis that structure height is a significant predictor of collision risk in the treeless tundra ecosystem of the Arctic. Please change to, “Vehicle and aircraft traffic; structures, including communication towers and drill rigs; and wires pose collision hazards that could kill or injure breeding, staging, or migrating birds.”
- Page 3-99, Paragraph 2: The statement, “Collisions with tall structures increase with tower height, bright lighting, and the presence of guy wires (Manville 2005; Gehring et al. 2011)” is incomplete. Perhaps the most important results in the citations provided is that risk of tower collisions is greatest when near wetlands or in migration corridors, but this is not included in the current text. Please change to, “Collisions with structures increase with height, bright lighting, guy wires, and when structures occur near wetlands or in migratory corridors (Manville 2005; Gehring et al. 2011).”
- Page 3-99, Paragraph 3: The statement, “Collisions would be expected to occur annually in small numbers, but mortalities could be serious if flocks of birds of conservation concern are involved” does not appear to be well supported. Collisions with towers are estimated to kill millions of birds annually (see Manville 2005). Please provide citations to support that collisions are expected to occur in small numbers, or change to, “Collisions are expected to occur annually and the number of birds likely injured or killed is unknown.”
- Page 3-99, Paragraph 3: The following statement is unclear: “The potential impacts of collisions are short term, infrequent, and seasonal but would occur throughout the life of any development project and would be restricted to roads and facilities.” The effects of collisions are often permanent and result in death. Frequency of collisions would depend on a host of factors including season, number of birds moving through an area, and weather. In some situations, dozens or more collisions occur in any given day. Collisions may also occur with aircraft anywhere in the program area. Please consider changing to, “Collisions would vary by season and occur throughout the life of any development project”.



- Page 3-99, Paragraph 6: The following statement is incorrect: “Potential salt-water spills would not be toxic to birds but would likely kill vegetation in the spill zone and thus alter habitat.” Many species of birds are not tolerant of ingestion of saltwater and others are not tolerant to its ingestion for extended periods or during certain parts of their life history. For example, despite their ecology, plovers and sandpipers lost weight when provided 0.3 M NaCl for drinking water, half the concentration of normal seawater (Purdue and Haines 1977). Even species that spend most of the lives at sea, like common eider, risk mortality if provided only saltwater during the brooding period (Devink et al. 2005). Please change to, “Potential salt-water spills would likely kill vegetation and invertebrates, and could be toxic to birds.”
- Page 3-101, Paragraph 3: The statement, “Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds in tundra habitats could occur over about 2 percent of the area available for leasing” may not completely describe the potential areas impacted if large portions of the 2000-acre footprint are linear features. Please consider changing to, “Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds would depend on the orientation of the footprint and amount of linear features.”
- Page 3-101, Paragraph 5: The following statement is inaccurate, “Fall staging snow geese are an important exception, as the area closed to leasing overlaps extensively with areas historically used by the largest numbers of fall staging snow geese in the program area.” There are no areas closed to leasing in Alternative C. A substantial portion of area heavily used by snow geese in the 2000s occurs in areas with standard terms and conditions (Kendall 2006). Please change to, “Fall staging snow geese are an exception, as the area of NSO overlaps with many areas used by the large numbers of fall staging snow geese that use the program area (Kendall 2006).”
- Page 3-101, Paragraph 7: The statement, “With Alternative C, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would be similar to Alternative B” is incomplete. An important feature of Alternative C, compared to B, is that more wetlands and moist tundra would be afforded protections through NSO along the coast and from increased buffers around those rivers most important to breeding waterbirds and shorebirds (e.g., see Brown et al 2007). Please consider changing to, “With Alternative C, potential long-term loss and alteration of the most heavily used bird habitats (wetland and moist tundra) from direct and indirect effects of gravel deposition would be somewhat less than Alternative B (the entire area is available for leasing) and would occur over approximately 1 percent of the program area; disturbance and displacement could occur over about 2 percent or more of the program area.”
- Page 3-102, Paragraph 1: Oil spills in riverine, deltaic, and lagoon habitats has the greatest likelihood of high impact to waterbirds. For this reason, Alternative D that includes the highest setbacks from waterways for refueling operations and that maximizes no surface occupancy for these habitats, will provide some protections for migratory birds. Please update the text to reflect this information.
- Page 3-102, Paragraph 2: The following statement is incomplete: “Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, somewhat more protective of avian habitats in riparian areas.” The larger river setbacks in Alternative D would also provide some protections for habitats adjacent to riparian areas, such as wetlands. Please consider changing to, “Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, more protective of avian habitats in riparian areas and other important adjacent habitats such as wetlands.”



- Page 3-102, Paragraph 3: The following statement is incomplete: “however, the various NSO areas with Alternative D would be protective to many important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, and coastal habitats.” During the breeding season, shorebird, waterfowl, loon, and larid densities are highest in wetlands (Brown et al. 2007, Bart et al. 2012). Even lapland longspurs, the most abundant passerine in the ARCP, occur at somewhat higher densities in wetlands compared to drier sites (Bart et al. 2012). Within the ARCP, wetlands are generally most abundant along rivers and river buffers are largest for Alternative D. Therefore, Alternative D provides more NSO coverage of wetlands adjacent to rivers than Alternative B or C. Please change to, “however, the various NSO areas with Alternative D would be protective to the most important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, river deltas, wetlands associated with rivers and coastal habitats.”
- Page 3-102, Paragraph 3: The following statement is incomplete: “All these no lease areas, NSO areas, and CSU areas would potentially reduce impacts on birds. As with Alternative C, nearly all of the area closed to leasing are in the area of low HCP and in inland and drier habitats.” No areas are closed to leasing in Alternative C. Please change to, “All these no lease areas, NSO areas, and CSU areas would likely reduce impacts on birds. Nearly all of the area closed to leasing is in the area of low HCP and in inland and drier habitats.”
- Page 3-102, Paragraph 6: The statement, “Under Alternative D, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would occur over approximately 1.6 percent of the area available for leasing (1,037,200 acres). Disturbance and displacement could occur over about 3 percent of the area available for leasing” is confusing and makes it difficult to compare potential impacts for the various Alternatives. Recommend deleting this paragraph or maintaining a consistent denominator (i.e., the program area) for all alternatives. Specifically, we recommend that the comparison be the percent of the project area, not the leased area that would be affected by each alternative. Another way to present this is the total number of acres potentially altered under each alternative. Either of these would provide a more accurate comparison across alternatives than the current approach.

## **Wilderness**

- Recommend under Oil and Gas Field Abandonment, all alternatives specify that before final abandonment, all impacted areas should be reclaimed to a point where the area is again eligible for designation as Wilderness.
- Page 3-211: The statement about Wilderness recommendation beginning with “In the Arctic Refuge CCP...” should read, “...the USFWS recommended and the President recommended the lands in the program area for wilderness designation.”
- Page 3-216: Recommend changing the first sentence of second paragraph to read “. . . naturalness, wildness, and symbolic values of an area that may be affected . . .”
- Page 3-216: Recommend changing the 3rd sentence under Alternative A to read, “Current USFWS management focuses on no or minimal manipulation of the environment, wildness, and promoting...”
- Page 3-216, 3rd full paragraph, last sentence: Recommend changing to read “. . . and, therefore, would affect an area’s . . .”



- Page 3-216, under Alternative B, line 7: Recommend changing “...would likely retain its overall wilderness character to “. . . would likely retain some of its overall wilderness character”, as the wilderness character would be lost to some degree.

### **Water Quality and Quantity and the Diversity of Aquatic Habitats and Species**

- F-18, F.4.10: Recommend the types of impacts under drilling and operation be expanded to include reinjection of waste/hazardous waste. Impact indicators should include ground water quality.
- F-18, F.4.10: Recommend the types of impacts under barge docks and seawater treatment plant construction and operation include alterations of water temperature, salinity, and currents, as well as sediment deposition.
- F-17, F.4.10: Construction and maintenance of gravel pads, roads and air access facilities can alter wetland area and extent, and can lead to inundation and starvation of tundra. Recommend these impacts be listed under impact indicators.
- Page 3-51, 3.2.10: Tiering the impacts on water resources to BLM’s documents (NPR-A 2013, NPRA 2004a, BLM 2018) is inappropriate in many cases as impacts in the Arctic Refuge 1002 Area will be different due to the many differences between the 1002 Area and the developed areas in the NPR-A. For example, in the Arctic Refuge 1002 Area, water is relatively scarce, the terrain is steeper, and major groundwater-fed springs are extremely important. Recommend removing language related to the assumption of impacts where appropriate.
- Page 3-51, Affected Environment: Please add “topography” to controlling forces.
- Page 3-51, Affected Environment: Add “Annual total precipitation averages a little greater than 6 inches of liquid equivalent.” Source: WRCC 2018a. Historical Climate Summaries. <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak0558>. This is directly from Section 3.2.1, and is relevant in this section because the precipitation in the Arctic is that of a desert.
- Page 3-51, Affected Environment: Hydrology, freeze-up and break-up are described repeatedly, but there is little discussion of summer streamflow conditions. Streamflow diminishes after break-up. Many streams and rivers become discontinuous due to limited summer precipitation and/or distribution of channels as they cross the coastal plain. Recommend the Affected Environment be expanded to include a robust discussion of summer streamflow and hydrologic conditions.
- Page 3-52, Watersheds, Rivers and Streams: The overview of freeze-up and break-up are of a general nature for north slope rivers and streams covering timing of annual flow, but lacks site specific knowledge of the coastal plain rivers and streams in which the topography, springs, and aufies are significant to the hydrology. For example, as the Hulahula River flows north from Fishhole 1, the single channel distributes into several braided channels. Often the flow within the braided channels goes subsurface or is intermittent. The data in table H-5 indicate that streamflow in several rivers diminishes significantly after break-up, but does not show that flow in several of the gaged rivers becomes intermittent (West Fork Tamayariak, West Fork Itkilyariak and Sikrelurak would be examples). The topography of the coastal plain and morphology of rivers and streams of the coastal plain differ from that of the NPRA. River channels distribute into many channels as the flow north from the mountains or foothills. As a result, surface flow during the summer months diminishes and may be intermittent at times or in specific locations (Table H-5). Recommend including a map that highlights the hydrology of the coastal plain.



- Page 3-52, Lakes and Wetlands: Insert “due to the topography” before the statement, “lakes are very scarce...”
- Page 3-53: Insert a comma in the heading between “Groundwater” and “Springs and Aufies”. Springs (groundwater) provide significant year round habitat for aquatic resources.
- Page 3-5: Flow paths of groundwater and spring recharge within and adjacent to the coastal plain are poorly understood. We recommend the EIS consider the effects of reasonably foreseeable development activities on groundwater flow paths, evaluate the risks associated with reinjection of hazardous wastes into subsurface aquifers, and develop stipulations for leasing to avoid and minimize the potential contamination of springs. For additional information on subject see Kane et al. (2013).
- Page 3-53: Add “Tamayariak and Okerokovik” to the springs identified in this section.
- Page 3-54, Water Rights: Text incorrectly states, “...and over 360 Instream Reservations completed and pending under the USFWS. While the Instream Reservations have not been issued as a water rights permit, those applications would have seniority over any new applications received by ADNR.” Please correct and replace the portion of the text in quotation marks with the following, “...the Service has applied for 152 Instream flow Reservations within the Refuge and project area to ensure the protection of aquatic habitats and wildlife. These reservations have been pending ADNR adjudication since 1994 and have seniority over any new application for water use.”
- Page 3-55: Edit the header of the first bullet list to include “ground water quality.”
- Page 3-55: Add the following to the list of activities that will affect the hydrology and water quality: injection/reinjection of waste, drilling muds, and other contaminants.
- While Map 3-12 includes streams in which anadromous fish presence has been documented, and springs that contain resident Dolly Varden and Arctic Grayling, it needs to more clearly indicate that the Canning River supports the greatest diversity of anadromous and freshwater resident fish species in the area: it is not clear from the icons used.
- The caption for Table 3-17 suggests that this list of streams includes all fish habitat in the Program Area, yet it only identifies rivers that are classified as anadromous waters and ignores springs such as Sadlerochit Spring that supports resident Dolly Varden and Arctic Grayling. If this table is intended to be a comprehensive list of fish habitat, as the caption suggests, it should identify the rivers, springs, and lakes in the program area that support fish. The associated map (Map 3-13) does not convey much meaningful information. Please consider presenting a figure that illustrates stream monitoring locations.
- General to mapping springs, fishery resources, and water resources: Sadelrochit Springs is not a direct tributary to the Sadelrochit River. It originates west of the Sadlerochit River and is a tributary to the Itkilyariak River. Recommend correcting this information where appropriate.
- Page 3-58: Under “Changes to Surface Water Quality,” change to “...dust fallout from vehicle traffic could increase turbidity *and contaminant loads* in ponds...”
- Page 3-58: The reference to BLM 2012 4.5.4.2 is not relevant to the 1002 area and does not present an analysis or discussion, as it simply states that impacts are not long-term and provides no supporting data. Recommend deleting the statement or providing a more appropriate reference if the statement is retained.



- Page 3-58, Last paragraph: It should be stated that erosion and thermokarst related to development activities will have long-term impacts on surface water quality.
- Page 3-59: Under “Changes to Marine Waters” and elsewhere in the document: we question that the effects of an oil spill would be “short-term and localized,” And recommend that you remove this statement. Effects and damages from an oil spill depend entirely upon the circumstances of the spill, including material type, volume, spill response capability, weather, and sensitive resources in the area of the spill.
- Page 3-59: It cannot be assumed that water will be recharged during snowmelt because of stipulations in place. Adequate recharge depends on several factors including connectivity, watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not be fully recharged during snowmelt after water withdrawal, especially during low snow years. For more information on “recharge vulnerable” lakes in the NPRA, see Figure 6 in Jones et al. (2017). More than 50% of the lakes presented in this study are considered recharge vulnerable. An even greater proportion of the lakes in the 1002 Area of the Arctic Refuge are likely recharge vulnerable. Recommend this information be incorporated in the document as appropriate.
- Page 3-59: Insert, “Infrastructure and operations will result in permanent changes to permafrost resulting in thermokarst and irreversible impacts to overland flow and shallow groundwater.”
- Page 3-59: In the impacts analysis section, the discussion on impacts to groundwater is limited to gravel mining impacts to subsurface flows. The potential impacts to deep groundwater flowpaths that support perennial springs are not mentioned. Deep groundwater sources and perennial springs are very important in the 1002 Area. Perennial springs have very different chemistry, thermal regimes, and ice phenology compared to other water bodies in the Refuge (See the Arctic Refuge Comprehensive Conservation Plan 2015 or papers by Alex Huryn for more information). Recommend the discussion on impacts to groundwater be expanded to include deep groundwater flowpaths and their influence on perennial springs.
- Page 3-59: In the impacts analysis section, note that contamination related to injection of hazardous wastes in subsurface areas and fracking could have major irreversible impacts to the ground and surface water quantity and quality and could impact major spring-fed systems that are important for wildlife and subsistence users. This is an important piece of information for subsistence hunters.
- General Analysis Comments for water resources and aquatic communities:
  - Be explicit about what offshore actions are planned so that these can be considered in the range of effects.
  - Total projected ice road use should be presented under development scenarios. It is expected that ice road use could increase greatly under Alternative B. Without assessments of ice road use under all alternatives, it is not possible to adequately conduct analyses of the impacts of development on vegetation, fish, other aquatic species, birds, soils, and water.
  - We recommend the feasibility of using freshwater resources (versus using groundwater or a seawater treatment plan) be more rigorously analyzed within the different alternatives. This information is necessary to develop an appropriate analysis of the impacts of development on water resources, fish, and other aquatic species.



## **Air quality**

- The DEIS states that the location, timing, and level of future oil and gas development on the Coastal Plain is unknown at this time and that a qualitative air analysis is being performed. In the other Alaska projects mentioned in this section, quantitative analyses have been performed using a low, medium, and high projected level of development. This type of air analysis has provided informative data to the decision makers and the public. Additionally, further project specific air analysis can tier off of the quantitative air analysis. We recommend that Appendix B., Reasonably Foreseeable Development Scenario for Oil and Gas Resources, which quantifies the most likely unconstrained projected oil and gas baseline development scenario for the Coastal Plain, be used as a basis for a quantitative air analysis and to serve as a general estimate to determine the air quality impacts due to leasing and development.

## **Hazardous Materials**

- F-18, F.4.11 Actions affecting the resource should include injection of hazardous fluids.
- Section 3.2.1, Page 3-5, first two lines: The DEIS states, “For example, a significant fraction of CO<sub>2</sub> emitted by human sources each year is taken up by the biosphere, which is gaining mass in response to the emissions.” Please remove this line as a significant fraction of human-sourced CO<sub>2</sub> is also not sequestered by the biosphere, resulting in increasing CO<sub>2</sub> atmospheric concentrations and increasingly obvious patterns of climate change effects, particularly in the Arctic.
- In multiple DEIS sections (e.g., Water Resources, Terrestrial Environment), description of impacts from “dust,” “fugitive dust,” “erosion,” “scour,” and “sedimentation” need to include the potential for exposure of terrestrial and aquatic biological communities, and subsistence users that rely on those, to contaminants of concern including heavy metals. Such exposure may occur through earth-disturbing activities (depending on the underlying geology) and along roadsides (from vehicle traffic).
- Thawing permafrost may also mobilize previously-sequestered contaminants, including mercury (Schuster et al. 2018, Ryder et al. 2010). Additionally, wetlands created through thawing of permafrost add to the mercury methylation potential of watersheds. Throughout the DEIS, many post-leasing activities are described as having the potential to thaw permafrost without mentioning these significant related potential effects. Please correct as appropriate throughout the document.
- Page 3-61, first bullet list: Clearly list other hazardous materials by chemical name, as has been done for methanol, propylene glycol, and ethylene glycol. Include the constituents of the industrial product types that are currently listed.
- Page 3-62, Paragraph 1: This analysis should use all of the most recent information to describe past spill frequency and volume, not just information in BLM 2014, Section 4.5.2, including all information in the National Response Center (NRC) database (at <http://nrc.uscg.mil/>).
- Oil or other hazardous spills within the Arctic National Wildlife Refuge Coastal Plain are low probability, but high consequence, events. We agree that the probability for a large oil or other hazardous material spill is low, as discussed on page 362. However, the consequences of even small (pages 3-61–3-62) spills in the otherwise pristine environment would result in significant changes from the environment as it is currently managed for non-extractive Refuge purposes. Except for areas outside the area boundaries (e.g., DEW Line sites, Kaktovik), the Coastal Plain of the Arctic Refuge is perhaps the only Arctic region on the planet that has not experienced industrial activity and subsequent contamination, as demonstrated by baseline contaminants data (Snyder-Conn and



Lubinski 1993, Vols. 2 and 3). Therefore, this EIS should discuss the consequences of an oil or hazardous material spill due to post-lease activities within the unimpacted portion of the action area, on all potentially impacted resources (water, soil and sediments, biota including microbes, invertebrates, plants, fish, and FWS trust resource birds and mammals).

- The DEIS does not clearly discuss the risk of spills in the marine shipping lanes, from Unalaska to Kaktovik, which were identified as part of the project area. Recommend expanding the discussion of spill risk to all identified parts of the project area, see Ryder et al. 2010; Schuster et al. 2018; Snyder-Conn & Lubinski 1993a & 1993b.

## **Vegetation and Wetlands**

- Page 3-71: Long-term impacts (>20 years) of ice roads and snow trails are described, but there is not a similar discussion describing the short-term impacts. Impacts lasting even one or two years will have effects on wildlife and visitors, and perhaps more significant indirect impacts on soils, hydrology, etc. Short-term impacts need to be identified and addressed in the document as appropriate.
- Page 3-65-66: Overall this section is very difficult to follow or interpret. The headings in the discussion section do not match those in the map. For example, in the text there is a section heading “Moist Herbaceous Meadow”, and there is no corresponding heading in the map legend. It appears this may be the “Herbaceous (mesic; northern and western Alaska)” on the map but there is no discussion that allows the reader to understand how the text translates to figure 3-10. Appendix J states the information was pulled from Boggs et al. (2016). We recommend rewriting Appendix J and Section 3.3.1 pages 3-65 and 3-66 to reflect the structure in Boggs et al. (2016) and provide descriptions in Appendix J of the “Fine Scale” cover classes in the original source. See the text below as an example:

### Herbaceous (mesic; Northern and Western Alaska)

Text describing this cover class.

### Fine Scale cover classes

Herbaceous – Dwarf Shrub

Vegetation description and relevant information

Leymus

Vegetation description and relevant information

Herbaceous Mesic

Vegetation description and relevant information

- Page 3-67 and 3-68: Recommend using 1:63,000 map to assess wetlands instead of coarse scale analysis. At a minimum there should be definitions included in Appendix J for each wetland class. “National Wetlands Inventory Notes to the Users for North Slope 1:63,000” information sheet has definitions and a key for map codes.
- Page 3-39, Wetland Functions and Values: We recommend the section be removed or revised. The section makes one statement at the beginning relative to the affected environment in the first line of the first paragraph. The remainder of the section refers to mitigation and wetland functional assessments that are a part of that mitigation and not the affected environment. Any statements as to the value of functional wetlands in the context of Berkowitz et al. (2017) should be reconsidered



since that reference states, “This method does not identify the importance of wetlands within a watershed, measure specific wetland functions, or determine sufficiency for mitigation on its own. This methodology can be used to inform project alternatives, assess unavoidable impacts, and aid in the determination of sufficiency for mitigation.” We suggest the author rewrite this section to describe the influence wetlands currently have on the system in general or cite specific papers that evaluate Arctic wetland functions and their role in Arctic systems. This will need to be done at a very high/coarse level given there was no analysis of the finer scale National Wetland Inventory products available at the 1:63,000 mapping scale.

- Page 3-69, Paragraph 6: “Relative to wetlands in temperate regions, North Slope wetlands tend to have low function for most of the hydrologic, biogeochemical, or social functions.” Please provide a citation for this statement. Additionally, this appears to be an inappropriate comparison as functional assessments are completed at the local scale and functional values are not comparable. If one uses the hydrogeomorphic classification (Brinson, 1993), a wetland is compared against another wetland characteristic of the same class so comparison with temperate regions would also be inappropriate.
- Page 3-72, Rare and Invasive Plants: For both the impact to rare plants and the probability of introduction of invasive plants, impacts might be equal across all alternatives for the actual disturbance footprint; however, the analysis should take into account the scale of each alternative. For example, under Alternative B there may be an equal probability across the entire program area for the introduction of invasive plants and destruction of rare plants, however, under Alternative D there is an extremely low probability in the no lease sale area for the introduction or destruction of plants because there will be no disturbance in this area.
- Page 3-72, Alternative B: “...Alternative B is herbaceous (mesic) tundra, ranging from 16.4 percent in high HCP to 39.9 percent in low HCP areas...” Maximum value is 42.5 under Medium HCP TL section of Appendix J table J-3. Please correct in the Table and text as appropriate.
- Page 3-73, Alternative B, Paragraph 4: “The NSO protections preferentially preserve wetter more vulnerable vegetation common to riparian areas ...” This statement runs contrary to “Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree...” from the impacts common to all alternative section above. It is not clear where the author argued that wetter sites/riparian area were “more vulnerable”. Given that riparian areas tend to be high disturbance environments, a description of those vulnerabilities should be provided. Please provide further explanation of why and, or how NSOs preferentially preserve these areas.
- Page 3-73, Alternative B, Paragraph 5: The document states, “Because of the higher incidence of low shrub vegetation ...” but fails to provide any points of comparison. Suggest rewording to “... higher incidence of low shrub vegetation in the central and eastern portion of the project area...” or something similar.
- Page 3-73, Alternative B, Paragraph 6: “The wetter types occurring in the broad freshwater emergent class are often higher functioning wetlands but were not delineated separately in the NWI mapping used in this analysis.” Because “higher functioning” is not defined, we recommend rewording as “more productive,” if that is what the author intended. Additionally, it is likely many of these habitats are delineated by using the ATTRIBUTE designation instead of the WETLAND\_TY (type) in the NWI data layer. Also see previous comment on page 3-69, paragraph 6 regarding the use of “functioning” for wetland value.



- Page 3-73, Alternative C: The source of the following statement is unclear: "...herbaceous (mesic), ranging from less than 0.1 percent to 37.4 percent of the areas open for leasing, and tussock tundra, ranging from less than 0.1 percent to 41.1 percent ...". Appendix J table J-5 has Herbaceous (mesic) values ranging from 20.9 to 56.3 and Tussock tundra ranging from 4.7 to 44.2. Please correct if the values are inaccurate or provide a citation if values are from some other data source.
- Page 3-74, Alternative C, Paragraph 2: "The vulnerable wet tundra types in the NSO riparian areas under Alternative C are protected to a limited extent, depending on the specific design of an anchor oil field development and whether stream crossings are approved." The document will be clearer if a specific stipulation for the statement is cited given that Alternative B states, "This restriction, however, would not preserve vulnerable vegetation or wetland types because construction would be permitted outside the TL period and would still affect vegetation and wetlands" and it does not appear that any of the stipulations in Alternative C completely prevent development.
- Page 3-74, Alternative C, Paragraph 3: "The NSO requirements for Alternative C effectively protect high-value estuarine wetlands (see discussion under *Affected Environment* and *Alternative B* above)." Contradicts Alternative B "*Impacts Common to All Action Alternatives*" would likely occur throughout the NSO/high HCP areas but to a lesser extent than in the standard terms and conditions or TL areas." Additionally, neither of these statements address what "effectively protect" means and it is not defined in the Affected Environment section. Please clarify this statement or providing specific examples of how this protection is "effective".
- Page 3-74, Alternative D, Paragraphs 4-6: There are multiple references to high and low-value wetlands and habitats, however, these terms or the method with which the value was determined is not stated. Please elaborate on the methods for determining value of habitats.
- The type descriptions on page J-2 are incomplete. Within each of the four types described, not all subtypes (e.g., those show on the tables) are described. The descriptions should include ecological information, for example 'commonly occurs of low-centered polygons', or 'with lots of permafrost features such as frost boils'. Refer to the vegetation type descriptions in the Arctic Refuge CCP for examples.
- Tables J-1 to J-7. Please consider arranging the table a hierarchy, with land cover types divided into shrub-dominated, moist herbaceous, wet herbaceous, and other (barren, sparse and water), following the style of most vegetation classification systems, including The Alaska Vegetation Classification (Viereck et al. 1992) rather than listed in alphabetical order. For example, under wet herbaceous meadow would be listed 3 types: 'herbaceous (wet), herbaceous (marsh), and herbaceous (wet-marsh)'. It is typical to list the most common land cover type first. Then on page J-2, under the heading 'wet herbaceous meadow', all 3 types would be described, with the most common one described first. Right now, that paragraph on page J-2 describes only the 2 types that cover <1% of the study area. The third type that fits in this category (herbaceous (wet)), which covers 16% of the area as mapped, is currently not described. It includes large areas of wet tundra that are not in lakes or on edges of lakes or coast. Consider describing it first, followed by the two less common types.
- The category 'moist herbaceous meadow' includes moist tussock sedge tundra (26% of area) and 'herbaceous (mesic)', (31% of area). In the description on page J-2, the first two sentences describe the herbaceous (mesic), but most readers would not recognize or be familiar with that. Given that the type covers almost a third of the study area, consideration of a more detailed description is warranted.
- Appendix F, Section F.4.12, Vegetation Information: Information in the "Impact Indicator" is not consistent with how habitat changes are quantified for other resources throughout the DEIS. The



same difficulties exist for quantifying habitat changes for migratory birds (see page F-26) and caribou, but different wording is used. Please consider quantifying habitat changes similarly, and using common language, for the different resources impacted (e.g., vegetation, birds, and caribou).

- Tables starting on page F-19 repeatedly state “no indicator available to assess possible plant community changes.” When “no indicator available”, is stated in the DEIS, we recommend indicators be developed when practicable. For example, plant community composition can be quantified with field work.

### **Soil Resources**

- The DEIS does not mention the importance of intact soil and sediment microbial communities, which form the base of the food chain. As an example, during cleanup of oil spills (especially to land) natural remediation of unrecovered petroleum products is dependent upon soil microbes. We recommend that the DEIS evaluate practices that affect soil microbes, including compaction, gravel and sand extraction, and any intentional (chlorinated domestic water) or unintentional (hazardous material) spills that affects the soil microbial biome and could diminish recovery processes.
- Recommend including “Massive Ice” map from Jorgenson et al. (2015).

### **Physiography**

- There is no discussion about the difference in gradient and terrain between the 1002 and NPR-A and we recommend this information be included in the document. Differences in physiography are highly relevant given that the area is to be managed in a manner similar to the NPR-A yet the physiography is significantly different. Additionally, a comparative discussion between the two areas is appropriate given that there is significant comparison of water availability in Section 3.2.10.

### **Invasive Species**

- The Service has management authority for the conservation of a variety of trust resources including migratory birds, inter-jurisdictional fish, threatened and endangered species, and their habitats. Invasive species have the potential to negatively impact these resources. Therefore, we recommend the incorporation of appropriate control and management actions be taken to avoid and minimize adverse impacts associated with invasive species and encourage the development of an invasive species control plan for all phases of the proposed project. Additional general and specific recommendations for incorporation into the EIS are provided below:
- Recommend additional information about certified weed-free gravel and supplies for road corridor construction (e.g., hay bales, wattles, blankets) and pipeline construction should be recognized throughout the document where appropriate.
- The DEIS does not adequately address the threat of aquatic invasive species (e.g., Elodea) and how the transfer of aquatic plants from other infested water bodies in the state will be prevented. Please include a description of the prevention plan and describe the planned response to an invasive species introduction.
- Additionally, we recommend the EIS state how the proponent will prevent and respond to the introduction of the following types of invasive species that may be brought in on construction supplies and equipment:
  - invasive terrestrial invertebrates;



- invasive terrestrial vertebrates (e.g., rodents); and
  - marine invasive species.
- Page 2-36, Operating Procedure: Objective - Invasive Species Prevention: Please include the list of supplies in the requirements (not just equipment and vehicles). Please add boats, planes, and helicopters to the description of what is considered a vehicle as these are all considered vectors for introduction. We also recommend adding language related to monitoring at ports for invasive species at barges, air strips, and landing pads. Additional consideration and language specific to response to invasive species other than weeds should be considered in the EIS; the paragraph in the DEIS currently only discusses "weed control measures".
  - Page 3-67, Paragraphs 4 and 5, Nonnative and Invasive Plants: The statement "According to the ecological risk analysis conducted by Carlson et al. (2015), none of the documented species listed above are regarded as a significant ecological threat" is not accurate. Canada thistle and white sweetclover are ecosystem changers that stakeholders across the state are trying to prevent from spreading. The AKEPIC invasiveness rankings for those species are 76 and 81, respectively. A value of 70 or higher is recognized as a species of high concern that managers agree need action. The other species have rankings of 63 or less. This section also lacks any acknowledgement of species that are not yet in the Arctic or the Dalton Highway Corridor but could easily make it here. It is inaccurate to suggest that we are only concerned about the few species listed in the DEIS, and the concerns about species currently provided are downplayed. Please correct this information as appropriate.
  - D-3: Please add the National Invasive Species Act (Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (As amended through the National Invasive Species Act (NISA)). The NISA mandates the Service to provide leadership on national efforts to prevent the spread of aquatic invasive species. The NISA furthered Aquatic Nuisance Species (ANS) activities by calling for ballast water regulations, the development of State management plans and regional panels to combat the spread of ANS, and additional ANS outreach and research. Section 1204 of the Act authorizes the ANS Task Force to provide funding to states that have an ANS management plan. The NISA established the ANS Task Force to coordinate nationwide ANS activities.
  - Page D-6, Executive Orders: There is a newer Executive Order (EO) related to invasive species that should replace or be added to the current reference. Please use EO 13751.
  - Action Affecting Resources, Project Construction and Operations: The section appears to be focused on terrestrial plants. Recommend this section be expanded to include aquatic plants and terrestrial invertebrates.
  - Action Affecting Resources, Barging of Materials: Recommend this section be expanded to discuss possible introduction of rodents.

## **Visitor Use**

- Section 3.4.6: Preservation of recreational hunting, fishing, hiking and boating values and opportunities is an original purpose of the Arctic Refuge and is continued under ANILCA. The majority of visitors to the Refuge recreate within the project area. Recreational access and prohibitions before, during, and after leasing and surface activity (where people can/cannot expect to be able to go, and what they expect to be able to do/not do) is not adequately addressed for Alternatives B-D, though Alternative D minimizes indirect and cumulative effects upon visitor



experiences. The EIS should further explain how recreational access before, during and after leasing will be addressed under each of the Alternatives.

## **Visual Resources**

- Appendix A: We recommend that maps and figures be developed as part of a computer-assisted viewshed analysis using the BLM visual resource management system. Maps and figures should model foreseeable potential effects of typical layouts by showing expected changes in viewshed form, line, color, and texture of landform, vegetation, and water from: (1) suitable river corridors (including the Kongakut River, which is outside the project area, but which was found to have a scenic ORV); (2) Kaktovik; and (3) popular recreation areas. These models should identify the distances from which vertical structures could be detected. Maps modeling areas where changes to dark skies and wildlife abundance and, or distribution are foreseeable and could also be provided.

## **Acoustic Environment**

- Within the Acoustic environment, we recommend that the effects to natural quiet and the attempts to maintain natural quiet be discussed wherever natural sounds and noise are addressed.

## **Fish and Aquatic Communities**

The following corrections should be made to Table K-1, Appendix K-4 and K-5:

- Arctic Cisco habitat use description should delete the words "...freshwater and...", it is extremely rare to find an Arctic Cisco in freshwater at any time except during their spawning runs up the Mackenzie River. Here, it appears to read that one would be equally likely to find them in freshwater or marine environments, which is not accurate.
- Arctic Grayling spawn in the program area. While, they have rarely been encountered in the fyke net sampling programs that have been operated along the coast, all life stages are abundant in the freshwater drainages that support overwintering fish, including the Canning, Hulahula, and Sadlerochit, as well as in some lakes in the program area.
- The Arctic Grayling habitat use section should clarify that they live during all seasons in the program area. There are some streams such as the Tamayariak and Okpilak that they occupy during summer only, but those are rivers that share deltas with the Canning and Hulahula rivers, respectively.
- Burbot likely spawn in the program area. It is true that burbot have never been captured in the fyke net sampling programs that have been operated for more than seven years in the lagoon habitats of the program area and we are not aware of them being captured in the long-term fyke netting programs in Prudhoe Bay. However, they are present in the Canning River and large rivers to the west. Therefore, it is highly likely they spawn in the Canning River. They may spawn upstream from the 1002 Area boundary, but if that uncertainty is a concern, then the answer should be "probably" as to whether burbot spawn in the program area.
- Burbot habitat use description should indicate that as a freshwater fish they are present during all seasons in the Canning River, but not elsewhere in the program area. They do not migrate anywhere else for the winter as the column in the table currently reads.



- Chinook Salmon lifespan should be modified to read “4-7”, and age at maturity should be the same. They do not mature at age-1 or age-2, a small fraction may mature at age-3, but for the purposes of this general life history table, maturity at “4-7” would be appropriate.
- Chum Salmon lifespan and age at maturity should both read “3-6”. Age-4 and age-5 are the most common ages at maturity, but ages 3-6 are almost always represented as well in spawning runs.
- The Chum Salmon habitat use section should be modified by deleting the words “...and foraging...”. Similar to Chinook Salmon, Chum Salmon might forage a little in coastal marine water as they approach a spawning stream, but they would not be feeding if they were migrating upstream in freshwater.
- The Dolly Varden habitat use section reads as though Dolly Varden are common during summer and winter months in coastal and marine waters. This should be reworded to indicate that they are only found in coastal and marine waters during summer months.
- Least Cisco likely do not spawn in the program area. They occur only rarely in fyke net catches in the region and no lake bound or riverine populations have been discovered in the area.
- In the Ninespine Stickleback habitat use section, the wording suggests that they are common during summer and winter months in both marine and freshwaters, but this is not likely. The species is classified as anadromous and does venture into coastal and nearshore marine water during summer but overwinters in freshwater ponds and if available, the lower reaches of rivers. However, none of the rivers in the program area provide brackish interfaces with the sea. Ninespine Stickleback are capable of spawning in both freshwater ponds and in brackish areas.
- The Pink Salmon habitat use section should be modified by deleting the words “...and foraging...”. See related comments on Chum Salmon habitat use above.
- Round Whitefish likely spawn in the program area. Round Whitefish is a freshwater species found only in the Canning River within the program area, and both adults and juveniles are found there. We have not captured them in the coastal lagoons and bays of the area, but they do spawn in the Canning River. They may spawn in the Canning River upstream from the 1002 Area boundary, but if uncertainty is a concern, then the answer should be “probably” as to whether Round Whitefish spawn in the program area.
- The Round Whitefish habitat use section should reflect that Round Whitefish is common in the Canning River throughout the year, but not found elsewhere in the program area.

## Maps

- Page 2-30: Map references aerial observations as coming from “North Slope Eider aerial survey and Arctic Coastal Plain breeding waterbird aerial survey”; however, the point location to the northeast (Beaufort Lagoon) and in the northwest (Brownlow Point) are not within the sampled area of the aerial breeding surveys. Instead, the Brownlow Point observation came from the Common Eider breeding pair survey in 2000 (referenced in Maps 3-15 through 3-20). The eastern point in Map 3-14 (Beaufort Lagoon) is misplaced and should be near Demarcation Point, which is outside of the project area. Please correct the map as appropriate. The map should also indicate that the area in white was not sampled in the aerial breeding pair surveys.
- Page 2-30: The upper panel of each of these maps should be labeled breeding survey, not post-breeding survey. The survey was timed for early incubation of common eiders. Birds observed during this survey may also include non-breeding or failed breeding birds.



## Appendix D. Laws and Regulations

- Page D-3, Section D.2.2: The fourth bullet discusses the ESA. The first part of this paragraph addresses section 7(a)(2), the consultation provision of the ESA. We suggest also inserting the following language which is contained in section 7(a)(1) of the ESA: “The ESA requires federal agencies, in consultation with and with the assistance of the Secretary, to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species.
- Page D-3, Section D.2.2: Bullet 5 addresses MMPA. We suggest adding the following to this paragraph: The USFWS may authorize the incidental take of small numbers of marine mammals of a species or stock only if it can be found that such take will have a negligible impact on a species or stock and will not have an unmitigable adverse impact on the availability of such species or stock for subsistence purposes.
- Page D-4, Section D.2.2: Bullet 2 addresses the Bald and Golden Eagle Protection Act. Please add the following language between the two existing sentences to ensure the full prohibitions of the Act are clear: “The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.”
- Page D-4, Section D.2.2: Bullet 3 addresses the Fish and Wildlife Coordination Act. We recommend replacing the existing language to clearly explain the legal authorities of the act: “The Fish and Wildlife Coordination Act provides one of the basic legal authorities for assessing the impacts on fish and wildlife resources at water resource development projects. Under the FWCA, any public or private agency under federal permit or license to modify or control for any purpose any stream or other water body is required to consult with the Service with the view to the conservation of wildlife resources by preventing loss of and damage to such resources. The term wildlife resources is explicitly defined to include birds, fishes, mammals, and all other classes of wild animals and types of aquatic and land vegetation upon which wildlife is dependent. Further, the FWCA states that reports determining the possible damage to wildlife resources and an estimation of wildlife loss “shall be made an integral part of any report prepared or submitted by any agency with the authority to authorize” water projects (16 U.S.C. 662 (b),(f)).
- Page D-4, Section D.3, Executive Orders: This list should include Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.



## Literature Cited

- Avian Power Line Interaction Committee. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Unpublished report, Edison Electric Institute and APLIC, Washington, DC 2012.
- Barr, J. F., C. Eberl, and J. W. McIntyre. 2000. Red-throated Loon (*Gavia stellata*), version 2.0. In *The Birds of North America* (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.513>
- Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. *Arctic shorebirds in North America: a decade of monitoring*. University of California Press.
- Bayne, E. M., L. Habib, and S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology* 22:1186-1193.
- Becker, M. S., and W. H. Pollard. 2016. Sixty-year legacy of human impacts on a high Arctic ecosystem. *Journal of Applied Ecology* 53(3):876-884.
- Bentzen, R., J. Liebezeit, M. Robards, B. Streever, S. Strindberg, and S. Zack. 2018. Bird Use of Northern Alaska Oilfield Rehabilitation Sites. *Arctic* 71:422-430.
- Bollinger K. S. and R. M. Platte. 2012. Aerial population surveys of common eiders and other waterbirds during the breeding season - Northwest Alaska, 2006–2009. U. S. Fish and Wildlife Service, Fairbanks, Alaska.
- Brown, S., J. Bart, R. B. Lanctot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the Arctic National Wildlife Refuge. *The Condor* 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. *Waterbirds* 35:546-554.
- Chaulk, K. G., and M. L. Mahoney. 2012. Does spring ice cover influence nest initiation date and clutch size in common eiders? *Polar Biology* 35:645-653.
- Church J. A., P. U. Clark, A. Cazenave, J. M. Gregory, S. Jevrejeva, A. Levermann, M. A. Merrifield, G. A. Milne, R. S. Nerem, P. D. Nunn, A. J. Payne, W. T. Pfeffer, D. Stammer, and A. S. Unnikrishnan. 2013: Sea Level Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. In: Stocker, T. F. D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (Editors). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013, pp. 1137-1216.
- Churchwell, R. T. 2015. Stopover ecology of Semipalmated Sandpipers (*Calidris pusilla*) at coastal deltas of the Beaufort Sea, Alaska. University of Alaska Fairbanks, Fairbanks, Alaska.



- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of Beaufort Sea deltas by hatch-year semipalmated sandpipers. *Estuaries and Coasts* 41:280-292.
- Curatolo, J. A., and S.M. Murphy. 1986. The effects of pipelines, roads, and traffic on movements of caribou, *Rangifer tarandus*. *Canadian Field-Naturalist* 100:218 –224.
- Dale, B. C., T. S. Wiens, and L. E. Hamilton. 2009. Abundance of three grassland songbirds in an area of natural gas infill drilling in Alberta, Canada.
- Day, R. H., A. E. Gall, T. C. Morgan, J. R. Rose, J. H. Plissner, P. M. Sanzenbacher, J. D. Fenneman, K. J. Kuletz, and B.H. Watts. 2013. Seabirds new to the Chukchi and Beaufort seas, Alaska: response to a changing climate? *Western Birds* 44, 174–182.
- Devink, J. M. A., H. G. Gilchrist, and A. W. Diamond. 2005. Effects of water salinity on growth and survival of common eider (*Somateria mollissima*) ducklings. *Auk* 122:523-529.
- Dickey, M.-H., G. Gauthier, and M.-C. Cadieux. 2008. Climatic effects on the breeding phenology and reproductive success of an arctic-nesting goose species. *Global Change Biology* 14:1973-1985.
- Divoky G. J. 1978. Breeding bird use of barrier islands in the northern Chukchi and Beaufort seas. Partial Final Report. Environmental Assessment of the Alaskan Continental Shelf, Annual Reports. 1: 482-569
- Esler, D., T. D. Bowman, T. A. Dean, C. E. O'Clair, S. C. Jewett, and L. L. McDonald. 2000. Correlates of harlequin duck densities during winter in Prince William Sound, Alaska. Volume 102. SPIE.
- Flydal K., P. Jordhoy, C. Nellemann, E. Reimers, O. Strand, and I Vistnes. 2002. Rapport fra REIN-posjektet. The Research Council of Norway.
- Frost, G., T. Christopherson, M. T. Jorgenson, A. K. Liljedahl, M. J. Macander, D. A. Walker, and A. F. Wells. 2018. Regional Patterns and Asynchronous Onset of Ice-Wedge Degradation since the Mid-20th Century in Arctic Alaska. *Remote Sensing* 10(8), 1312
- GAO (General Accounting Office). 2002. Alaska's North Slope: requirements for restoring lands after oil production ceases. Washington, D.C.: U.S. General Accounting Office; Resources, Community, and Economics Development GAO/RCED-02-357.
- Gilbert, M. M., and A. D. Chalfoun. 2011. Energy Development Affects Populations of Sagebrush Songbirds in Wyoming. Volume 75. SPIE.
- Guillemette, M., A. Reed, and J. H. Himmelman. 1996. Availability and consumption of food by common eiders wintering in the Gulf of St Lawrence: Evidence of prey depletion. *Canadian Journal of Zoology-Revue Canadienne De Zoologie* 74:32-38.
- Halas, Gabriela. 2015. Caribou migration, subsistence hunting, and user group conflicts in northwest Alaska: a traditional knowledge perspective. University of Alaska Fairbanks, Fairbanks, Alaska.



- Hjort, J., O. Karjalainen, J. Aalto, S. Westermann, V. E. Romanovsky, F. E. Nelson, B. Etzelmuller, and M. Luoto. 2018. Degrading permafrost puts Arctic infrastructure at risk by mid-century. *Nature Communications* 9(1), 5147.
- Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*), version 2.0. In *The Birds of North America* (P.G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.10>
- Humphries, G.R.W. and F. Huettmann. 2014. Putting models to a good use: a rapid assessment of Arctic seabird biodiversity indicates potential conflicts with shipping lanes and human activity. *Diversity and Distributions*, 1–13.
- Jones, B. M., C. D. Arp, M. S. Whitman, D. Nigro, I. Nitze, J. Beaver, A. Gädeke, C. Zuck, A. Liljedahl, R. Daanen, E. Torvinen, S. Fritz, and G. Grosse. 2017. A lake-centric geospatial database to guide research and inform management decisions in an Arctic watershed in northern Alaska experiencing climate and land-use changes. *Ambio*. Volume 46 (7):769-786. DOI:10.1007/s13280-017-0915-9 <https://link.springer.com/article/10.1007/s13280-017-0915-9>
- Jorgenson, M. T., M. Kanevskiy, Y. Shur, J. Grunblatt, C. L. Ping, and G. Michaelson. 2015. *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Jorgenson, M. T., Y. L. Shur, and E. R. Pullman. 2006. Abrupt increase in permafrost degradation in Arctic Alaska. *Geophysical Research Letters*, 33(2).
- Kalyn Bogard, H. J., and S. K. Davis. 2014. Grassland songbirds exhibit variable responses to the proximity and density of natural gas wells. *The Journal of Wildlife Management* 78:471-482.
- Kane, D.I., K. Yoshikawa, J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrology Journal* 21:41-52.
- Kanevskiy, M., Y. Shur, T. Jorgenson, D. R. Brown, N. Moskalenko, J. Brown, D. A. Walker, M. K. Reynolds, and M. Buchhorn. 2017. Degradation and stabilization of ice wedges: Implications for assessing risk of thermokarst in northern Alaska. *Geomorphology*, 297, 20-42.
- Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U. S. Fish and Wildlife Service.
- Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.
- Kendall, S., and C. Villa. 2006. Nesting ecology of tundra-nesting birds at the Canning River Delta, Arctic National Wildlife Refuge, Alaska, June-July 2005. Pages 57 in Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service, Unpublished Report.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). Version 2.0. In *The Birds of North America* (A. F. Poole, and F. B. Gil, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.684>



- Kubelka V., M. Šálek, P. Tomkovich, Z. Végvári, R. P. Freckleton, and T. Székely. 2018. Global pattern of nest predation is disrupted by climate change in shorebirds. *Science* 362: 680-683.
- Kuletz, K. J., M. Renner, E. A. Labunski, and G. L. Hunt. 2014. Changes in the Distribution and Abundance of Albatrosses in the Eastern Bering Sea: 1975-2010. *Deep Sea Research II* 109: 282 – 292.
- Kuletz, K., M. Ferguson, A. Gall, B. Hurley, E. Labunski, and T. Morgan. 2015. Seasonal spatial patterns in seabird and marine mammal distribution in the eastern Chukchi and western Beaufort Seas: Identifying biologically important pelagic areas. *Progress in Oceanography* 136: 175-200.
- Kuletz, K. J. and E. A. Labunski. 2017. Seabird Distribution and Abundance in the Offshore Environment, Final Report. US Dept. of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region. OCS Study BOEM 2017-004. Provided to BOEM by the U.S. Fish and Wildlife Service, 59 pp, plus 400 pages of Appendices. <https://www.boem.gov/2017-004/>
- Larsen, J. K., and M. Guillemette. 2000. Influence of annual variation in food supply on abundance of wintering common eiders *Somateria mollissima*. *Marine Ecology Progress Series* 201:301-309.
- Lehner, N. S. 2012. Arctic fox winter movement and diet in relation to industrial development on Alaska's North Slope. University of Alaska Fairbanks.
- Liebezeit J., E. Rowland, M. Cross, and S. Zack. 2013. Assessing climate change vulnerability of breeding birds in arctic Alaska. a report prepared for the arctic landscape conservation cooperative. Wildlife Conservation Society, North America Program, Bozeman, MT. pp. 167.
- Liljedahl, A. K., J. Boike, R. P. Daanen, A. N. Fedorov, G.V. Frost, G. Grosse, L. D. Hinzman, Y. Iijima, J. C. Jorgenson, N. Matveyeva, M. Necsoiu, M. K. Raynolds, V. E. Ramonovsky, J. Schulla, K. D. Tape, D. A. Walker, C. J. Wilson, H. Yabuki, and D. Zona. 2016. Pan-Arctic ice-wedge degradation in warming permafrost and its influence on tundra hydrology. *Nature Geoscience* 9(4), 312.
- Lintern D. G, R. W. Macdonald, S. M. Solomon, and H. Jakes. 2013. Beaufort Sea storm and resuspension modeling. *Journal of Marine Systems* 127: 14-25.
- Love, O. P., H. G. Gilchrist, S. Descamps, C. A. D. Semeniuk, and J. Bêty. 2010. Pre-laying climatic cues can time reproduction to optimally match offspring hatching and ice conditions in an Arctic marine bird. *Oecologia* 164:277-286.
- Ludlow, S. M., R. M. Brigham, and S. K. Davis. 2015. Oil and natural gas development has mixed effects on the density and reproductive success of grassland songbirds. *The Condor* 117:64-75.
- Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.
- Manville II, A. M. 2005. Bird strike and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science-next steps toward mitigation. Bird Conservation Implementation in the Americas: Proceedings 3<sup>rd</sup> International Partners in Flight Conference 2002, C. J. Ralph and T. D. Rich, Editors. U.S.D.A. Forest Service General Technical Report PSW-GTR-191, Pacific Southwest Research Station, Albany, CA: 1051-1064



Murphy, S. M. 1988. Caribou behavior and movements in the Kuparuk oil field: Implications for energetic and impact analyses. Proceedings of the Third North American Caribou Workshop. Alaska Department of Fish and Game, Juneau, Alaska. Wildlife Technical Bulletin 8:196 – 210.

Murphy, S. M., and J. A. Curatolo. 1987. Activity budgets and movement rates of caribou encountering pipelines, roads, and traffic in northern Alaska. Canadian Journal of Zoology 65:122–128

National Research Council. 2003. Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. Washington, DC: The National Academies Press.  
<https://doi.org/10.17226/10639>.

Pamperin, N. J. 2008. Winter movements of arctic foxes in northern Alaska measured by satellite telemetry. University of Alaska Fairbanks

Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.

Perreault, N., E. Lévesque, D. Fortier, D. Gratton, and L. J. Lamarque. 2017. Remote sensing evaluation of High Arctic wetland depletion following permafrost disturbance by thermo-erosion gully processes. Arctic Science 3:237-253.

Petersen M. R. and P. L. Flint. 2002. Population structure of Pacific common eiders breeding in Alaska. Condor 104: 780-787.

Purdue, J. R., and H. Haines. 1977. Salt Water Tolerance and Water Turnover in the Snowy Plover. The Auk 94:248-255.

Raynolds, M. K., D. A. Walker, K. J. Ambrosius, J. Brown, K. R. Everett, M. Kanevskiy, G. P. Kofinas, V. E. Romanovsky, Y. Shur, and P. J. Webber. 2014. Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global change biology, 20(4), 1211-1224.

Renner, M. and K. J. Kuletz. 2015. A spatial-seasonal analysis of the oiling risk from shipping traffic to seabirds in the Aleutian Archipelago. Marine Pollution Bulletin 101: 127-136.  
<http://dx.doi.org/10.1016/j.marpolbul.2015.11.007>

Rode, K. D., J. W. Olson, D. L. Eggett, D. C. Douglas, G. M. Durner, T. C. Atwood, E. V. Regehr, R. R. Wilson, T. S. Smith, and M. St. Martin. 2018. Den phenology and reproductive success of polar bears in a changing climate. Journal of Mammalogy 99(1):16-26.  
<https://doi.org/10.1093/jmammal/gyx181>

Ryder, J., J. Klaminder, P. Rosen, R. Bindler. 2010. Climate driven release of carbon and mercury from permafrost mires increases mercury loading to sub-arctic lakes. Sci Tot Environ 408:4778-4783

Schuster, P. F., K. M. Schaefer, G. R. Aiken, R. C. Antweiler, J. F. Dewild, J. D. Gryziec, A. Gusmeroli, G. Hugelius, E. Jafarov, D. P. Krabbenhoft, L. Liu, N. Herman-Mercer, C. Mu, D. A. Roth, T. Schaefer, R. G. Striegl, K. P. Wickland, and T. Zhang. 2018. Permafrost stores a globally significant amount of mercury. Geophysical Research Letters 45:1463-1471.



- Smith, L. C., Y. Sheng, G. M. MacDonald, and L. D. Hinzman. 2005. Disappearing Arctic Lakes. *Science* 308:1429-1429.
- Smith, M. A., M. S. Goldman, E. J. Knight, and J. J. Warrenchuk. 2017. *Ecological Atlas of the Bering, Chukchi, and Beaufort Seas*. 2nd edition. Audubon Alaska, Anchorage, AK.
- Smith, M. A., N. J. Walker, C. M. Free, M. J. Kirchhoff, G. S. Drew, N. Warnock, and I. J. Stenhouse. 2014. Identifying marine Important Bird Areas using at-sea survey data. *Biological Conservation* 172:180-189.
- Smith, W. T. and R. D. Cameron. 1983. Responses of caribou to industrial development on Alaska's Arctic Slope. *Acta Zoologica Fennica* 175:43-45.
- Smol, J. P. and M. S. V. Douglas. 2007. Crossing the final ecological threshold in high Arctic ponds. *Proceedings of the National Academy of Sciences* 104:12395-12397.
- Snyder-Conn, E. and M. Lubinski. 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 2. Raw Data. NAES-TR-93-03. 305pp.
- Snyder-Conn, E. and M. Lubinski. 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 3. Quality Assurance / Quality Control Statistics. NAES-TR-93-03. 109pp.
- Stephensen, S.W. and D. B. Irons. 2003. A comparison of colonial breeding seabirds in the eastern Bering Sea and Gulf of Alaska. *Marine Ornithology* 31: 167-173.
- Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. *Arctic* 67:196-202.
- Uher-Koch, B. D. 2017. Satellite telemetry data of red-throated loons (*Gavia stellata*) breeding on the Copper River Delta, Yukon-Kuskokwim Delta, Seward Peninsula, and Arctic Coastal Plain of Alaska, 2000-2011: U.S. Geological Survey data release, <https://doi.org/10.5066/F7TH8KVH>.
- USFWS (U.S. Fish and Wildlife Service). 2014. North Pacific Seabird Colony Database. <http://axiom.seabirds.net/maps/north-pacific-seabirds>. (accessed 08/05/14).
- USFWS (U.S. Fish and Wildlife Service). 2015. Arctic National Wildlife Refuge, Alaska; revised Comprehensive Conservation Plan and Final Environmental Impact Statement. US Fish and Wildlife Service, Anchorage, Alaska, 2015.
- USFWS (U.S. Fish and Wildlife Service). 2017. Alaska seabird die off Fact Sheet, U.S. Fish and Wildlife Service. Available at: [www.fws.gov/alaska/pdf/BeringSea\\_DieOff\\_Info\\_September2017Update.pdf](http://www.fws.gov/alaska/pdf/BeringSea_DieOff_Info_September2017Update.pdf)
- USFWS and BLM (U.S. Fish and Wildlife Service and Bureau of Land Management). 2018. Rapid-response resource assessments and select references for the 1002 area of the Arctic National Wildlife Refuge in anticipation of an oil and gas exploration, leasing and development program, per the Tax Act of 2017, Title II Sec. 20001. Prepared for Alaska Regions of the U.S. Fish and Wildlife Service and Bureau of Land Management, Anchorage, Alaska.



USGS Alaska Science Center, Polar Bear Research Program. 2018. Denning phenology, den substrate, and reproductive success of female polar bears (*Ursus maritimus*) in the southern Beaufort Sea 1986-2013 and the Chukchi Sea 1987-1994: U.S. Geological Survey data release, <https://doi.org/10.5066/F7DF6PC9>.

U.S. Shorebird Conservation Plan Partnership. Shorebirds of conservation concern in the United States of America. 2016. In: Andres B, editor. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2016. 12 pp.

Vermaire J. C, M. F. J. Pisaric, J. R. Thienpont, C. J. C. Mustaphi, S. V. Kokelj, and J. P. Smol. 2013. Arctic climate warming and sea ice declines lead to increased storm surge activity. *Geophysical Research Letters*. 40(7): 1386-1390.

Viereck, L. A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 pp.

Vistnes, I. and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology*, 31(4):399-407.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Volume 71. SPIE.

Walker, D. A., M. T. Jorgenson, M. Kanevskiy, A. K. Liljedahl, M. Nolan, M. K. Reynolds, and M. Sturm. 2019. Likely impacts of proposed 3D-seismic surveys to the terrain, permafrost, hydrology, and vegetation in the 1002 Area, Arctic National Wildlife Refuge, Alaska. Alaska Geobotany Center Publication AGC 19-01. University of Alaska Fairbanks, Fairbanks, Alaska, USA.

Wauchope, H. S., J. D. Shaw, Ø. Varpe, E. G. Lappo, D. Boertmann, R. B. Lanctot, and R. A. Fuller. 2017. Rapid climate-driven loss of breeding habitat for Arctic migratory birds. *Global Change Biology* 23:1085-1094.

Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.





**To:** Wendy Loya[wendy\_loya@fws.gov]  
**From:** Siekaniec, Greg  
**Sent:** 2019-03-11T13:53:27-04:00  
**Importance:** Normal  
**Subject:** Draft EIS comments  
**Received:** 2019-03-11T13:54:16-04:00  
[DRAFT\\_USFWS Comments and Cover Letter to BLM\\_Coastal Plain DEIS\\_20180301\(gs4\).docx](#)

After all the iterations this is what Andrea is looking at and has a couple of questions.  
please join me in my office at 1:45 today.

thank you,

greg





# United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE

1011 East Tudor Road

Anchorage, Alaska 99503-6199



IN REPLY REFER TO:

FWS/R7/FES

## Memorandum

To: Nicole Hayes, Bureau of Land Management, Project Manager Coastal Plain Oil and Gas Leasing Program EIS

From: Greg Siekaniec, U.S. Fish and Wildlife Service, Alaska Regional Director

Subject: Comments on the 2018 Draft Environmental Impact Statement (DEIS) for the Coastal Plain Oil and Gas Leasing Program for the Arctic National Wildlife Refuge, Alaska

The U.S. Fish and Wildlife Service (Service) appreciates the opportunity to review the Bureau of Land Management's (BLM) DEIS for the proposed Coastal Plain Oil and Gas Leasing Program in the Arctic National Wildlife Refuge (Arctic Refuge) for which we are a cooperating agency pursuant to the National Environmental Policy Act (NEPA).

Our comments and recommendations are provided in accordance with the NEPA, Alaska National Interest Lands Conservation Act (ANILCA), National Wildlife Refuge System Administration Act as amended by the National Wildlife Refuge System Improvement Act, Endangered Species Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Fish and Wildlife Coordination Act, Wild and Scenic Rivers Act, and Public Land Order 2214.

For the last year, we have worked with the BLM on development of alternatives to help ensure that all purposes of the Arctic Refuge as outlined in the Public Land Order and ANILCA, as currently amended, are met. The ANILCA purposes are:

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, the Porcupine caribou herd (including participation in coordinated ecological studies and management of this herd and the Western Arctic caribou herd), polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, snow geese, peregrine falcons and other migratory birds and Arctic Char and Grayling;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents;



(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.”; and

(v) to provide for an oil and gas program on the Coastal Plain

The Tax Act of 2017 added the fifth purpose for the Arctic Refuge, and the DEIS examines alternatives for implementing that purpose. The Service is required to manage refuge lands and waters in a way that is consistent with all purposes. To meet this requirement, the consistency of all Alternatives with the other purposes of the Arctic Refuge is important. We believe the DEIS can be improved by a more explicit analysis and comparison of the impact of the alternatives on the achievement of each of the purposes of Arctic Refuge.

Alternative D2 contains the primary elements put forth by the Service during the alternatives workshop for cooperating agencies, and is our preferred alternative for meeting all of the purposes of the Arctic Refuge and best preserving the wilderness characteristics provided for in ANILCA. Alternative D2 also helps ensure management interests and requirements to maintain river values (free flow, water quality, outstandingly remarkable values) and preliminary river classifications of river corridors determined to be suitable additions to the National Wild and Scenic River System (NWSRS) in this area are maintained. Additionally, Alternative D2 is also the most consistent with the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA) and bilateral and international agreements. The modifications recommended in the attachment include specific stipulations (Stips) and Required operating Procedures (ROPs) that help improve upon the work that has already been done.

In order to aid the BLM’s NEPA review process, we provide comments and recommendations that are more detailed in the Attachment. Please accept these review comments in the spirit of improvement. Our comments are organized into three sections:

- Section 1: General Comments;
- Section 2: Comments on Proposed Stipulations and ROPs; and
- Section 3: Specific Comments.

Thank you for your continued coordination. We appreciate and value our cooperating agency status on this project, as the Service has managed the Arctic National Wildlife Refuge and its resources for several decades and has information and expertise that is valuable in formulating a final EIS that can withstand the scrutiny of legal sufficiency. For questions regarding these recommendations please contact our Arctic Science Program Coordinator Dr. Wendy Loya at the Anchorage Regional Office at 907-786-3532 or via e-mail at [wendy\\_loya@fws.gov](mailto:wendy_loya@fws.gov).

Attachment



# **U.S. Fish and Wildlife Service Cooperating Agency Review, Arctic National Wildlife Coastal Plain Oil and Gas Leasing Program Draft Environmental Impact Statement**

## **Section 1: General Comments**

Many issues identified during scoping have been included in the Draft Environmental Impact Statement (Draft EIS or DEIS), which improves the analysis of potential resource impacts. However, there are several aspects of the analysis that with additional attention can help ensure the adequacy of the final Environmental Impact Statement (EIS). Our key general concerns for the project are described below:

- As the land and surface estate manager, the Service would like to be considered as a co-lead in implementing the oil and gas program given these activities may affect the resources managed by the USFWS Arctic National Wildlife Refuge. We recommend that relationship be defined in Section 1.7 and throughout Section 2. While there is a statement describing the coordinating relationship between BLM and FWS at the bottom of Table 2-2 on page 2-4, we believe this consensus warrants being included in the text. The table should be revised where it states that exceptions could be made by the Authorized Officer to indicate that exceptions would be made by consensus of the BLM Authorizing Officer and the USFWS designated Officer.
- Given the overlap of potential lease blocks and polar bear denning habitat, we recommend ensuring that surveys of polar bear denning habitat are required under all alternatives and development scenarios. We also emphasize that it would be important to ensure that all potential lessees are aware that they will have to consider the need to avoid disturbance of denning polar bears when they consider the temporal and spatial aspects of their operations. The impact of those temporal and spatial considerations on their operations will depend on the degree of overlap of specific lease blocks with denning habitat and the location of detected dens in any given year.
- The analysis and area estimates for 3-D seismic used in the Reasonably Foreseeable Development Scenario are now based on the incorrect assumption that area-wide seismic would occur prior to the Record of Decision. This affects the impact analysis throughout the document. Further, the analysis evaluates the assumption that only about 35% of the project area (900 sq. miles) will be surveyed using 3-D seismic. This estimate originates from typical 3-D survey operations in the NPR-A. However, it is unlikely these efforts are comparable with proposed seismic plans in the project area. For example, Walker et. al (2019) assumed the entire project area would be explored and estimated a total of 37,800 miles of seismic lines could impact an estimated 235 sq. miles with long-term impacts. The document mentions that seismic exploration will be further detailed in the seismic Environmental Analysis, but the assumed timing presented in Table B-3 is highly uncertain. Details and analysis regarding seismic exploration in the program area should be evaluated and revised in this document.
- The Introduction, Overview, states that the issuance of an oil and gas lease does not have any direct effects on the environment since it does not authorize drilling, or any other ground disturbing activities; however, a lease does grant the lessee certain rights to drill for and extract oil and gas subject to reasonable regulation, including applicable laws, terms, conditions and stipulations of the lease. Given our recent experience examining a proposal to conduct seismic operations in the 1002 Coastal Plain, we believe it is important that lessees understand that there may need to be significant temporal and spatial conditions placed on activities that overlap in time and space with polar bear denning habitat. Such conditions are necessary to ensure compliance with the ESA and MMPA. We believe this information should influence BLM's decision of which tracts of land should be offered



for lease and the terms and conditions to be applied to such leases and subsequent authorizations for oil and gas activities.

- USGS (Attanasi 2005) resource assessment of the 1002 Area delineates a high and low resource potential area. According to the values from the USGS reproduced in the Draft EIS as Appendix B Table B-1, the highest probability oil resource is believed to be in the Topset Play, accounting for a mean of 4.325 BBO of Oil, or nearly 67% of the mean total undiscovered oil in the refuge and about 34% of the gas. The next highest potential is believed to be the Turbidite Play, with approximately 20% of the mean estimated oil and 32% of the gas. Thus, these two formations should be made as fully available for leasing to meet the requirement of the Tax Act that no less than 400,000 acres be made available through 2 lease sales in the next 8 years. The Draft EIS goes beyond the USGS assessment to identify the Thin-Skinned Thrust Belt Play as an area of moderate oil potential, potentially accounting for 13% of the total mean undiscovered oil resources (7.687 BBO in total when the estimated mean resources in the Undeformed Area are combined with estimated mean resources in the Deformed Area; see Tables B-1 and B-2). This play, which the DEIS describes as “Alaska Native allotment lands and Alaska Native lands that are patented or interim conveyed” (page B-1) does not therefore meet the criteria of the highest resource potential, and should only be made available outside of the program area.
- The DEIS could better address strategies to prevent introduction and spread of invasive species. To address invasive terrestrial plants, the Required Operating Procedures (ROPs) should recognize the use of, and include additional information about, certified weed-free gravel and supplies for road corridor construction and pipeline construction. Additionally, the document does not adequately address the threat of introduced aquatic invasive species (e.g., Elodea), invasive terrestrial invertebrates, or invasive terrestrial vertebrates (e.g., rodents). The DEIS should also describe how the proponent will respond to an introduction of nonnative species.
- We recommend adding a ROP under all alternatives the requirement for development of spill response plans. This is currently only found under Stipulation 4, Alternative D, Standard iv. Our recommended standard/requirement is as follows: Operators would be responsible for developing comprehensive spill prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans as well as to maintain adequate oil spill response capability to effectively respond during periods of ice, broken ice, or open water. Plans should be based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM and USFWS.
- The effects of a changing arctic environment should be further addressed within the EIS. There is a large body of literature that describes the potential landscape level changes on the North Slope, including changes in permafrost, hydrology, land cover and infrastructure stability. For example, a recent study by Hjort et al. 2018 indicates that the effects of permafrost melt will be an engineering hazard to infrastructure by mid-century. Additionally, there are specific effects related to environmental change such as ice wedge degradation leading to subsidence and changes in hydrology, snow accumulation and plant communities (Jorgenson, M. T., Shur, Y. L., & Pullman, E. R. 2006; Raynolds et al. 2014). Effects of these changes have been shown to be more severe in areas with topographic complexity such as the 1002 coastal plain (Liljedahl et al. 2016). We recommend that studies like these be included in the analysis of potential impacts to various development scenarios. Additional information on this topic can also be found in Jorgenson et al. 2016, Frost et al. 2018 and Kanevskiy et al. 2017.



- The Reasonably Foreseeable Development Scenario and associated analyses used in alternatives development does not provide any differentiation between jobs creation, employment income, revenue to communities or government entities, or recovery/production of oil and gas resources. As such, the assumption is that these factors are held constant regardless of the alternative selected. Therefore, the BLM should primarily base their decision on the differing environmental consequences identified in the analyses under the action alternatives. The Service's preference for Alternative D2 as the Environmentally Preferred Alternative is supported by the analyses provided in the DEIS.
- The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be eligible and suitable for inclusion in the National Wild and Scenic River System, as noted in the DEIS. All Stipulations and ROPs should strive to not affect the Wild and Scenic characteristics and values of these rivers. We have noted specific suggestions in the following sections.
- Because of the complexity and length of NEPA documents, we recommend including information referred to in other NEPA documents (e.g. Greater Mooses Tooth-2 FEIS, National Petroleum Reserve Area (NPRA) Integrated Activity Plan/EIS) in the appendices so that when information found within these documents is used or referenced within the EIS, it is easily accessible. We also suggest that all references to other regulatory documents include chapter or page numbers to guide the reader to the appropriate information.
- Throughout the DEIS there are requirements that applicants will need to fulfill to monitor, assess, and evaluate the effects of development activities on the resources of the Arctic Refuge. In all of these instances, the data and analysis information should be provided to the USFWS and BLM for their records. Data should be provided in electronic format and be accompanied by complete metadata and information about collection and analysis methodology.
- Arctic Refuge Special Use Permits authorize private businesses to operate commercial hunting, fishing, recreation, polar bear viewing, and general visitor access to the 1002 coastal plain area. All alternatives should address impacts to the operations of these private businesses and their continued viability.



## Section 2: Comments on Stipulations and ROPs

### Stipulation 1: Rivers and Streams

- The Marsh Fork-Canning and Hulahula Rivers were found to be eligible and suitable for inclusion in the National Wild and Scenic River System, as noted in the DEIS. We recommended that river setbacks be used to meet the objectives stated in Stipulation 1, which include the other Refuge purposes. Alternative D reflects the FWS recommended minimum of 0.5 mi setback for all identified rivers. Larger setbacks are identified for larger rivers and are necessary and appropriate to protect Wild and Scenic River values. Overlaying river setbacks on the viewshed study submitted by TrueNorth GIS suggests that Alternative D would condition approximately 25% more land with NSO than the other alternatives, better protecting the species, habitats and activities identified in the Refuge purposes while allowing for oil and gas development through subsurface leasing. We recommend that all rivers have minimum setbacks of 0.5 mi under Alternatives B and C, except for spring-fed rivers, which should have minimum setbacks of 1 mile. We believe this change is necessary to ensure that Alternatives B and C are compatible with the purposes of the Arctic Refuge as stated in ANILCA.
- Given the high use of the Coastal Plain for denning by polar bears, especially when compared to the rest of northern Alaska, ensuring bears have access to preferred areas of denning habitat is important. This is highlighted by the fact that terrestrial denning is likely to continue increasing as sea ice conditions deteriorate further in future years. While Alternatives B and C provide some protection of high use polar bear denning habitat under Lease Stipulation 1, there are large areas where numerous polar bears dens have been recorded (Map 3-24) that do not have restrictions on surface occupancy under these alternatives. Even if surveys were conducted under MMPA Incidental Take Regulations with the intention of reducing the potential to disturb denning bears in those areas, Incidental Take Regulations (and hence Stipulation 5 for Alts B and C) would offer no protections against behavioral avoidance of those areas once developed. This could effectively lead to a loss of preferred denning habitat. Stipulation 1 under Alternative D protects a much broader area of important, and highly used denning habitat than the other alternatives, especially in the central portion of the Coastal Plain. We believe application of this Stipulation across alternatives B and C would be more consistent with all of the purposes of the Arctic Refuge, the MMPA and BLM's responsibility under Section 7(a)(1) of the ESA.
- We recommend that appropriate Stipulations and ROPs to minimize impacts to Wild and Scenic River characteristics (e.g., maintaining water quality, free-flowing condition, identified ORVs, and wild classifications) be applied whenever activities may affect a river's Wild and Scenic River characteristics.
- Requirement/standard(s) should be added that prohibits infrastructure within maximum perceptible visible distances (e.g: how far an individual person would be able to see from any place inside a river buffer); or above heights that an individual person (spatially) is likely to be able see. Additional analysis should be completed to determine the area extent of the infrastructure prohibitions/height limitations.
- Analysis by Service staff, using available viewshed information conducted by True North GIS and submitted to the BLM for consideration in the DEIS, shows most infrastructure with a maximum of 15m height would be visible if built within any of the setbacks for the six rivers as described currently in Alternatives B-D. Our analysis shows Alternative D (with approximately 750 km of the Coastal Plain protected by NSO setbacks on the six named rivers) provides complete viewshed protections for just under 12% of the project area (where infrastructure of any height would otherwise be visible from the rivers). Further, an additional 23% of the viewsheds from these six



river corridors are protected when infrastructure is modeled to be at or below 15m in height, as specified in Alternative D. (see personal communication Paul Leonard, “Re-analysis of Viewshed Modelling for the Arctic Refuge’s Coastal Plain Major Rivers.”)

- Protecting natural quiet (as well as natural sounds and noise) is inherent to preserving river values for suitable rivers classified as wild and possessing recreational and cultural ORVs. We recommend that Requirement/Standard(s) should be added across alternatives B-D that provides acoustic protections for natural quiet from within suitable river corridors.
- We recommend adding a Requirement/Standard(s) under Oil and Gas Field Abandonment, across alternatives B-D that specifies before final abandonment, if a suitable river corridor’s eligibility characteristics have been impacted by leasing and production activities, all eligibility findings and suitability factors as specified in the Arctic Refuge wild and scenic river review should be restored to a point where the area is again qualified for inclusion in the NWSRS.
- We recommend adding an additional Requirement/Standard(s) that reads: Before activities affecting suitable NWSRS river corridors can occur, collection of baseline data that documents current suitable river characteristics will be completed as prescribed by the Authorizing Officer and in consensus with the USFWS as the surface management agency. This information will be used to monitor impacts, detect when NWSRS values are threatened, and identify needs for changes in practices. The lessee is to provide support for these efforts to help monitor and analyze effects on suitable river values and wild classification.
- The Requirement/Standard(s) should be designed to specifically maintain characteristics of the recreation and scenic ORVs for the Kongakut River, even though it is outside the project area. GIS modeling should be completed to determine whether/to what extent a setback within the eastern boundary of the project area would be needed to maintain viewshed characteristics of the scenic ORV for the Kongakut River.
- Lease Stipulation #1: Alternatives B-D prohibit permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines) within certain river corridors; and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. We recommend changing requirement/standard wording for Canning and HulaHula rivers under all alternatives to include the following language: “(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances to protect Wild and Scenic River characteristics.” Alternatives B-D seek to “minimize the disruption of free flow” but language should specify that *maintaining* free flow is required to meet Service interim management requirements for suitable rivers.
- Preservation of recreational hunting, fishing, hiking and boating values and opportunities is an original purpose of the Arctic Refuge, and the majority of visitors recreate within the project area. In order to meet the original purpose of this area, an objective for Alternatives B and C should be to minimize impacts on recreation.
- The Canning, Marsh Fork-Canning (main tributary of the Canning), Hulahula, and Kongakut Rivers are highly valued and/or used by the public for recreation. The objective of this stipulation should develop a ROP identifying how Recreational Outstandingly Remarkable Values as described for the Marsh Fork-Canning, Hulahula and Kongakut Rivers shall be maintained, consistent with USFWS interim management prescriptions for suitable rivers.



- We recommend deleting the last sentence in the objective “Protect the water quality, quantity....across the coastal plain”, and include “springs and aufeis” in the first sentence following “riparian areas”.
- While Sadlerochit Springs appears to be within the Sadlerochit River, it is actually west of the Sadlerochit River and is a tributary to the Itkilyariak River. We recommend that Sadlerochit Springs and Creek, and Itkilyariak Creek-complex have a 3-mile setback in all alternatives in Leasing Stipulation 1 due to its cultural significance and unique terrestrial and aquatic communities. The Sadlerochit Spring Creek and Itkilyariak Creek complex have a unique endemic population of dwarf Dolly Varden and is an important subsistence use area. For more information see Arctic Refuge CCP (2015).
- To meet the objective for Stipulation 1 and meet the other identified Refuge purposes, gravel mining sites should not be allowed in areas designated No Surface Occupancy.
- It is difficult to address the adequacy of a standard that allows case-by-case approvals for development in nearshore waters when the objective is to protect habitat. The standard's adequacy will remain unknown until we know more about what will be approved and how those developments will fare over time. The standard states "exploratory drill pads, production pads, or CPFs are not allowed unless they're approved" which imparts significant subjectivity. We recommend the EIS provide additional clarity on how case-by-case approvals may occur and how they will be decided. Additionally, we recommend including a requirement that approvals will be reached by consensus between the BLM Administrative Officer and an authorized Service representative.

## **Stipulation 2: Canning River Delta and Lakes**

- Water resources in the Canning River Delta, including lakes, represent some of the highest quality wetland habitat within the Refuge. Unlike the coastal plain ecosystems to the west of the Refuge, the Refuge Coastal Plain has considerably fewer lakes. Therefore, lakes in the Canning River delta provide important habitat for fish and waterbirds that is not widespread in the project area. Protection of these habitats from disturbance is required to conserve fish and wildlife populations and habitats in their natural diversity and ensure water quality and quantity within the refuge is maintained. We previously recommended No Surface Occupancy be allowed in this area except for essential infrastructure approved by the BLM and with consensus from the Service. This requirement is currently supported in Alternative D, and should be applied to alternatives B and C to help maintain the other ANILCA purposes of the Refuge.

## **Stipulation 3: Springs/Aufeis**

- We recommend adding NSO buffers and no lease setbacks described in Alternative D to all alternatives as Alternatives B and C may not meet the other purposes of the refuge without this requirement. Rivers in the Arctic Refuge with perennial springs support fish during the harsh winters, and rivers without springs have no fish. All Arctic Grayling and Dolly Varden are major subsistence resources in the Arctic Refuge, and their survival depends on approximately twenty springs found within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations, requiring special recognition. Subsurface flow paths to perennial springs are unknown and could potentially be disturbed by drilling or fracking activity. This universal stipulation is needed to ensure that these important and unique habitats and water resources are protected per ANILCA purposes of the Refuge, while accounting for uncertainty regarding sources and flowpaths of groundwater in the Coastal Plain.



- Specific protective setback distances from springs and aufeis should exist, but not be defined until studies of spring flows and sources are completed, as flow to springs may originate outside of a 3-mile setback. Flows to springs likely traverse or originate in groundwater beneath permafrost; this groundwater is identified as the recipient water body for potentially toxic drilling wastes via injection wells. Studies of springwater flows, including sources, should accurately identify and delineate surface water and groundwater flow to and from springs; these flow patterns may be linear (channels) or large areas (aquifers) that require differently shaped buffers. Delineating specific protective buffers prior to these studies are completed may result in buffers that are insufficient to protect these important aquatic habitats. To help ensure the other purposes of the refuge are met, we recommend that the Requirement/Standard for Stipulation 3 be changed under all alternatives to: “Before exploratory or production drilling, the lessee/operator/owner would conduct studies to ensure drilling would not disrupt flow to or from, and waste injection wells will not contaminate any perennial springs. Study plans would be developed in consultation with the BLM, USFWS, and other agencies, as appropriate.” Under all alternatives, the following phrase should be added after all delineated buffers referring to “above” springs: “or to a distance that sufficiently protects groundwater sources and flows of (the named spring), whichever is greater.”

**Stipulation 4: Nearshore Marine, Lagoon, and Barrier Island Habitats of the Southern Beaufort Sea within the Boundary of the Arctic Refuge (Map 2-2 and Map 2-4)**

- Due to the abundance, diversity and accessibility of subsistence resources in the nearshore area, this zone is a significant subsistence hunting area. Alternative D requirements to coordinate with local users represents best-practices developed for NPRA and the Chukchi Sea leasing programs and should be applied consistently when subsistence resources may be impacted.
- As polar bear use of the onshore environment increases in summer/autumn due to sea ice loss, it will become increasingly important to reduce human-polar bear conflict, ultimately leading to reductions in polar bears killed in defense of life. While all alternatives provide good protections for polar bears on barrier islands, Alternatives B and C are insufficient to minimize human/bear conflict when bears are active on the mainland coast. Bears move up and down the coastline during summer and autumn as they search for beach-cast marine mammal carcasses or subsistence whale remains. As such, the coastline provides an important movement corridor and habitat for resting for bears during summer and autumn. Alternatives B and C do not provide temporal restrictions on activities which could lead to unnecessary conflict with polar bears. Alternative D restricts activities in this area to the time of year when polar bears are less likely to be moving along the coast, thus providing a good mechanism for reducing conflicts, and potential lethal removal of bears. We recommend that the requirements/standards from D be applied across all alternatives to ensure requirements of the MMPA and ESA are met.
- We recommend altering the Objective in this stipulation to better describe the diversity of avian species. ‘Waterfowl’ is used, but should be ‘waterbirds’, and include ‘sea birds and larids’, since larids and seabirds are not covered by definition of ‘waterbirds’ on p. 3-86, or in Table J-9. Please change to “Objective: Protect fish and wildlife habitat, including that for waterbirds, larids, sea birds, and shorebirds, caribou insect relief”

**Lease Stipulation 5: Coastal Polar Bear Denning River Habitat**

- Alternatives B and C do not provide protections for the possible behavioral avoidance of important polar bear denning habitat even with a small development footprint. Alternative D allows polar bears unhindered access to large areas of their preferred denning areas in the Coastal Plain. This will become increasingly important as the density of land-based dens increases in future years due to sea



ice loss. We recommend that the requirements/standards from Alternative D be applied to Alternatives B and C. This would be most consistent with the Refuge purposes as outlined in ANILCA, the ESA and the MMPA.

- The language in Alternative D, Requirements/Standard subparts (a) and (b) allow the BLM Authorizing Officer to approve alternative protective measures. We recommend any such approvals be granted only in the case of consensus by the Service, given the need to ensure compliance with the ESA and MMPA.
- Changes in denning and/or disturbance should be monitored and evaluated over time. We recommend adding a requirement that a study of a minimum of 5 years be conducted to detect polar bear dens in all active lease blocks that overlap with polar bear designated critical habitat. If changes and/or disturbance are identified, then corrective measures may be applied.

#### **Lease Stipulation 6: Caribou Summer Habitat**

- As shown in Maps 3-21 and 3-22, the entire Coastal Plain of the Refuge is high value caribou calving and/or insect relief habitat used by the Porcupine and Central Arctic herds. Female caribou with calves are sensitive to disturbance during the summer periods when they inhabit the coastal plain. We recommended timing limitations described under Alternative D in order to minimize impacts on this internationally important herd and subsistence resource. Importantly, Alternative D2 allows for exceptions to the timing limitations if approved by the Authorized Officer in consensus with the Service as the surface management agency, to account for variability in herd distribution. Recognizing the uncertainty about how much development will occur when and where, Alternative D2 provides managers with the ability to regulate development activity if needed.
- Recommend ROP be revised as: “Objective: Reduce disturbance of caribou and hindrance or alteration of caribou movements during periods when caribou are sensitive to disturbance.”
- Recommend that the monitoring plan required in Requirement/Standard “g.” in ROP 23 be expanded beyond vehicle use management to all potential activities that may disrupt caribou, and that allows for adaptive management to ensure ROP 23 is effective.

#### **Lease Stipulation 7: Porcupine Caribou Primary Calving Habitat Area (Map 2-2)**

- A significant number of scoping comments called for protection of the Porcupine Caribou herd calving grounds, as has been done for the Teshekpuk and Western Arctic herds in NPRA. In the absence of delineated Special Areas identified for NPRA, the Draft EIS uses high density calving habitat to delineate the area where disturbance should be minimized during calving. Requirements found in Alternative D are designed to minimize impacts on caribou and their calves and protect the spring and fall primary migration corridor for the entire herd. The No Leasing restrictions occur in the area of lowest resource potential, while still allowing sufficient acreage to meet the requirements of PL 115-97. The timing limitations under Alternative B to minimize construction activity during the calving period would only be effective during the 1-2 years of an individual well pad construction, but would not minimize disturbance during exploration or during 30+ years of operations. Alternative C would allow for exploration, which includes disturbance during summer for studies, “stick-picking” and other activities.
- Recommend that the “Note” in this section be reworded as: “For the purposes of this document, the Porcupine Caribou Herd (PCH) primary calving habitat area was defined as the area with a higher-than-average density of cows about to give birth during more than 40 percent of the years surveyed.



It is recognized that locations of important calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”

- Recommend revision of the Objective for this stipulation to: “Reduce the possibility of disturbance of caribou or hindrance or alteration of their movements in the south-southeast portion of the Coastal Plain, which has been identified as important caribou calving habitat during many years.”
- Recommend that the monitoring plan required in Requirement/Standard “a.i.” be expanded beyond vehicle use management to all potential activities that may disrupt caribou, and that allows for adaptive management to ensure Lease Stipulation 7 is effective.

#### **Lease Stipulation 8: Porcupine Caribou Post-Calving Habitat Area**

- Because of the level of activity, noise and larger footprint associated with Central Processing Facilities, we recommended that they be prohibited from the lands identified as calving and post-calving habitat in Maps 3-22 and 3-23 for the PCH and Central Arctic Herd (CAH), as described in Alternative D. The footprint limits recommended in Alternative D are intended to avoid high-density infrastructure in this area and ensure that caribou can move freely and undisturbed through the area per the requirements of ROP 23.
- Recommend revision: “Note: For the purposes of this document, the PCH post-calving area was defined as the area with a higher-than-average density of cows during the post-calving period for more than 40 percent of the years studied. This includes and extends beyond the primary calving area. It is recognized that locations of important post-calving areas may shift over time; thus, this definition will require continued assessment and possible revision.”
- Recommend the following revision of the Objective for this stipulation: “To protect key surface resources and subsistence resources/activities from disturbance resulting from permanent oil and gas development and associated activities in areas used by caribou during post-calving and insect-relief periods.”

#### **Lease Stipulation 9: Coastal Area (Map 2-2)**

- Recommend revising the Requirement Standard under Alternative B as follows:  
“...lessee/operator/contractor would develop and implement a *Service-approved Polar Bear* impact and conflict avoidance and monitoring plan.”
- While an impact and conflict avoidance plan as identified in Requirement/Standard of Alternative B would help reduce conflict with polar bears, it is an insufficient protection for bears on shore in summer and autumn for the following reasons:
  - It would not account for the potential behavioral avoidance of polar bears seeking maternal denning habitat.
  - While polar bears have been observed traversing oil facilities along the coast during summer/autumn, by not restricting infrastructure along the coast, there is an increased risk of human-polar bear conflict that could lead to more bears being killed in defense of life, or that come into contact with hazardous materials.

We are concerned that under Alternative B we could not successfully manage human-polar bear conflicts and ensure compliance with the MMPA and ESA, as Alternative B does not provide sufficient protections for polar bear coastal habitat. Alternative C begins to make meaningful progress towards minimizing effects to coastal denning habitat and reducing the probability of



human-polar bear conflict. However, we recommend the protections for polar bears and their habitat as outlined in Alternative D be adopted to help ensure compliance with MMPA and ESA.

#### **Lease Stipulation 10: Wilderness Boundary**

- We recommend that a setback be stipulated in order to protect wilderness values of the Mollie Beattie Wilderness Area from visual and acoustic disturbance associated with oil and gas exploration and development. The NSO setback should be based off viewshed and soundscape analysis. Lacking these data during alternative development, we recommended a 3 mile buffer to provide a degree of protection, and thus support Alternative D or a variation as refined by further viewshed and soundscape modeling.

#### **ROP 1:**

- To meet all purposes of the Refuge, the Requirement/Standard for this ROP should read: “Areas of operation would be left clean of all debris, residual soil contamination, surface water contamination, and groundwater contamination where groundwater is hydrologically connected to springs.”

#### **ROP 2:**

- Recommend adjusting the wording in the Requirement /Standard as follows:
  - The plan would be submitted to the BLM Authorized Officer ~~for approval~~, in consultation with federal, State, and NSB regulatory and resource agencies *for approval*, as appropriate.
  - b. Lessees/operators/contractors would have *an approved* a written procedure.
  - c. To protect the water quality standard inherent to the wild river classification, add: “i. within setbacks for all suitable rivers, no pumpable, solid, liquid, and sludge waste shall be disposed of by injection (as is the standard elsewhere). Rather, ADEC approved storage for backhaul shall be the standard method for disposal of pumpable waste products.”
- Under disposal of rotting waste (b), recommend requiring exclusionary devices (e.g., grating, mesh, fence) be installed at all incineration sites to preclude access by wildlife.

#### **ROP 3:**

- Recommended revision: The BLM Authorized Officer may allow storage and operations at areas closer than the stated distances if properly designed *and contained* to account for local hydrologic conditions.
- Under all alternatives, recommend adding language to the Requirement/Standard that requires secondary containment and spill response equipment for all fuel equipment and caches.
- For Alternatives B-D: To protect the water quality standard inherent to the wild river classification, recommend inserting a Requirement/Standard specific to suitable rivers: “Refueling equipment within setbacks for all suitable rivers is prohibited. Fuel storage stations would be located outside the setbacks except for small caches (up to 210 gallons) for motor boats, float planes, and ski planes, and for small equipment such as portable generators and water pumps, which would be located at least 100 feet from the active floodplain of suitable rivers.”



#### **ROP 5:**

- The Requirements/Standard section under ROP 6 should be moved in its entirety to ROP 5 and added to the current ROP 5 Requirement/Standard.

#### **ROP 6:**

- Consistent with the mandate for habitat protection within the project area(s), environmental damage and unnecessary or undue degradation of the lands should be avoided and minimized to the greatest extent practicable, including that which may be caused by vehicular traffic.
- Paragraphs “b.” and “e.”: In order to determine air impacts to the Arctic National Wildlife Refuge, we recommend adding “and Class II” after Class I areas.
- Paragraph “g.”: Ambient monitoring data can be used to determine impacts to Air Quality Related Values (AQRVs). This paragraph should include the following language: “or shows impacts above specific levels of concern for AQRVs”.

#### **ROP 8:**

- This Requirement/Standard as currently worded does not meet the stated Objective or ANILCA purposes for the refuge. We recommend editing the objective to read: “In flowing waters (rivers, streams and springs) ensure water of sufficient quality and quantity to conserve fish, waterbirds, and wildlife populations and habitats in their natural diversity.”
- We recommend the Requirement/Standard be edited to read:
  - a. Withdrawal of unfrozen water from springs, rivers and streams during winter (onset of freeze-up to break-up) is prohibited. The removal of ice aggregate from grounded areas 4 feet deep or less may be authorized from rivers on a site-specific basis.
  - b. Water withdrawal is prohibited year round from the following rivers, streams and springs: Canning, Hulahula, and Sadlerochit rivers including Itkilyariak Creek, a tributary of the Sadlerochit River that drains the Sadlerochit Spring, and perennial springs on the Tamayariak, Sadlerochit (the spring is located just west of the main stem in a tributary of the Sadlerochit River), Fishhole 1 Spring on the Hulahula River, and the perennial spring on the Okerokovik River, which is a tributary to the Jago River.
  - c. Water withdrawal from other rivers and streams, outside of the winter, may be approved by the BLM Authorized Officer, in consensus with the Service, with adequate protection of hydrologic regimes, water quality and fish and wildlife habitats and populations.”
- We recommend the ROP identify who will monitor these requirements/standards and how the operator will determine the best approach to achieve required percentages and depths.

#### **ROP 9:**

- Recommend providing additional explanation in the body of the document as to how water withdrawal amounts were determined within the Requirement/Standard and whether these withdrawal amounts ensure water volumes will remain sufficient to support fish communities found within the affected water bodies.
- We recommend adding the following requirement to this ROP as it currently does not contain requirements for determining fish presence prior to activities that could impact fish: “Sensitive and



non-sensitive fish species will be assumed to be present until surveys with 95% detection probability have been conducted during the appropriate seasons.”

- We recommend adding the phrase “connectivity to adjacent bird nesting sites” under the Requirement/Standard. Additionally, we recommend changing the rest of the Requirement/Standard to read: “Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas 4 feet deep or less during winter and withdrawal of water from lakes during the summer may be authorized on a site-specific basis, depending on water volume and depth, the fish community, and connectivity to other lakes or streams and adjacent bird nesting sites.”
- Under Alternative D: This ROP is applicable to all birds. Please change “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds” to “Additional modeling and monitoring of lake recharge may be required to ensure natural hydrologic regime, water quality, and aquatic habitat for birds.”

#### **ROP 10:**

- This ROP currently states that these restrictions do not apply to the use of equipment on ice roads after they are constructed. This is inconsistent with the language below and also with standards promulgated in ITRs for polar bears. If an ice road is constructed and a polar bear den is later detected within 1 mile of it, industry will likely have to reroute the road. While it is true that ITRs will likely have requirements about detecting dens, this ROP does not provide enough detail on how dens will be detected. Without a survey, there would be no known dens, and therefore no need to modify activity. Section b under Alternative D should be included in Alternatives B and C as well, given there is a requirement that all known dens be avoided and surveys are necessary to locate dens.
- Recommend modifying the date range in Section b to end on April 18th, as this is the upper tail of den emergence for land-based denning for bears in the Southern Beaufort Sea as calculated from data published in Rode et al. (2018) and summarized in USGS Alaska Science Center, Polar Bear Research Program (2018). The text should clarify that if an aerial infrared survey is to be conducted, it should be conducted between December 15 and January 31 of any given year.
- Requirement/standard (a) states that use of vehicles and other equipment is prohibited within 0.5 miles of grizzly bear dens identified by ADFG, however ADFG does not currently identify grizzly bear dens in the Refuge. Revise this to state that grizzly bear dens will be identified by the Service, and if the data are not available then the lessee will work with the Service to develop or conduct studies to model habitat use (including denning, foraging and travel) by grizzlies in and around 1002.

#### **ROP 11:**

- The program area is steeper, more incised, and includes more river systems compared to flat areas in NPRA where extensive 3D-seismic surveys have been conducted. Topography strongly affects snow, hydrology and permafrost regimes of this generally hilly region and increases the potential for significant impacts to vegetation. Detailed microtopographic transects across existing 3D seismic trails show that there is compression of the tundra vegetation mat that is up to 20 cm in depth. These changes to microtopography within the track cause other changes to snow, hydrology, and thermal regimes, which make the tracks visible from the air and create conditions in some areas favorable to thermokarst and thermal erosion. Changes in the microtopography and compression of the vegetation mat also would have likely consequences to habitats of many species of plants, insects, small mammals, and birds (Walker et al. 2019). In order to minimize these effects, we suggest the following:



- For Alternatives B-D, change requirement/standard h. to “...overland travel *will* be monitored, and the operator will accommodate representative(s) during operations.”
- In Alternatives B-D, recommend including a snow monitoring plan that outlines measurement protocols (occurring before and during operation) to be submitted to BLM for review in conjunction with FWS prior to work being conducted to ensure habitat impacts are minimized.
- Under Requirement/Standard “a,” all Alternatives, indicate that the exact dates are determined annually.
- Change Requirement/Standard “b,” second sentence, under all Alternatives to read: “These vehicles would be selected and operated in a manner that eliminates direct impacts on the tundra *caused by* shearing, scraping, ....”
- Alternatives A-D treat physiographic regions across the program area as homogenous. Suggest a delineation of regions with tundra travel opening criteria based on terrain ruggedness, elevation, and landforms (e.g., Map 3-1).
- Alternative D (standard a) mentions measurements should be made “over the highest tussocks”. No features are mentioned in alternatives A-C leaving the question open from where measurements can originate. Suggest standardizing across alternatives (e.g., above tussock tops).
- Under Requirement/Standard h. Seismic operations and winter overland travel will be monitored by agency representatives, and the operator will accommodate the representative during operations.
- Requirement/standard (a) for alternative D should be changed to the following to help ensure protection: “Snow depth and density and vegetation data should be collected where ground operations will actually be occurring. There is a great deal of evidence that shows how variable these conditions are even within the same watershed. The exact dates should be determined by the BLM authorized officer in coordination with the USFWS.”
- For all Requirements/Standards that need to be approved by the BLM authorized official, the decision of approval should be made in coordination with the Service project officer. Winter ground operations are known to have negative impacts on the tundra. These impacts can have cascading effects on water quantity, water flow paths, and habitat quality for fish and wildlife.

#### **ROP 15:**

- The Requirement/Standard listed here may be conflicting with ROP 11, standard G. We recommend reviewing these two requirements for compatibility.

#### **ROP 16:**

- To avoid impacts in the floodplains of fish bearing streams, we recommend removing the 2nd statement in the Requirement/Standard (e.g. on a case by case basis) and require in these areas that only directional drilling be allowed for exploratory purposes.
- Non-fish bearing systems provide important habitat that supports invertebrates, migratory birds and other wildlife. We recommend adding the following requirement to help ensure protection of fish,



invertebrates, riparian vegetation and water resources: “Exploratory drilling is prohibited upon or within 100-year flood plains of streams and rivers, on or within 2,000 feet of the ordinary high water mark of potential fish-bearing lakes, and 1,000 feet as measured from the ordinary high water mark of non-fish-bearing water bodies unless further setbacks are stipulated under Lease Stipulations.”

#### **ROP 19:**

- Recommend changing the Requirement/Standard “a”. to read: “...unless further setbacks are stipulated under lease stipulations 1, 2, and 3.”
- Requirement/Standard “a.” and “c.”: Alternatives B-D allow for non-permanent oil and gas facilities (gravel pads, roads, airstrips, pipelines), and on a case-by-case basis allow pipeline and road crossings deemed essential to cross through setbacks. This threatens the tentative wild classification of suitable rivers. We recommend changing the Requirement/Standard wording to: “(NSO) No permanent or temporary oil and gas facilities are allowed in the streambed and within the setback distances outlined to protect Wild and Scenic River characteristics.”
- Recommend changing the Requirement/Standard “c.” to read, “Siting temporary winter exploration and construction camps on river sand and gravel bars is allowed and encouraged, *except on suitable river setbacks.*”

#### **ROP 21:**

- For any gravel-related work, where that gravel is brought in from off the Refuge, we recommend a condition requiring the use of Certified Weed-Free Gravel to lessen chances of introducing invasive plants.
- Recommend editing “e.” to read, “Using approved impermeable liners under gravel infrastructure to minimize the potential for hydrocarbon and other hazardous materials spills to migrate to underlying ground or adjacent water resources.”
- In order to address the topography/gradient difference of the Arctic Refuge as compared to the NPRA, we recommend adding the following: “j. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow.”

#### **ROP 22:**

- Recommend the following changes to the Requirement/Standard:
  - a. To allow for sheet flow and floodplain dynamics and to ensure passage of fish and other organisms, *single* span bridges are preferred.....
  - Add “d. Facilities and infrastructure will be designed to minimize alteration of sheetflow/overland flow.”
  - Add the following to requirements: e) we recommend adequate data on stream flow, seasonal patterns in lake connectivity, and sheet flow be collected prior to planning bridges and culverts. Data will be stored in a centralized database and available to the general public.



**ROP 23:**

- These recommendations were developed for the Central Arctic Caribou Herd . Given the differences in herd and range characteristics, they may or may not be appropriate or effective at mitigating impacts to the Porcupine Caribou Herd. We recommend that the monitoring plan noted in Requirement/Standard “g.” be expanded beyond vehicle use management to monitor the effectiveness of these requirements on the PCH. The plan should allow for adaptive management to ensure effectiveness.
- We recommend approval on the adequacy of any caribou studies be granted only in the case of consensus by the Service and in consultation with the Porcupine Caribou Management Board. Additionally, we recommend that any development proposal should include studies of caribou movements before, during and after completion.

**ROP 24:**

- For Alternatives B and C, in Requirement/Standard, suggest deleting “c. Potential use of the site for enhancing fish and wildlife habitat.” It may be that fish will eventually find gravel pit water reservoirs and use them, but it would not be in keeping with Refuge purposes to promote this. Additionally, any impoundments affecting suitable rivers would threaten the interim management responsibilities of the Service to maintain free-flowing condition.
- Requirement/Standard “a” in Alternative D should be modified to read “...floodplains of the three rivers...” and remove the Aichilik River from the list of major fish bearing rivers because it is outside of the 1002 Area.
- Requirement/Standard “a.”: Alternatives B-C: Recommend changing gravel mine site language to “Locate outside the active floodplain; *except where further setbacks are stipulated under Lease Stipulation 1.*” Alternative D: insert additional requirement: “Construction of gravel mine sites or water reservoirs may not be considered within the setbacks stipulated for suitable rivers under Lease Stipulation 1.”
- In order to promote development of mining restoration plans (see 2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003), we recommend adding the following requirement to each alternative: “Each proposed mine site shall have a Service-approved restoration plan and effectiveness monitoring plan prior to site approval and construction.”

**ROP 25:**

- Recommend adding that the Service be involved in the development and approval of a plan to help prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes as well as assist in monitoring during on-going activities.
- Recommend correcting the language in the Objective. Change “...populations of ground-nesting birds” to, “populations on ground-nesting birds.”

**ROP 27:**

- The Service recommends the use of lattice towers and avoidance of guy wires which pose a significant collision risk for birds.



- Page 2-29 ROP: Under Requirement/Standard: The Avian Power Line Interaction Committee (APLIC) produced a document in 2012 with guidance for reducing bird collisions with power lines. We recommend the Requirement/Standard include complying with the most up-to-date, suggested practices as published in the 2012 APLIC document, “Reducing Avian Collisions With Power Lines: The State Of The Art In 2012” and future updates to this guidance to minimize collisions and subsequent unauthorized take of eagles, other protected species, and birds in general.
- Under Requirement/Standard: If exceptions are granted to the requirement/standard, wires would pose a risk to birds, but mitigation measures are available. Recommend changing the language in this section read: “If exceptions are granted allowing overhead wires, overhead wires would be clearly marked along their entire length to improve visibility to low-flying birds. Such markings would be developed through consultation with the USFWS”, after items "i." through "iii."

#### **ROP 28:**

- Current plans for developing an Ecological map does not specify including information on habitat needs of priority birds and mammals to help determine *a priori* which land is most likely important for these animals. Information currently available on habitat suitability should be part of the ecological mapping process. Further, more than one year of surveys is needed to understand wildlife values, particularly for species showing large variation in numbers from year to year (e.g., opportunistic shorebirds such as pectoral sandpipers, red and red-necked phalaropes, buff-breasted sandpipers). The number of years of surveys necessary would be species dependent.
- The proposed “*ecological land classification map of the area*” would likely not be able to address the stated objective. We recommend the development of a database, map, and models of likelihood of use need for targeted species within the program area.
- The requirement should include cooperation with the Service to assess the information necessary for planning of ground-based wildlife surveys.

#### **ROP 29:**

- Recommend adding to Requirement/Standard: “Cultural Outstandingly Remarkable Values as described for the Hulahula River shall be maintained.”
- Recommend including the following language, “If the Permittee discovers any historic, prehistoric, or archaeological sites or artifacts during the course of field operations, all activity at that site shall cease and the State Historic Preservation Office in conjunction with BLM and USFWS shall be contacted immediately but not more than 24 hours after the incident occurs.”

#### **ROP 30:**

- Under Requirement/Standard: Activities associated with removal of less than 100 cubic yards of bedrock outcrops, sand or gravel from cliffs also have potential to result in raptor mortality and nest/territory abandonment (all of which are prohibited under the Bald and Golden Eagle Protection Act). To avoid unauthorized take of these protected species, project proponents must consult with the Migratory Bird Management Permit Office prior to conducting these activities. The presence of nests may not preclude the work, but an Eagle or Eagle Nest Take Permit may be required before work commences to avoid unauthorized eagle take. Please add a statement that lessee/operator/contractor will consult with the USFWS Migratory Bird Management Permit Office prior to conducting activities that disturb potential eagle habitat.



- Please use metric units in this ROP (e.g. 200 meters rather than 656 feet). This change will ensure consistency and reduce confusion.

#### **ROP 33:**

- In order to monitor and assess impacts of construction on wildlife movements, we recommend adding that the lessee may need to support studies and monitoring efforts in addition to providing information on locations of new infrastructure.

#### **ROP 34:**

- We recommend adding a Requirement/Standard to address aircraft associated disturbance to denning polar bears, as well as polar bears active on the land during summer and autumn. Minimum altitudes for aircraft should be 1,500 feet above ground level (except for takeoffs and landings). This requirement should be applied to all alternatives to ensure requirements under MMPA and ESA are met.
- Under Requirement/Standard, Effects of low-flying aircraft on wildlife: To avoid unauthorized take (including disturbance) of eagles, aircrafts operating within 0.5 mile of any eagle nest should be prohibited below 1,500' regardless of nest substrate. As currently written, the ROP only precludes aircraft activity around nests on cliff substrates. Protected nests may be located on almost any substrate type including the ground (e.g. owls) or in trees (e.g. bald eagle). Any eagle disturbance regardless of activity type (including takeoffs and landings), is prohibited by federal law without a USFWS Eagle or Eagle Nest Take Permit.

#### **ROP 35:**

- The lack of adequate restoration plans and adequate bonds to cover reclamation of areas impacted by oil and gas development on the North Slope is a concern as highlighted in the 2003 NRC report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope (2003). Restoration standards should be set in stipulations in this EIS. It should also be clearly stated what level of restoration will be required before land is no longer considered part of the infrastructure development cap. We also suggest that the EIS include a description of the process that will be used to approve restoration and ultimately remove these acres from the cap. Restoration plans should be required and reviewed prior to issuing a lease. Additional information on this issue can be found in Becker et al. 2016; Walker et al 2019; NRC 2003; GAO 2002.
- Under Alternatives B and C, we recommend the following change: "...would be *adequately* reclaimed to ensure eventual restoration of ecosystem function, *productivity and value*. The leaseholder would develop and implement a BLM *and* USFWS-approved abandonment and reclamation plan.
- Under Alternative D, we recommend the following change: "...would be restored to ensure eventual restoration of ecosystem function, *productivity and value*, and meet *adequate* standards..."
- Under all Alternatives, we recommend changing "...visual, hydrological, and productivity objectives..." to "visual, hydrological, *contamination*, and productivity objectives..."
- Recommend adding the following requirement to this ROP and elsewhere as appropriate: "All survey flagging, stakes, wire, or other debris associated with this program should be removed from the Refuge. However, shot points may remain identified to assist the required summer cleanup crew until that project has been completed."



**ROP 36:**

- Recommend changing Requirement/Standard, line “d” to, “...assess and appropriate range of potential effects on resources and subsistence, *including contamination of those resources*, as determined...”

**ROP 40:**

- Lease Notice 1 provides language regarding ESA Section 7 Consultation. We suggest an additional Lease Notice be included for MMPA, similar to the following:
  - Lease Notice 2: The lease area may now or hereafter contain marine mammals. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved actions that would contribute impacts to marine mammals. The BLM would not approve of any action that may affect marine mammals until it completes its obligations under application requirements of the MMPA.

**ROP 41:**

- Along with approved studies that stipulate individual vehicles, suggest adopting general stipulations similar to guidance from state of AK DNR about summer off-road travel including:
  - Operations shall be restricted to dry uplands whenever possible.
  - Wetland crossing shall be minimized to the extent practical.
  - Multiple passes over the same area shall be kept to a minimum.
  - All operators should be made familiar with arctic vegetation types to ensure compliance.

**ROP 42:**

- Recommend clarifying in the existing Requirement/Standard that chasing wildlife with ground vehicles or *aircraft* is prohibited.
- Recommend adding a Requirement/Standard to avoid and minimize the disturbance to loafing and nesting birds to the extent practicable, unless deemed to be an invasive or invading species that may negatively impact other animals that are deemed to be a priority.
- Recommend adding a statement under Requirement/Standard: “Disturbance to both bald and golden eagles is prohibited under the Bald and Golden Eagle Protection Act (BGEPA). Appropriate spatial buffers around nests may be required to avoid take (including disturbance) by project activities. Buffer distances are both species and activity (e.g. land clearing, vehicle operation, building construction, pile driving, aircraft operation, etc.) specific. Buffer sizes range from 330 feet to 2 miles. To avoid violations of the BGEPA, the USFWS recommends project proponents apply for a USFWS Eagle and/or Eagle Nest Take Permit prior to conducting any activity with potential to take (including disturb) eagles or their nests (occupied or unoccupied).”

**ROP 43:**

- If gravel is to be brought in from off the Refuge it will be clean of invasive species or “weed free”.
- Annual monitoring for nonnative species will likely not allow for adequate eradication and control measures to be implemented. Because most invasive plants are wind-dispersed, if anything is detected, it should be eradicated immediately, not the following year. Therefore, all appropriate NEPA documents, Refuge Pesticide Use Permits, and Certifications must be in place prior to any oil/gas activities occurring on the Refuge, to allow an ADEC-certified chemical applicator to



conduct eradication/control efforts in response to the observance and documenting of invasives during growing season.

- Executive Order 13112 (1999) requires all federal agencies to prevent the introduction of invasive species; provide for their control; and minimize their impacts to the local economy, ecology, and human health. We recommend adding the following language under the Requirement/Standard: “In consultation with the USFWS, the operator/contractor shall develop and implement a long-term monitoring and treatment plan for invasive plant species, in conjunction with the authorized work. This plan shall be developed prior to the start of work, to allow for review and subsequent approval by the USFWS.”
- Recommend changing the Requirement/Standard to read: “...detailing the methods for cleaning equipment and vehicles, *including off-site disposal of cleaning fluids or materials and detected organisms*, and monitoring...”
- Erosion waddles and similar have been identified as vectors for invasive species. Therefore, these should be certified weed-free prior to allowing their use on the Refuge.
- There are so few invasives that have been documented north of the Brooks Range that it is imperative a project of this magnitude implement a higher standard of care when addressing the potential for the spread of invasives. Therefore, all equipment must be thoroughly washed at the point of departure to ensure invasives are not brought onto the Refuge. If being transported on trailers up the haul road, by barge or plane, all equipment should be cleaned at the point of departure and not cleaned in Deadhorse, Kaktovik, etc. Additionally, an approved Invasive Plant Management and Response Plan should be in place that addresses all approved chemicals for use on the Refuge, certifications of those who will be applying those chemicals and how often those chemicals can be used.

### **Additional Recommended Stipulations and ROPS**

- Under all alternatives, we recommend adding the requirement for development of spill response plans, which is currently only under Stipulation 4, Alternative D, Standard iv (with *these edits*): “Operators would be responsible for developing comprehensive *spill* prevention and response plans, including Oil Discharge Prevention and Contingency Plans and spill prevention, control, and countermeasure plans and maintain adequate oil spill response capability to effectively respond during periods of *ice*, broken ice, *or* open water, based on the statutes, regulations, and guidelines of the EPA, Alaska Department of Environmental Conservation (ADEC), and the Alaska Oil and Gas Conservation Commission (AOGCC), and well as Best Management Practices (BMPs), stipulations, and policy guidelines of the BLM *and USFWS*.” Alternatively, we recommend creating a Stipulation or ROP to address this requirement, which is then required across all habitats. Any requirement for development of spill response plans should reference water quality standards for a suitable river’s preliminary classification.
- A concern with oil development on the North Slope has been the lack of data to assess cumulative impacts of oil and gas development (see National Research Council Report, Cumulative Environmental Effects of Oil and Gas Activities on Alaska’s North Slope (2003)). Therefore, we recommend a long-term monitoring program be developed that analyzes the effectiveness of the Lease Stipulations and ROPs. Statistically valid sampling designs with clearly defined levels of inference and change detection capabilities should be included in the design. Development of this program would help detect impacts and employ adaptive management techniques as necessary.



### Section 3: Resource Specific Comments

#### Subsistence and Section 810 Analysis, Appendix E

- Conclusions of no positive findings for Alternatives B, C, and D within the DEIS (e.g., the DEIS concludes that Alternatives B, C, and D will not result in a significant restriction in subsistence uses) are not justified, particularly in light of a positive finding for the cumulative case. The potential impacts on caribou abundance, distribution, and movements are far more likely to affect availability of caribou to subsistence users throughout the PCH range than the relatively minor, local effects of limiting access by Kaktovik residents to some areas on the coastal plain. Statements such as “Potential impacts on subsistence resources and access from future oil and gas exploration, development, and production would be minimal or would be adequately mitigated by stipulations or ROPs...” (page E-10) may be overly optimistic given that these recommendations were mostly developed for oilfields farther west, and have not been tested for the PCH. Given the lack of testing for the PCH, there is uncertainty regarding the effectiveness or adequacy of the mitigation measures in this situation. This means that abundance and, or movements of the PCH could be substantially affected, with resultant effects on availability of caribou to subsistence hunters throughout the herd’s range. Recommend this uncertainty be acknowledged by a positive determination for all the action alternatives.
- Section E.3-22, Page E-7: The DEIS states, “In general, caribou responses to aircraft adhering to effective stipulation measures tend to be short-lived (Fullman et al. 2017).” Fullman et al. (2017) has been frequently mischaracterized in the literature. These authors used a limited dataset on take-offs and landings and did not consider flight altitude and patterns near the herd, distance from lead caribou, private aircraft, disturbance near narrow mountain corridors, or any number of other potentially important factors. The authors do, however, indicate that their results are limited to movements within the Noatak River valley. Given that, this paper does not lend itself to the broad application suggested in the 810 analysis. Additionally, it should be highlighted that the short-term effects of aircraft activity on caribou movements and resultant hunter success may be critical to subsistence opportunity and food security. This concern is frequently voiced by subsistence hunters of the coastal plain.
- Section E.3-22, Page E-7: The DEIS states, “Low-level flights or maneuvering in the presence of unhabituated caribou can elicit increased speed and abrupt direction change. Alternatively, caribou can become habituated to aircraft, particularly when aircraft pilots maintain altitudes greater than 500 feet above ground level and do not haze or harass the caribou (Valkenburg and Davis 1983).” Habituation and avoidance behavior may take quite some time and this should be pointed out in the 810 analysis. A recent analysis by the Office of Subsistence Management included the following information: studies [of caribou] have also reported reduction in the use of areas within 5 km from infrastructure and human activity (including aircraft) by 50–95% for weeks, months, or years (Vistnes and Nellemann 2008, Flydal et al. 2002). We recommend the potential for reduced use of areas in proximity to infrastructure be fully disclosed.
- Section E.3-22, Page E-7: The DEIS states, “Caribou crossing success would vary by season, behavioral motivation, level of habituation, and activity levels” but also states on page E-6, “Caribou abundance or availability and the subsistence use thereof would not likely be affected as a result of direct habitat loss.” These statements seem incongruent as there are too many unknowns about the short and long-term changes to migration patterns that may result. Minor changes, even if temporary, may have major impacts to subsistence if caribou move further from communities and traditional hunting grounds. Caribou migration patterns are very complex and the Fullman et al.



(2017) paper, though a useful starting point, should not be considered definitive evidence of minimal effect. As mentioned in previous comment, habituation can take months or years.

- With regards to ensuring a meaningful subsistence experience, page 3-121 of the DEIS includes the following:

*In addition to affecting resource availability, future noise, traffic, and human activity may also affect user access by deterring subsistence users from their usual harvesting areas. Avoidance of subsistence use areas due to development has been documented in Nuiqsut (SRB&A 2017) and would likely occur for some Kaktovik harvesters if development occurs in their harvesting area. Residents may experience discomfort hunting in the presence of outsiders; may avoid hunting near areas of high air or ground traffic because of a perceived or actual reduction in the availability of subsistence resources; may avoid hunting near activity due to safety concerns; or may consider noise pollution and increased human activity to degrade the subsistence experience.*

We recommend the above language also be included in the 810 analysis. The ANILCA protects and recognizes many values associated with subsistence, far beyond the nutritional value. The cultural values associated with the subsistence “experience” need to be explicitly stated. In one example, noise pollution may affect these experiences as was noted in Chapter 3. We recommend including factors discussed in Halas (2015) as important factors affecting the subsistence experience. One potentially relevant quote from this paper:

*Whether the aircraft intentionally or unintentionally may be ‘influencing’ caribou movement, observing ‘scared’ caribou can be a powerful experience for hunters. Observations of caribou disturbance may impact the quality of a good hunting experience for a subsistence hunter. Respondents who perceived that caribou are impacted by the behavior of aircraft may evaluate their own harvest success to the interaction between aircraft and movement of caribou.*

### **River Corridors Determined to be Suitable Additions to the NWSRS**

- Section 3.4.7, Page 3-210, Wild and Scenic Rivers, Paragraph 4: In order to address interim management guidance for suitable rivers affected by proposed activities (whether the rivers lie inside or outside the project area), we recommend that the first sentence be changed to: “The Marsh Fork-Canning, Hulahula, and Kongakut Rivers are north-flowing waterways found to be...”. Change last sentence of paragraph to: The Marsh Fork-Canning (Recreational ORV) and Kongakut (Recreational, Scenic, and Geologic ORVs) Rivers are not within the project area, but stipulations and ROPS would be applied to protect their WSR characteristics (e.g.: the scenic ORV for the Kongakut River may necessitate modeling and additional setbacks within the project area to insure infrastructure is not visible from any point within the Kongakut River corridor; or the sport fishing opportunities described as part of the Marsh Fork-Canning recreational ORV may be preserved by stipulating program actions within the downstream project area) (see Section 5.7.2 of CCP, Appendix I: Wild and Scenic River Review).
- Section 3.4.7, Page 3-214, Impacts Common to all Action Alternatives: In order to address interim management guidance for suitable rivers affected by proposed activities (whether the rivers lie inside or outside the project area), we recommend changing the sentence beginning with “General impacts...which could affect cultural, fish, geologic, recreation, and wildlife ORVs.” to also include the scenic ORV.



- Section 3.4.7, Page 3-214-3-215: We recommend providing additional information on why setback distances are different across alternatives, what the ecological justification for the differences is, and what the relative impact of the different setbacks on the achievement of the stated objectives in Stipulation 1 is.

## **Fish and Aquatic Species**

- Section 3.3.2 Fish and Aquatic Species, Affected Environment, Page 3-80, last two sentences of last paragraph in section on Direct Habitat Loss or Alteration: The last two sentences in the paragraph suggest that placing gravel mines in river beds and subsequently creating deep water reservoirs could be seen as a long-term benefit for fish in the area. These alterations should be viewed as an anthropogenic alteration of the natural habitat rather than an enhancement. Recommend the last sentence be deleted and the second to last sentence be edited to read, “Following gravel extraction, the excavation can then serve as a water reservoir for industrial activities, which is common practice in other North Slope gravel mines farther west (BLM 2012).”
- We recommend adding a description of the seasonal use of the nearshore marine waters and lagoons by fish within Section 3.3.2. This information is important in understanding the seasonal movement of fish and how the proposed activities will affect fish and subsistence users. For instance, as winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes eventually retreat to offshore environments.
- We recommend adding a description of the difference between rivers with and without perennial springs. This description would provide helpful background for the proposed protections for perennial springs. It is known that the perennial springs support fish during harsh winters and rivers without springs have no fish. This spring water is believed to be ancient, having fallen as precipitation on the south side of the Brooks Range hundreds to thousands of years ago. All Arctic Grayling and Dolly Varden are major subsistence resources in the Arctic Refuge and their survival depends on approximately twenty springs found within the coastal plain and adjacent foothills, thus they are truly critical habitats. Only four rivers that cross the 1002 Area support major anadromous or endemic fish populations requiring special recognition.

## **Polar Bears**

- Page 3-125: In the second full paragraph, the DEIS confuses incidental take with intentional take. ITRs and associated LOAs are for the incidental take of polar bears as a consequence of an otherwise lawful activity. Independent of that, authorizations are provided to allow intentional take through harassment in order to protect human life.
- Page 3-127: The DEIS states that critical denning habitat for polar bears only occurs in those areas with topography sufficient to capture enough snow for dens to be constructed. However, the actual critical habitat designation covers a much larger area and includes not only the microhabitat features (i.e., those where snow can accumulate), but also the macro-habitat features that allow bears to access those features and move back to the sea ice post emergence. This should be corrected in the final EIS.
- Page 3-133: The DEIS states that post-lease activities could include seismic, but fails to consider the fact that due to the future leasing activities analyzed in the DEIS, seismic surveys could occur prior to leasing. We recommend correcting this in the final EIS.



- Page 3-137: The DEIS states “If dens are detected within a 1-mile buffer zone around the proposed locations of roads and pads, then the facility locations would be moved outside of that radius to avoid dens, as required by ITRs, to reduce the effects on occupied dens to a negligible level.” While that is currently true, if new data emerged that suggests bears could be disturbed at distances >1 mile, then a larger buffer would be required. Similarly, if data supported a smaller area, a smaller buffer could be required. We recommend the language be revised to reflect that this no disturbance buffer is subject to change.
- Page 3-141: The discussion of the potential effects of an oil spill on polar bears is not sufficient. While it’s true that a spill associated with an accident involving a barge would likely be smaller than that modeled for an offshore oil well, sufficient volume of oil could still be released that could harm polar bears. This is especially true depending on where and when barges are likely to land. If barge landings are in the vicinity of Kaktovik, they could coincide with large aggregations of bears during the open water period. A spill adjacent to those waters could expose a large number of polar bears.
- Page 3-146: The DEIS states, “The highest number of documented historical polar bear dens and the greatest area of potential maternal denning habitat occur in the high- and medium-potential hydrocarbon zones, where the least restrictive development activities would be most likely to occur.” This statement reinforces our concerns over the level of protection afforded to polar bears under Alternatives B and C, and highlights the need to provide the level of protections for polar bears found in Alternative D in any and all development scenarios.
- Page 3-146: The DEIS states, “Under ROP 10, the pre-activity surveys required to locate dens, plus the 0.5-mile and 1-mile buffers for seismic and heavy equipment operation around occupied dens of grizzly and polar bears, respectively, would help to reduce the impacts of behavioral disturbance on denning bears (as well as birth lairs of ringed seals on landfast ice along the coast) throughout the entire program area.” However, Alternatives B and C do not require such surveys, just a requirement to avoid known dens. We recommend changing the ROP under Alternatives B and C to require den surveys. Without the requirement for surveys to detect dens, the requirement to avoid known dens carries greatly diminished conservation value.
- Map 3-24: The map legend is mislabeled. It states that the stars are potential denning habitat when in reality they depict sites of known polar bear dens observed over the years. Additionally, those data are wrongly attributed to Durner et al. (2006) rather than to the USGS den catalogue. Similarly, the yellow lines depicting potential denning habitat should be cited as Durner et al. (2006) rather than just “Durner data” and should be labeled as “polar bear denning habitat” rather than just “polar bear habitat”.

## **Terrestrial Mammals**

- Page 3-115: The DEIS states that, “Similar delays have not been observed in caribou in the existing North Slope oil fields, ...” Recommend modifying this statement to state: “Although CAH caribou have been observed to cross roads and pipelines in the existing North Slope oil fields during the summer insect season, fine-scale studies of CAH movements like those of caribou near the Red Dog mine road have not been conducted.” As currently worded, it implies that a study has looked at this and not documented a delay. To our knowledge, there has not been a study looking at caribou movements at the spatial/temporal scales required to detect an effect for caribou in the oil fields.
- Page 3-120: The DEIS states that under Alternative D, Lease Stipulation 5 would prohibit winter activity within 1 mile of polar bear denning habitat. This is not accurate, as the stipulation states activity within a mile of denning habitat in particular regions of the Coastal Plain would be



restricted, but not the entire region. We recommend correcting the statement to better reflect what Lease Stipulation 5 actually requires.

- Page 3-108: Recommend adding the following information to the discussion of muskox: “Another group of approximately 24 muskoxen inhabits the northwestern Yukon Territory, is commonly found near the Alaska-Yukon border and frequently wanders into the Refuge. They have been found as far west as the Aichilik River, on the boundary of the program area.”
- Page 3-108: Recommend including the following information in the discussion of moose on the coastal plain: “Moose numbers east of the Canning watershed are currently low, but numbers in tributaries of the Canning (both east and west sides) are greater; some of these would be in the project area and other moose just outside the area to the west could be affected by equipment moving into/out of the area. Moose aggregate in brushy habitat along streams during winter, but then disperse across the ACP during summer (particularly pregnant cows). Moose are an important subsistence species for Kaktovik hunters, who are extremely interested in seeing moose populations recover to previous levels that will allow additional hunting opportunities.” It would be helpful to provide maps of current moose winter habitat and locations of moose found on spring surveys, which we can provide.

### **Wildlife Direct and Indirect Impacts**

- Recommend providing a quantitative analysis of direct and indirect impacts to wildlife where possible or summarizing the results of quantitative studies that have been completed. For example, the following study is an example of where a quantitative analysis was completed for the PCH and should be incorporated into the description of impacts: *Russell, D., and A. Gunn. 2019. Vulnerability analysis of the Porcupine Caribou Herd to potential development of the 1002 lands in the Arctic National Wildlife Refuge, Alaska. Report prepared for: Environment Yukon, Canadian Wildlife Service, and GNWT Department of Environment and Natural Resources. 143 pp.*
- Given the importance of moose as a subsistence species to local communities, we recommend adding a description of potential impacts of development on moose, including: disturbance of cows during calving and displacement during summer from coastal plain habitats with few predators, impacts to riparian vegetation that may reduce moose winter habitat, displacement of moose from winter habitat, disruption of movements to/from seasonal ranges, changes in predator abundance and distribution as a result of supplemental foods or habituation to humans.
- Page 3-110: Please include moose in the list of mammals (grizzly bear and muskox) that may be disturbed by winter seismic exploration.
- Page 3-110: Although it is true that only a small proportion of the PCH remains on the ACP during winter, these caribou can number in the hundreds and are an important winter subsistence resource for Kaktovik hunters. Thus, localized disturbance or displacement of caribou during winter could have a significant impact on subsistence hunters. Recommend clarifying that although the number of PCH caribou on the ACP during winter is small, they are still an important subsistence resource for local communities.
- Page 3-113: Please provide citations for the sentence “Although some habitat damage would result from the use of ice roads and pads because the ice road is temporary, the long-term impacts would be considerably less than those associated with gravel roads and pads”. Ice roads and snow trails have the potential to delay greenup in affected vegetation, and may retard growth during an entire growing season. This effect could be repeated every year that exploration and development occur.



Additionally, these routes are likely to be much wider than a gravel road, with the potential to impact more habitat in a given year resulting in greater impacts to caribou habitat.

- Page 3-114: Recommend revising the sentence that begins “The patterns of CAH demography following development should be applied to the PCH with caution...” to “Demographic changes exhibited by the CAH during the development period cannot be extrapolated to the PCH due to the substantial differences between these herds and the geography of their ranges.” For example, the CAH was at an historic low point in the herd’s abundance when development began, whereas, the PCH is currently at an historic high level. In addition, compared to the CAH, the PCH has shown a much lower population growth rate during periods of increase; concentrated calving density of the PCH is much higher; areas surrounding the PCH calving grounds contain less high-quality forage and higher predator densities; and these areas exhibit more topographic relief than do the current PCH calving grounds or areas used by the CAH following displacement from their original calving grounds (Clough et al. 1987; Griffith et al. 2002).”
- Page 3-115, Paragraph 2: The following studies related to caribou should be included in this section: Smith and Cameron, 1985; Curatolo and Murphy, 1986; Murphy and Curatolo, 1987; Murphy, 1988. These studies indicate that large groups of caribou were less successful in crossing roads and pipelines during insect harassment; which is likely to be more of an impact for the much larger groups typical of the PCH during summer.
- Page 3-115, Paragraph 5: It is not clear how the definition of PCH calving area was determined to be the “concentrated calving area during >40% of years“, as the most of the 1002 area is used for calving by either the PCH or CAH, and often both herds. Recommend providing additional discussion and citations as to how this was defined.
- Page 3-116: There is substantial uncertainty that design specifications outlined in ROP 23 will be sufficient to minimize disruptions to caribou movements in the 1002 Area due to substantial differences in geography and herd characteristics. Recommend adding a description of the substantial uncertainty that exists regarding whether these practices will be sufficient, and a statement that additional restrictions may be necessary to maintain the ability of the PCH to continue unrestricted use of the area.

## **Resident and Migratory Birds**

- Section 3.3.3 Birds, Affected Environment, Shorebirds: Only the following 10 species are fairly common, common, or abundant in the program areas: American golden-plover, ruddy turnstone, semipalmated sandpiper, red-necked phalarope, red phalarope, Western sandpiper, dunlin, stilt sandpiper, pectoral sandpiper, and long-billed dowitcher. The following four additional species are less common: semipalmated plover, Baird’s sandpiper, whimbrel and buff-breasted sandpiper (based on PRISM surveys reported in Brown et al. 2007). Data from transmitters indicate that some birds also migrate westward across the ARCP before migrating southwest across Alaska and down either the Pacific Flyway or the East Asian-Australasian Flyway. Recommend correcting the information related to species abundance and including information related to the eastward migration that occurs. Brown et al. (2007) is the best source of data for shorebirds relative to the project area.
- Section 3.3.3 Birds, Affected Environment, Climate Change: Although summer duration may increase due to climate change effects, it is unlikely that insectivores will increase as invertebrate emergence is mediated by snow melt initially, followed by cumulative degree days of temperature. The volume of invertebrates may be limited, with the emergence simply occurring earlier. Contrary to what is stated in the DEIS, avian habitat is changing rapidly, both on the coast and inland tundra



areas. Comparison of photographic images taken at Prudhoe Bay in the 1980s and the present show the landscape drying up, with a change from low-centered polygons to high-centered polygons (see Liljedahl et al. 2016). This in turn is leading to drainage of uplands and creation of larger water bodies that may indeed be good for species of waterfowl and loons. River deltas may also be affected from reduction in glacier melt-off. This change and the storm surges could affect migratory birds through changes in invertebrate distribution and composition (Churchwell et al. 2018). The DEIS does not correctly assess the potential impacts to birds and their habitat resulting from the changing climate. Please ensure the EIS accurately assesses the potential impacts to birds and their habitat resulting from a changing climate based on the best available science.

- Section 3.3.3 Birds, Affected Environment, Direct and Indirect Impacts: The DEIS understates the potential impact from water removal during ice road construction on wildlife. The 1002 Area has relatively few water resources compared to the NPR-A and the use of large volumes of water could negatively affect nesting habitat in the succeeding summer. Breeding grounds are the only place for the birds to increase their numbers, and thus are an essential part of the annual cycle for maintaining bird numbers. Please ensure the document more accurately reflects the potential impacts to breeding birds from the project as a result of water removal.
- Page 3-92: The indirect effects of post-leasing oil and gas activities on birds should be included in the DEIS, including the indirect effects of increasing contaminant concentrations below levels that would cause mortality. This discussion should include mobilization of contaminants, particularly heavy metals, from climate change (e.g., flood events contributing to increased erosion and release of contaminants from glaciers); earth-disrupting activities contributing to dust, sedimentation, or erosion; and activities that may result in melting permafrost with subsequent mobilization of mercury. These activities have the potential to increase contaminant concentrations in birds of the Arctic Refuge, especially those that eat invertebrates (shorebirds, nesting waterfowl) and fish (loons), and in raptors to levels below those that may cause mortality, but which may still result in population-level effects such as decreased productivity.
- Page 3-99: We disagree that “salt-water spills would not be toxic to birds,” especially if spills occurred in waterfowl breeding ponds. Newly hatched ducks have poorly developed salt glands and exposure to elevated salinity can cause impacts including mortality (e.g., DeVink et al. 2005). Additionally, saline spills can kill invertebrate prey.
- Page 3-84, Paragraph 7: Arctic Refuge CCP 4.3.6 states, “In the northern foothills of the Brooks Range, Arctic coastal plain and adjacent marine waters, 158 species have been recorded”. It appears the species list from Appendix F in the CCP was used here to assign a number of 158 species, but the inclusive areas for these sections is slightly differently between the CCP text and Appendix F. Please change, “According to the USFWS (USFWS 2015a), 156 bird species have been recorded in the Arctic Refuge on the northern foothills of the Brooks Range, in the ACP (an area inclusive of the program area), and in adjacent marine waters” to “According to the USFWS (USFWS 2015a; Appendix F), 156 bird species have been recorded in the Arctic Refuge Coastal Plain [i.e., the area between the coast and the Brooks Range inclusive of coastal areas (lagoons, barrier islands, and Beaufort Sea) and inland areas (uplands near the foothills of the Brooks Range)]”.
- Page 3-85, Paragraph 1: The statement, “With few exceptions, all birds in the program area are migratory and are present only during the summer breeding season, May to September, depending on species” is incomplete. Several raptor species may occur during the latter part of winter in the Program Area. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most golden eagle nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive



during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Some marine birds occur in the area throughout October and into November and leave with advancing sea ice. In the immediate area offshore, such species groups include larids, murres, puffins, guillemots, seaducks, and sometimes shearwaters (Kuletz et al. 2015; Kuletz and Labunski 2017, Appendix 1; USFWS data). Please change to, “With few exceptions, all birds in the program area are migratory and present February to November, depending on species”.

- Page 3-85, Paragraph 1: Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Appendix F of the CCP states, “Rock ptarmigan (*Lagopus muta*) – Common permanent resident in all areas of Refuge.” Please change, “Winter residents include small numbers of ravens and ptarmigan, dippers near open running water, and occasional gyrfalcons” to, “Resident birds include ravens, ptarmigan, dippers near open running water, snowy owls, and gyrfalcons”. Cite the CCP and citations below.
- Page 3-85, Paragraph 2: Sentence, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ACP (Liebezeit et al. 2009)” could be more specific. Data on population size is available for the ARCP, so using information for the whole of the ACP seems unnecessary. Also, the cited reference did not conduct extensive surveys across the whole of the ACP for estimating density, therefore this reference doesn’t support the statement as given. Please change to, “Shorebirds and passerines are the most abundant guilds of nesting birds on the ARCP (Bart et al. 2012).”
- Page 3-85, Paragraph 3: The Affected Environment coverage of the “marine vessel route to Dutch Harbor” should be expanded. This route may impact areas used by the ESA listed short-tailed albatross and species of concern such as yellow-billed loon, red-legged kittiwake, Aleutian tern, and Kittlitz’s murrelet. Special consideration should be given to Important Bird Areas and “hotspots” that occur along the route. For examples, the area near the mouth of Barrow Canyon (and around Point Barrow) is a “hotspot” of marine bird and marine mammal activity throughout summer and fall “hotspots” occur offshore from Wainwright (head of Barrow Canyon) and over Hanna Shoal area (see Kuletz et al. 2015). Any marine vessel route would pass by large seabird colonies at Cape Lisburne (northernmost seabird colony of AMNWR) and Cape Thompson. Vessels would have to go through Barrow Strait, an Important Bird Area (Smith et al. 2017) and recognized “hotspot” for marine birds (Humphries and Huettmann 2014; Kuletz et al. 2015). The Bering Strait region supports mixed-species colonies of millions of birds (Stephensen and Irons 2003), with some of the largest seabird colonies in the world on Diomedes, King Island, St. Lawrence Island, and farther south – St. Matthew Island. An estimated 12 million seabirds aggregate in the Bering Strait region in summer through early fall (USFWS 2014). There are many “Important Bird Areas” identified along the route to Dutch Harbor and nearby Aleutian passes (Smith et al. 2014; 2017). Please add “waterbirds” and “larids” to the groups discussed in this section.
- Page 3-85, Paragraph 4: The statement, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important nesting, rearing, and migration staging periods” is incomplete. The coastal lagoons and deltas provide important stopover habitat during spring migration/pre-breeding period, as well. Please change to, “The ARCP represents a substantial portion of the Beaufort Sea coastline in Alaska. Accordingly, it also supports a large number of birds during the important pre-breeding, nesting, rearing, and migration staging periods.”
- Page 3-85, Paragraph 4: The statement, “Prior studies (summarized in USFWS 2015a) have demonstrated that at least several hundred thousand breeding and nonbreeding birds use the ARCP and program area during the short arctic summer” is incomplete. Likely as many or more birds use



the ARCP during the fall. Please change to, “Prior studies (summarized in USFWS 2015a, Pearce et al. 2018, USFWS and BLM 2018) have demonstrated that at least several hundred thousand birds use the ARCP during for breeding in the short arctic summer and fueling and resting during migration in the fall”.

- Page 3-86, Paragraph 1: The unpublished data cited here belongs to USFWS, not Mr. Latty. Also, one nest was included in an unpublished report, (Kendall and Villa 2006). Please change “(Latty, unpublished data)”, to “(Kendall and Villa 2006, USFWS, unpublished data)”.
- Page 3-86, Paragraph 1: The statement “The spectacled eider is an uncommon breeder in the program area, and nests have been documented only on the Canning River delta” only pertains to recent records of known spectacled eider nests found during operations of a primarily shorebird research site on the Canning River Delta and is therefore misleading. An exhaustive search for all records of spectacled eider nests occurring in the program area has not been conducted. This statement should also not be interpreted to mean that all locations within the program area have been searched to determine presence or absence. Rather, it only means that a few spectacled eider nests were found as part of other operations (primarily shorebird research) at a single small site on Canning River delta. There have been NO systematic ground surveys specifically targeting eider nests (outside the barrier islands) anywhere in the program area in the recent past. Please change to, “The spectacled eider is an uncommon breeder in the program area. Nests have been documented on the Canning River delta, but contemporary systematic ground surveys targeting tundra-breeding eiders have not been conducted.”
- Page 3-86, Paragraph 2: Spectacled eider nest density is expected to be low in the program area where suitable habitat is available. Please change, “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting period, where suitable habitat is available”, to “Low numbers of spectacled eiders are expected to occur in the program area during the pre-nesting and nesting period, where suitable habitat is available.”
- Page 3-86, Paragraph 3: Within the DEIS ‘Waterbirds’ appears to include mergansers and seaducks. Please include these groups in the list of Waterbirds (first line of paragraph).
- Page 3-86, Paragraph 4: In the second sentence, referencing the ACP survey, the text indicates that “prior to 2018 only about a quarter of the area was included...” Insert “program” prior to “area”. Without that specificity, the text suggests that only a quarter of the ACP was surveyed, when in fact one quarter of the program area that was surveyed as part of the ACP breeding pair survey.
- Page 3-86, Paragraph 4: In the last sentence, please change “unreliable” to “imprecise”. There is a large difference in meanings, and “imprecise” is the correct term here.
- Page 3-86, Paragraph 4: Bart et al. (2012) provides estimates of waterbird population sizes for the ARCP. Please consider including these population estimates here.
- Page 3-87, Paragraph 1: The waterbird classification includes waterfowl like Northern pintail that often nest in dryer habitats. Bart et al. (2012) estimated more than 18,000 Northern pintail breed on the ARCP. Please change, “In addition to water body shorelines and islands, most waterbirds use a variety of wet and moist tundra habitats for nesting, often next to water” to “Most waterbird species nest in association with ponds or in wet and moist tundra habitats, but some species primarily nest in drier habitats”.
- Page 3-87, Paragraph 1: A significant portion of the estimated hatch dates for several geese species in the program area in some years occur in June. Please change, “After hatching in July and August,



most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands” to, “After hatching in June through August, most waterbirds occupy lakes and ponds to rear their young, although geese and cranes graze in tundra wetlands.”

- Page 3-87, Paragraph 1: The following statement is not accurate for most waterbird species occurring in the program area, “In the late summer, post-breeding and molting (temporarily flightless) waterbirds use coastal lagoons behind the barrier islands. Waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration.” Please remove that statement and insert “In the late summer, post-breeding and molting (temporarily flightless) sea ducks (primarily long-tailed ducks) use coastal lagoons. Sea ducks and other waterbirds continue to forage in the lagoons in the fall as they stage for the southward migration.”
- Page 3-87, Paragraph 1: The statement, “Most waterfowl (swans, geese, ducks) migrate through the central continent to wintering areas across the continental US” is poorly defined and not correct as written. Please change to, “Most geese, swans, and dabbling ducks migrate through Pacific and Central Flyways after leaving the ARCP.”
- Page 3-87, Paragraph 2: Map 3-15, Post-Breeding and Fall Staging Common Eider, in Appendix A, is incorrectly titled. Map 3-15 depicts locations of likely breeding and post-breeding common eiders from two separate surveys conducted to estimate breeding and post-breeding (staging/molting) sea bird distribution and abundance. Please correct as appropriate.
- Page 3-87, Paragraph 2: Language as written is incorrect and no source is provided for 1976 data. Please change “Common eiders have been increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 nests were found”, to “Common eiders appear to be increasing in abundance on their barrier island breeding grounds in the Arctic Refuge since 1976, when only 14 active nests were found (Divoky 1978)”.
- Page 3-87, Paragraph 2: The statement “Common eiders winter in coastal areas from the Aleutian Islands south to southern Alaska,” is not correct. Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and Chukota peninsula in the Bering Sea (though some also are known to winter in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta). Please change to, “Common eiders breeding on Beaufort Sea barrier islands primarily winter near St. Lawrence Island and the Chukota peninsula in the Bering Sea, although some also have been documented wintering in the Olyutorskij Gulf, northern Bristol Bay, and off the coast of the Yukon-Kuskokwim Delta (Petersen and Flint, 2002).
- Page 3-87, Paragraph 2: The statement, “The USFWS conducts annual aerial surveys to estimate the number, distribution, and population trend of breeding common eiders in coastal habitats on the North Slope, including Arctic Refuge lands (summarized in USFWS 2015a)” is not accurate. The USFWS has not conducted aerial surveys of coastal habitats on the North Slope since 2009. Please correct language to recognize aerial surveys are not currently being conducted for common eider on the ACP, and have not in a decade.
- Page 3-87, Paragraph 2: The data referenced in, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 common eider nests were found (Latty, unpublished data)” belongs to USFWS, not Mr. Latty and the language is imprecise. Please clarify differences in spatial coverage between these two surveys. Please change to, “In a 2015 ground-based survey conducted across most Arctic Refuge barrier islands, over 800 active and inactive common eider nests were found (USFWS, unpublished data). There were differences in spatial coverage between the 1976 and 2015 surveys, primarily because the islands are constantly being reshaped.”



- Page 3-87, Paragraph 4: The statement, “In aerial surveys of nearshore waters and barrier islands conducted during the early post-breeding period (early July 1999–2009)” does not describe the survey referenced. The latest report on that survey, “Aerial Population Surveys of Common Eiders and Other Waterbirds During the Breeding Season - Northwestern Alaska 2006-2009” by Bollinger et al. 2012 states, “The objectives of this Northwestern Alaska Common Eider Survey were to: 1) Estimate a population index during the breeding season....” (2012). That report also states, “All surveys were flown during the interval from 15 June to 01 July (Table 2). Survey timing was intended to coincide with egg laying and early incubation while pair bonds are still intact and prior to the dispersal of males to molting sites” which does not match the statement in the DEIS. Please change this sentence to, “In aerial surveys of nearshore waters and coastal areas near barrier islands conducted during June and early July 1999–2009.”
- Page 3-88, Paragraph 2: Please provide a citation to support the statement, “It is likely that many of the birds using lagoons along the Arctic Refuge coast during post-breeding nested to the east, particularly in northern Canada” or remove.
- Page 3-88, Paragraph 3, Sentence 1: The 325,000 estimate is 40 years old and therefore should be referenced in the past tense. The most recent (15 year old) estimates are approximately 185,000 (Kendall 2006).
- Page 3-88, Paragraph 3: Please provide the Arctic Refuge CCP as a citation for the statement, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS and BLM 2018)”. Please change to, “Up to 325,000 snow geese of the Western Arctic Population use the ARCP as a staging area for fall migration (USFWS 2015a).
- Page 3-88, Paragraph 4: The Shorebirds of Conservation Concern in the United States of America - 2016 (U.S. Shorebird Conservation Plan Partnership, 2016) is the most up-to-date conservation status document for North American shorebirds; therefore, this list should be identified in the Affected Environment text, not just in the Appendix.
- Page 3-88, Paragraph 6: The statement, “Shorebirds use a wide range of aquatic, wet, and moist tundra habitats for nesting, often near bodies of water” is not correct as written. While most shorebirds prefer moist tundra, some use drier habitat and riverine areas. For example, whimbrels were only found in upland habitats on previous ARCP shorebird surveys. Please change to, “ARCP shorebirds use a wide range of tundra habitats for nesting. Most species occur in wetland, moist, and riverine habitats, but some species prefer drier upland sites (Brown et al. 2007).” Alternatively, remove this sentence and incorporate the information in the next sentence that includes the Brown et al. citation.
- Page 3-89, Paragraph 1-3: This section excludes discussion of bald eagles. Although not as abundant as golden eagles, bald eagles also occur on both the coastal plain and in the foothills of the Brooks Range. Please update text to reflect this information.
- Page 3-89, Paragraph 2: Up to several thousand shorebirds at a time may occur on individual river deltas in July and August (Churchwell 2015). Please change, “Most of the deltas are used by large numbers of foraging shorebirds” to “Most of the deltas are used by large numbers of foraging shorebirds. Up to 4,000 shorebirds were counted on daily surveys at Jago and Okpilak River Deltas in 2011 (Churchwell 2015)”
- Page 3-89, Paragraph 4, Line 7: Additional larid species encountered along the vessel route to Dutch Harbor (USFWS survey data, most in Kuletz and Labunski 2017) would include slaty-backed gull, red-legged kittiwake, Aleutian tern; (latter two are breeding birds of conservation of concern). These



species should be included here. Also, it was difficult to determine the vessel route, and not clear what that route would be used for – or how much vessel traffic the project would generate (especially through the Bering Strait). This information is necessary to adequately assess the affected environment and potential impacts.

- Page 3-89, Paragraph 5: Last line of paragraph. When offshore or over marine waters, jaegers also eat fish (and scavenge or steal those from other seabirds and larids). Please correct this in text.
- Page 3-91, Paragraph 2: Line 1-2. From our USFWS at-sea surveys in the waters off of ARCP, in addition to ones listed in Table J-9, glaucous gull, black-legged kittiwake, Ross’s gull, Sabine’s gull, and Kittlitz’s murrelet have also been recorded (see Kuletz and Labunski 2017, Appendix 1 for maps, or Kuletz et al. 2015 for some species; also USFWS/Kuletz, unpublished data). Please update text to reflect this information.
- Page 3-91, Paragraph 3: The DEIS contains few details regarding the “the marine vessel route to Dutch Harbor.” Vessels traveling through the Chukchi Sea and down length of the Bering Sea to Dutch Harbor could encounter more than 63 species of marine birds. As written, little information is given for the Affected Environment for the vessel route to Dutch Harbor, which reduces the ability to estimate potential impacts or threats. Please clarify the details of the “the marine vessel route to Dutch Harbor”, fully describe the Affected Environment in the appropriate sections in 3.3.3, and then discuss the potential impacts in the Direct and Indirect Impacts section beginning on page 3-92.
- Page 3-91, Paragraph 3: The ESA-listed short-tailed albatross occurs regularly (if not abundantly) in the southern portion of the route, and occurs in the northern portion in late summer and fall (especially the northwest outer shelf break, near the International Date Line), and near St. Lawrence Island. The short-tailed albatross and two other albatross species (black-footed and Laysan) have all increased in abundance and shifted distribution northward in the Bering Sea in recent decades (Kuletz et al. 2014), and so would be present enroute to Dutch Harbor. The Aleutian passes, especially Unimak Pass near Dutch Harbor, have the highest risk to seabirds from vessel accidents (Renner and Kuletz 2015, Humphries and Huettmann 2014) and very high densities of albatrosses occur there. The first recorded sighting of a short-tailed albatross in the Chukchi Sea was made in 2011 (Day et al. 2013); thus, it could be encountered in that portion of the vessel route as well. Please update text to reflect this.
- Page 3-91, Paragraph 5: It should be noted here that seabird die offs have occurred in the Bering Strait region in 2017 and 2018 (USFWS 2017, 2018) and were associated with very warm water conditions; die offs in this region were previously very rare (or perhaps never recorded, with exception of the 2013 die off near St. Lawrence Islands). Birds died from starvation, although effects of toxins cannot be ruled out. The combined effects of increased vessel traffic, disturbance, noise, and changes in prey and sea ice have potential for increased cumulative effects. Please update text to reflect this information.
- Page 3-91, Paragraph 5: Predation is the primary factor affecting productivity for many ARCP breeding birds, but recent work suggests predation is increasing in the Arctic and maybe linked to climate-induced shifts in predator-prey relationships. Please add, “Recent work suggests predation is increasing in the Arctic and is linked to climate-induced shifts in predator-prey relationships (Kubelka et al 2018)”.
- Page 3-91, Paragraph 5: A climate change vulnerability assessment on Alaska’s North Slope identified the barrier island nesting Pacific common eider as the marine bird at highest risk of climate change impacts, including impacts from predicted sea level rise, increasing storm surges, and erosion and/or restructuring of barrier islands (Liebezeit et al. 2013). With the low elevation profiles



of barrier islands and preference of low-lying nest sites by common eider, rising sea level and increasing storm surges may have significant effects on nest success of eiders. The intensity and frequency of storm surges in the Beaufort Sea is increasing, and sea levels have been predicted to rise by 0.26-0.98 meters by 2100 (Church et al. 2013). Model predictions suggest that wave heights and storm surges will continue to increase as ice retreats (Church et al. 2013, Lintern et al. 2013, Vermaire et al. 2013). In the future, eiders nesting on barrier islands may be impacted by both the increasing frequency and magnitude of storm surges, and an earlier timing of these events. Please include the following in this section: “Some species nesting on barrier islands, such as common eiders, could be negatively affected by predicted sea level rise and increasing storm surge. Both could flood nests and decrease productivity (see Liebezeit et al. 2013).”

- Page 3-91, Paragraph 6: Another potential impact of less sea ice is bigger, rougher sea conditions, which may impact foraging of marine birds, especially less experienced/smaller juveniles. Please update text to reflect this information.
- Page 3-91, Paragraph 6: Please provide a citation for the statement, “a delay in freeze-up in fall should be advantageous to the slow-growing young of such species as loons and swans, which are not always flight capable by time of freeze-up” or remove.
- Page 3-91, Paragraph 7: The statement, “Some species of insect-feeders (shorebirds and songbirds) can initiate nests earlier with early snowmelt, whereas others (jaegers, common eiders, and raptors) do not; however, it is unclear if birds relying on insects to feed their young (songbirds and shorebirds) could adapt to hatch at the optimum time as insect hatch continues to advance (Grabowski et al. 2013)” is incomplete for the body of climate-mediated links for some of these species. For example, as discussed in the cited reference (Grabowski et al. 2013), “The lack of response in the common eider to timing of snowmelt is consistent with other studies that have linked both nest initiation and productivity to the area of marine ice cover adjacent to the nesting grounds.” Love et al. (2010) found common eiders nested earlier in warmer years associated with earlier ice-breakup and Chaulk and Mahoney (2012) found spring ice cover was a positive predictor of nest initiation date, but was also linked to smaller clutch sizes. Because climate change is predicted to lead to earlier ice-out along the coast, common eiders breeding on ARCP barrier islands may nest earlier as warming advances, but the advantage or disadvantage of this is yet unclear. For Arctic breeding geese, lower snow cover was also related to earlier egg laying (Dickey et al. 2008). Suggest changing to, “Some species, such as passerines, shorebirds, and waterfowl, initiate nests earlier with early ice-breakup and snowmelt, but the overall impact to demography is still unclear (Dickey et al. 2008, Love et al. 2010, Chaulk and Mahoney 2012, Grabowski et al. 2013).”
- Page 3-91, Paragraph 8: The statement, “Avian habitat is likely to change slowly with climate change, except for coastal areas subject to erosion and deposition (see below)” appears to be incorrect as written. Most tundra nesting birds in the ARCP prefer wetlands or moist tundra (see Bart et al. 2012). However, Arctic lakes are disappearing (Smith et al. 2005), wetlands depletion is occurring following permafrost disturbance by thermo-erosion (Perreault et al. 2017), and ponds that have been permanent water bodies for millennia, are now completely drying during the polar summer (Smol and Douglas 2007). Therefore, Arctic habitats are already impacted and this loss is predicted to expand in the future [see, “Rapid climate-driven loss of breeding habitat for Arctic migratory birds” (Wauchope et al. 2016) for further discussion]. We recommend deleting this sentence or clarifying that habitat changes (e.g., higher water temperatures, less sea ice, lower zooplankton biomass, and smaller species of zooplankton) are already occurring in the marine environment.
- Page 3-92, Paragraph 3: Please add a paragraph specific to marine habitat after this coastal habitat paragraph.



- Page 3-92, Paragraph 4: The citation (Flint et al. 2003) does not appear to support the statement, “Erosion of coastal shorelines could increase inundation of tundra by salt water; the resulting salt-killed tundra may be colonized by salt-tolerant species and develop into salt marsh, a rare but important post-breeding habitat for geese.” Please correct or remove.
- Page 3-92, Paragraph 5, Line 7: If post-lease activities include transportation of oil, please address potential impacts to the marine environment. If oil transport includes any marine areas, it is not fully addressed in the draft EIS. Please update this section if oil will be transported in marine areas.
- Page 3-92, Paragraph 6: The statement, “Winter activities would affect few species and low numbers of year-round residents” is incomplete. Breeding golden eagles return to Alaska, including the Arctic Refuge, from late February to mid-April, with non-breeders arriving later (summarized in Kochert et al., 2002). Within the Arctic Refuge, most nests are initiated in mid-April (range: late March to early May) (Young et al., 1995). Some snowy owls winter on Arctic breeding grounds, but most arrive during April and May, with most egg laying occurring in mid-May (summarized in Holt et al., 2015). Based on this information, please change to, “Winter activities would affect few species and relatively low numbers of winter, spring, and year-round residents.”
- Page 3-92, Paragraph 6: Potential impacts of oil development on birds are listed as four primary categories, including “injury and mortality, and attraction of predators and scavengers (including both mammals and birds) to human activity or facilities, with subsequent changes in predator abundance”, but all are not discussed in the paragraphs that follow. Please consider the following to paragraph 1, page 3-93: “Changes in predator abundance and diversity could occur in all phases. For example, studies demonstrated low winter movement rates and high densities of habituated Arctic foxes in the Prudhoe Bay oil fields compared to more remote sites during winter (Pamperin, 2008; Lehner, 2012). Once uncommon, red foxes now occupy more den sites in Prudhoe Bay than arctic foxes and this shift has been linked to red foxes preference to den near facilities (Stickney et al. 2014). Injury and mortality from collisions with vehicles, structures, and wires and from contaminant exposure (including oil spills) could also occur at all phases, but would likely peak during drilling and operations.”
- Page 3-92, Paragraph 7: The statement, “Exploration occurs during winter and would have little direct effect on birds” may be incomplete if cleanup activities would occur during the snow-free season in relation to exploration. Please address how cleanup operations may impact migratory birds during the snow-free season. These impacts should be acknowledged and the effects should be analyzed
- Page 3-94, Paragraph 6: The statement, “Drawdowns may cause fish mortality, and lack of fish would make such lakes unsuitable for breeding loons” is incomplete. Most birds using aquatic habitats in the program area feed on aquatic invertebrates. The sentence before states, “Withdrawing water from under ice could ... possibly result in some ... impacts on aquatic invertebrate communities”; therefore, the effects to species that feed on invertebrates should be discussed. Please change to, “Lack of fish would make such lakes unsuitable foraging habitat for some loons. Lower invertebrate abundance, or a shift in invertebrate diversity, may affect the quality of ponds as a food source for birds in general, particularly waterbirds and shorebirds.”
- Page 3-94, Paragraph 6: The statement, “The long-term loss of nesting lakes would have potential population consequences for loons, primarily for Pacific and red-throated loons; yellow-billed loons in the Arctic Refuge nest primarily in the northern foothills of the Brooks Range and outside of the program area” is unclear, and may be incorrect depending on how interpreted. Yellow-billed loons are considered a rare breeder on larger lakes in the Brooks Range. Unlike other loons, red-throated loons leave breeding territories to forage during incubation and while rearing chicks. On the Arctic



Coastal Plain, these birds generally forage in the marine environment (See Barr et al. 2000, Uher-Koch 2017). In addition, the limiting factors of loons breeding in the program area is unclear, therefore the statement that the loss of a few nesting lakes could have broad population consequences seems somewhat unfounded. It is also unclear if the intention of this sentence is in regards to the loss of fish from lakes or from loss of nesting habitat through drying of lakes. Please consider providing citations to support, or change to, “The loss of nesting lakes by drying could have potential local population impacts for Pacific and red-throated loons.” If the sentence is only meant to convey the effects to loons of loss of fish from breeding ponds, please also remove the reference to red-throated loons because they generally feed in the marine environment during the breeding period.

- Page 3-95, Paragraph 1: The statement, “the impact [of gravel mining] on birds would be long term and somewhat ameliorated by reclamation plans (i.e., terrestrial breeding habitats could be replaced by aquatic habitats)” is incomplete as the species groups that are likely to use gravel pits filled with water will be different from those originally displaced. Suggest changing to, “the impact on birds would be long-term. Reclamation may reduce habitat loss if pits are fully transferred back to tundra, but reclaimed tundra is of lower value to breeding shorebirds and passerines compared to unaltered habitat (Bentzen et al 2018). If pits fill with water, habitat loss may be permanent for the species originally inhabiting the site, but could provide new habitats for waterbirds (i.e., terrestrial breeding habitats could be replaced by aquatic habitats).”
- Page 3-95, Paragraph 2: The following statement may be incorrect as written: “Future construction of gravel pads and roads would result in potential long-term direct loss of habitat and indirect alteration of habitat. Direct losses from gravel coverage (up to 2,000 acres allowable) would last as long as development projects are active, or until gravel is partially removed from retired roads and pads to restore some habitat features; this is estimated to be 85 years after the first lease sale before all facilities described in the hypothetical development scenarios are abandoned and reclaimed.” Gravel pads would always lead to direct loss and potential indirect alteration of adjacent habitat. The above states habitat losses would only occur as long as the project is “active”, but this term is undefined and direct loss from gravel coverage would last until gravel is removed. Reclaimed sites in Prudhoe Bay do not provide shorebird and passerine habitat comparable to that found prior to development (Bentzen et al. 2018). Please consider changing to, “Gravel pads and roads would result in the long-term direct loss of habitat and potential indirect alteration of habitat. Direct losses from gravel coverage would last until gravel is removed. In the hypothetical development scenarios, the gravel is predicted to be removed from all facilities 85 years after the first lease sale. Shorebird and passerine habitat quality is expected to be lower for at least 10 years for reclaimed sites (Bentzen et al. 2018).”
- Page 3-95, Paragraph 5: The statement “Potential effects on waterbirds would be minimized by using the shortest road routes and smallest pads” is incomplete as written. Densities of waterbirds and shorebirds is generally greatest in wetlands on the ARCP (Bart et al. 2012). Because here we are comparing the effects of 2000 acre development scenario as described by the Tax Act, making pads smaller wouldn't minimize the effect (i.e. 2000 acres would always be affected). The statement would only be accurate if applied specifically to minimizing footprints in wetlands. Please change to, “Potential effects to waterbirds and shorebirds would be minimized by minimizing footprints in wetlands where densities are generally highest (Bart et al. 2012).”
- Page 3-95, Paragraph 5: The statement, “Such habitats support higher densities of landbirds and impacts on these species could be greater as a result” is incomplete. Some species of waterfowl and shorebirds occur in higher densities in uplands and well-drained habitats composed of moist and shrub tundra on the ARCP (Bart et al. 2012). Lapland longspurs, the most abundant passerine



breeding in the ARCP, occur at somewhat higher densities during the breeding season in wetlands on the ARCP (Bart et al. 2012). Please change to, “Such habitats are important to landbirds and some species of other guilds. Impacts to these species may be greater as a result.”

- Page 3-95, Paragraph 7: Sea duck densities in coastal areas during the non-breeding season are related to habitat features including wind and wave exposure and substrate type (Esler et al. 2000). Common eider seek foraging habitats where food was most abundant, therefore not all habitat is of equal value (Larsen and Guillemette 2000). Sea ducks also deplete preferred foods when concentrated (i.e., as occurs during molt), causing birds to seek out new foraging sites (Guillemette et al. 1996). Given this information, please provide citations to support the statement, “Although high numbers of birds use the lagoons, they are highly mobile and likely would be able to move to adjacent similar areas if necessary” or remove.
- Page 3-95, Paragraph 7: ARCP mudflats are used by a large number of post-breeding shorebirds with up to 4,000 semipalmated sandpipers documented at some deltas in late July to mid-August (Brown et al. 2012, Churchwell 2018). If barging and screeding or other nearshore activities may affect habitat availability or quality into the late summer, large numbers of shorebirds may be affected. Please address this if it is applicable for the proposed activities.
- Page 3-95, Paragraph 8: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Alaska Beaufort and Chukchi Seas, as well as the program area. Please remove, “Long-tailed ducks made up 80 percent of the birds on surveys during late summer and fall in nearshore waters of the Beaufort Sea (Fischer et al. 2002). Other species included many of those potentially breeding in the program area, plus common eiders and scoters” and replace with, “Lagoon and near-shore surveys of post-breeding and molting waterbirds were conducted across the Alaska Arctic coast during fall 2002-2003 (Lysne et al. 2004). Up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and Pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Arctic Refuge coast. Over 28,000 long-tailed ducks were counted in the lagoons and nearshore waters along the Refuge coast in some years”.
- Page 3-96, Paragraph 3: This paragraph is incomplete. It discusses a variety of winter work that may impact resident birds, but does not consider that some cleanup from wintertime travel and construction is generally necessary during the snow-free season. If any summer or fall cleanup will occur because of seismic, construction, or winter travel, this section should include a discussion of potential effects here.
- Page 3-97, Paragraph 3: Impacts to bird densities from chronic disturbances are poorly studied in Arctic Alaska. Studies outside the Arctic found bird densities increased for some species and decreased for others in relation to oil and gas infrastructure (Walker et al. 2007, Bayne et al. 2008, Dale et al. 2009, Gilbert and Chalfoun 2011, Kalyn Bogard and Davis 2014, Ludlow et al. 2015). Please provide citations to support the statement, “Potential impacts of disturbance and displacement ... are unlikely to affect ... nesting densities of breeding birds”, or remove the reference about impacts to bird densities. Please consider changing the sentence to, “Potential impacts of disturbance and displacement by summertime construction and operations on the tundra would be long-term and may affect nesting success for some birds near facilities; however, they are unlikely to significantly affect regional or global population sizes.”
- Page 3-97, Paragraph 5: The survey (Fischer et al. 2002) was conducted along a small portion of the Alaska Arctic coast outside the program area and more applicable surveys (i.e., Lysne et al. 2004) are available that covered most of the Beaufort and Chukchi Seas in Alaska, as well as the program



area. Please change the latter two sentences in this paragraph to, “Common eider are the predominant species nesting on barrier islands and using associated nearshore areas during breeding (Kendall 2005). In aerial surveys of the lagoons and nearshore areas, surf scoters were the predominant species encountered in June and early July and long-tailed ducks in late July and August (Bollinger and Platte 2012, Lysne et al. 2004, Pearce et al. 2018). Long-tailed ducks use the lagoons during their flightless feather molt (Lysne et al. 2004).”

- Page 3-98, Paragraph 3: This paragraph primarily discusses how development of the ARCP may lead to increased air traffic in Deadhorse for transport of personnel. Although increased traffic through Deadhorse seems likely, moving personnel by fixed wing aircraft may also impact other sites. Airports at Barter Island and Kavik may also experience more flights since these airports would place staff closer to the Refuge (although still not within the ARCP). In order to move these staff during the snow-free season to duty stations within the program area, some additional means of transportation would be needed. Airports and roads may need to be built within the ARCP, and/or thousands of helicopter flights might be needed, all of which may impact birds. Please consider changing this paragraph to, “All types of air traffic could disturb and displace both breeding and non-breeding birds. Air traffic would include fixed-wing aircraft into Deadhorse, Kavik, and Barter Island airports; helicopters to move people and supplies from airports to sites within the program area, and potentially fixed-wing aircraft traveling in the program area if new airports are built on the ARCP. Potential impacts on birds would be both short- and long-term.”
- Page 3-98, Paragraph 6: The statement “Vehicle and aircraft traffic and tall structures, including communication towers and drill rigs, pose collision hazards that could kill or injure birds” is incomplete. Transmission and guy wires are an equal or greater collision risk (Manville 2005). There are limited data to support the hypothesis that structure height is a significant predictor of collision risk in the treeless tundra ecosystem of the Arctic. Please change to, “Vehicle and aircraft traffic; structures, including communication towers and drill rigs; and wires pose collision hazards that could kill or injure breeding, staging, or migrating birds.”
- Page 3-99, Paragraph 2: The statement, “Collisions with tall structures increase with tower height, bright lighting, and the presence of guy wires (Manville 2005; Gehring et al. 2011)” is incomplete. Perhaps the most important results in the citations provided is that risk of tower collisions is greatest when near wetlands or in migration corridors, but this is not included in the current text. Please change to, “Collisions with structures increase with height, bright lighting, guy wires, and when structures occur near wetlands or in migratory corridors (Manville 2005; Gehring et al. 2011).”
- Page 3-99, Paragraph 3: The statement, “Collisions would be expected to occur annually in small numbers, but mortalities could be serious if flocks of birds of conservation concern are involved” does not appear to be well supported. Collisions with towers are estimated to kill millions of birds annually (see Manville 2005). Please provide citations to support that collisions are expected to occur in small numbers, or change to, “Collisions are expected to occur annually and the number of birds likely injured or killed is unknown.”
- Page 3-99, Paragraph 3: The following statement is unclear: “The potential impacts of collisions are short term, infrequent, and seasonal but would occur throughout the life of any development project and would be restricted to roads and facilities.” The effects of collisions are often permanent and result in death. Frequency of collisions would depend on a host of factors including season, number of birds moving through an area, and weather. In some situations, dozens or more collisions occur in any given day. Collisions may also occur with aircraft anywhere in the program area. Please consider changing to, “Collisions would vary by season and occur throughout the life of any development project”.



- Page 3-99, Paragraph 6: The following statement is incorrect: “Potential salt-water spills would not be toxic to birds but would likely kill vegetation in the spill zone and thus alter habitat.” Many species of birds are not tolerant of ingestion of saltwater and others are not tolerant to its ingestion for extended periods or during certain parts of their life history. For example, despite their ecology, plovers and sandpipers lost weight when provided 0.3 M NaCl for drinking water, half the concentration of normal seawater (Purdue and Haines 1977). Even species that spend most of the lives at sea, like common eider, risk mortality if provided only saltwater during the brooding period (Devink et al. 2005). Please change to, “Potential salt-water spills would likely kill vegetation and invertebrates, and could be toxic to birds.”
- Page 3-101, Paragraph 3: The statement, “Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds in tundra habitats could occur over about 2 percent of the area available for leasing” may not completely describe the potential areas impacted if large portions of the 2000-acre footprint are linear features. Please consider changing to, “Alternative B would occur over 1 percent of the entire program area. Potential disturbance and displacement of breeding birds would depend on the orientation of the footprint and amount of linear features.”
- Page 3-101, Paragraph 5: The following statement is inaccurate, “Fall staging snow geese are an important exception, as the area closed to leasing overlaps extensively with areas historically used by the largest numbers of fall staging snow geese in the program area.” There are no areas closed to leasing in Alternative C. A substantial portion of area heavily used by snow geese in the 2000s occurs in areas with standard terms and conditions (Kendall 2006). Please change to, “Fall staging snow geese are an exception, as the area of NSO overlaps with many areas used by the large numbers of fall staging snow geese that use the program area (Kendall 2006).”
- Page 3-101, Paragraph 7: The statement, “With Alternative C, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would be similar to Alternative B” is incomplete. An important feature of Alternative C, compared to B, is that more wetlands and moist tundra would be afforded protections through NSO along the coast and from increased buffers around those rivers most important to breeding waterbirds and shorebirds (e.g., see Brown et al 2007). Please consider changing to, “With Alternative C, potential long-term loss and alteration of the most heavily used bird habitats (wetland and moist tundra) from direct and indirect effects of gravel deposition would be somewhat less than Alternative B (the entire area is available for leasing) and would occur over approximately 1 percent of the program area; disturbance and displacement could occur over about 2 percent or more of the program area.”
- Page 3-102, Paragraph 1: Oil spills in riverine, deltaic, and lagoon habitats has the greatest likelihood of high impact to waterbirds. For this reason, Alternative D that includes the highest setbacks from waterways for refueling operations and that maximizes no surface occupancy for these habitats, will provide some protections for migratory birds. Please update the text to reflect this information.
- Page 3-102, Paragraph 2: The following statement is incomplete: “Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, somewhat more protective of avian habitats in riparian areas.” The larger river setbacks in Alternative D would also provide some protections for habitats adjacent to riparian areas, such as wetlands. Please consider changing to, “Alternative D includes some larger setbacks than Alternatives B or C for riparian areas and is, therefore, more protective of avian habitats in riparian areas and other important adjacent habitats such as wetlands.”



- Page 3-102, Paragraph 3: The following statement is incomplete: “however, the various NSO areas with Alternative D would be protective to many important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, and coastal habitats.” During the breeding season, shorebird, waterfowl, loon, and larid densities are highest in wetlands (Brown et al. 2007, Bart et al. 2012). Even lapland longspurs, the most abundant passerine in the ARCP, occur at somewhat higher densities in wetlands compared to drier sites (Bart et al. 2012). Within the ARCP, wetlands are generally most abundant along rivers and river buffers are largest for Alternative D. Therefore, Alternative D provides more NSO coverage of wetlands adjacent to rivers than Alternative B or C. Please change to, “however, the various NSO areas with Alternative D would be protective to the most important avian habitats, including riparian and stream habitats, Canning River delta water bodies and wetlands, lagoon and barrier island habitats, river deltas, wetlands associated with rivers and coastal habitats.”
- Page 3-102, Paragraph 3: The following statement is incomplete: “All these no lease areas, NSO areas, and CSU areas would potentially reduce impacts on birds. As with Alternative C, nearly all of the area closed to leasing are in the area of low HCP and in inland and drier habitats.” No areas are closed to leasing in Alternative C. Please change to, “All these no lease areas, NSO areas, and CSU areas would likely reduce impacts on birds. Nearly all of the area closed to leasing is in the area of low HCP and in inland and drier habitats.”
- Page 3-102, Paragraph 6: The statement, “Under Alternative D, potential long-term loss and alteration of habitat from direct and indirect effects of gravel deposition would occur over approximately 1.6 percent of the area available for leasing (1,037,200 acres). Disturbance and displacement could occur over about 3 percent of the area available for leasing” is confusing and makes it difficult to compare potential impacts for the various Alternatives. Recommend deleting this paragraph or maintaining a consistent denominator (i.e., the program area) for all alternatives. Specifically, we recommend that the comparison be the percent of the project area, not the leased area that would be affected by each alternative. Another way to present this is the total number of acres potentially altered under each alternative. Either of these would provide a more accurate comparison across alternatives than the current approach.

## **Wilderness**

- Recommend under Oil and Gas Field Abandonment, all alternatives specify that before final abandonment, all impacted areas should be reclaimed to a point where the area is again eligible for designation as Wilderness.
- Page 3-211: The statement about Wilderness recommendation beginning with “In the Arctic Refuge CCP...” should read, “...the USFWS recommended and the President recommended the lands in the program area for wilderness designation.”
- Page 3-216: Recommend changing the first sentence of second paragraph to read “. . . naturalness, wildness, and symbolic values of an area that may be affected . . .”
- Page 3-216: Recommend changing the 3rd sentence under Alternative A to read, “Current USFWS management focuses on no or minimal manipulation of the environment, wildness, and promoting...”
- Page 3-216, 3rd full paragraph, last sentence: Recommend changing to read “. . . and, therefore, would affect an area’s . . .”



- Page 3-216, under Alternative B, line 7: Recommend changing “...would likely retain its overall wilderness character to “. . . would likely retain some of its overall wilderness character”, as the wilderness character would be lost to some degree.

### **Water Quality and Quantity and the Diversity of Aquatic Habitats and Species**

- F-18, F.4.10: Recommend the types of impacts under drilling and operation be expanded to include reinjection of waste/hazardous waste. Impact indicators should include ground water quality.
- F-18, F.4.10: Recommend the types of impacts under barge docks and seawater treatment plant construction and operation include alterations of water temperature, salinity, and currents, as well as sediment deposition.
- F-17, F.4.10: Construction and maintenance of gravel pads, roads and air access facilities can alter wetland area and extent, and can lead to inundation and starvation of tundra. Recommend these impacts be listed under impact indicators.
- Page 3-51, 3.2.10: Tiering the impacts on water resources to BLM’s documents (NPR-A 2013, NPR-A 2004a, BLM 2018) is inappropriate in many cases as impacts in the Arctic Refuge 1002 Area will be different due to the many differences between the 1002 Area and the developed areas in the NPR-A. For example, in the Arctic Refuge 1002 Area, water is relatively scarce, the terrain is steeper, and major groundwater-fed springs are extremely important. Recommend removing language related to the assumption of impacts where appropriate.
- Page 3-51, Affected Environment: Please add “topography” to controlling forces.
- Page 3-51, Affected Environment: Add “Annual total precipitation averages a little greater than 6 inches of liquid equivalent.” Source: WRCC 2018a. Historical Climate Summaries. <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak0558>. This is directly from Section 3.2.1, and is relevant in this section because the precipitation in the Arctic is that of a desert.
- Page 3-51, Affected Environment: Hydrology, freeze-up and break-up are described repeatedly, but there is little discussion of summer streamflow conditions. Streamflow diminishes after break-up. Many streams and rivers become discontinuous due to limited summer precipitation and/or distribution of channels as they cross the coastal plain. Recommend the Affected Environment be expanded to include a robust discussion of summer streamflow and hydrologic conditions.
- Page 3-52, Watersheds, Rivers and Streams: The overview of freeze-up and break-up are of a general nature for north slope rivers and streams covering timing of annual flow, but lacks site specific knowledge of the coastal plain rivers and streams in which the topography, springs, and auries are significant to the hydrology. For example, as the Hulahula River flows north from Fishhole 1, the single channel distributes into several braided channels. Often the flow within the braided channels goes subsurface or is intermittent. The data in table H-5 indicate that streamflow in several rivers diminishes significantly after break-up, but does not show that flow in several of the gaged rivers becomes intermittent (West Fork Tamayariak, West Fork Itkilyariak and Sikrelurak would be examples). The topography of the coastal plain and morphology of rivers and streams of the coastal plain differ from that of the NPR-A. River channels distribute into many channels as the flow north from the mountains or foothills. As a result, surface flow during the summer months diminishes and may be intermittent at times or in specific locations (Table H-5). Recommend including a map that highlights the hydrology of the coastal plain.



- Page 3-52, Lakes and Wetlands: Insert “due to the topography” before the statement, “lakes are very scarce...”
- Page 3-53: Insert a comma in the heading between “Groundwater” and “Springs and Aufies”. Springs (groundwater) provide significant year round habitat for aquatic resources.
- Page 3-5: Flow paths of groundwater and spring recharge within and adjacent to the coastal plain are poorly understood. We recommend the EIS consider the effects of reasonably foreseeable development activities on groundwater flow paths, evaluate the risks associated with reinjection of hazardous wastes into subsurface aquifers, and develop stipulations for leasing to avoid and minimize the potential contamination of springs. For additional information on subject see Kane et al. (2013).
- Page 3-53: Add “Tamayariak and Okerokovik” to the springs identified in this section.
- Page 3-54, Water Rights: Text incorrectly states, “...and over 360 Instream Reservations completed and pending under the USFWS. While the Instream Reservations have not been issued as a water rights permit, those applications would have seniority over any new applications received by ADNR.” Please correct and replace the portion of the text in quotation marks with the following, “...the Service has applied for 152 Instream flow Reservations within the Refuge and project area to ensure the protection of aquatic habitats and wildlife. These reservations have been pending ADNR adjudication since 1994 and have seniority over any new application for water use.”
- Page 3-55: Edit the header of the first bullet list to include “ground water quality.”
- Page 3-55: Add the following to the list of activities that will affect the hydrology and water quality: injection/reinjection of waste, drilling muds, and other contaminants.
- While Map 3-12 includes streams in which anadromous fish presence has been documented, and springs that contain resident Dolly Varden and Arctic Grayling, it needs to more clearly indicate that the Canning River supports the greatest diversity of anadromous and freshwater resident fish species in the area: it is not clear from the icons used.
- The caption for Table 3-17 suggests that this list of streams includes all fish habitat in the Program Area, yet it only identifies rivers that are classified as anadromous waters and ignores springs such as Sadlerochit Spring that supports resident Dolly Varden and Arctic Grayling. If this table is intended to be a comprehensive list of fish habitat, as the caption suggests, it should identify the rivers, springs, and lakes in the program area that support fish. The associated map (Map 3-13) does not convey much meaningful information. Please consider presenting a figure that illustrates stream monitoring locations.
- General to mapping springs, fishery resources, and water resources: Sadelrochit Springs is not a direct tributary to the Sadelrochit River. It originates west of the Sadlerochit River and is a tributary to the Itkilyariak River. Recommend correcting this information where appropriate.
- Page 3-58: Under “Changes to Surface Water Quality,” change to “...dust fallout from vehicle traffic could increase turbidity *and contaminant loads* in ponds...”
- Page 3-58: The reference to BLM 2012 4.5.4.2 is not relevant to the 1002 area and does not present an analysis or discussion, as it simply states that impacts are not long-term and provides no supporting data. Recommend deleting the statement or providing a more appropriate reference if the statement is retained.



- Page 3-58, Last paragraph: It should be stated that erosion and thermokarst related to development activities will have long-term impacts on surface water quality.
- Page 3-59: Under “Changes to Marine Waters” and elsewhere in the document: we question that the effects of an oil spill would be “short-term and localized,” And recommend that you remove this statement. Effects and damages from an oil spill depend entirely upon the circumstances of the spill, including material type, volume, spill response capability, weather, and sensitive resources in the area of the spill.
- Page 3-59: It cannot be assumed that water will be recharged during snowmelt because of stipulations in place. Adequate recharge depends on several factors including connectivity, watershed area and snow water equivalent. Many isolated lakes in small watersheds have very limited recharge capacity and may not be fully recharged during snowmelt after water withdrawal, especially during low snow years. For more information on “recharge vulnerable” lakes in the NPRA, see Figure 6 in Jones et al. (2017). More than 50% of the lakes presented in this study are considered recharge vulnerable. An even greater proportion of the lakes in the 1002 Area of the Arctic Refuge are likely recharge vulnerable. Recommend this information be incorporated in the document as appropriate.
- Page 3-59: Insert, “Infrastructure and operations will result in permanent changes to permafrost resulting in thermokarst and irreversible impacts to overland flow and shallow groundwater.”
- Page 3-59: In the impacts analysis section, the discussion on impacts to groundwater is limited to gravel mining impacts to subsurface flows. The potential impacts to deep groundwater flowpaths that support perennial springs are not mentioned. Deep groundwater sources and perennial springs are very important in the 1002 Area. Perennial springs have very different chemistry, thermal regimes, and ice phenology compared to other water bodies in the Refuge (See the Arctic Refuge Comprehensive Conservation Plan 2015 or papers by Alex Huryn for more information). Recommend the discussion on impacts to groundwater be expanded to include deep groundwater flowpaths and their influence on perennial springs.
- Page 3-59: In the impacts analysis section, note that contamination related to injection of hazardous wastes in subsurface areas and fracking could have major irreversible impacts to the ground and surface water quantity and quality and could impact major spring-fed systems that are important for wildlife and subsistence users. This is an important piece of information for subsistence hunters.
- General Analysis Comments for water resources and aquatic communities:
  - Be explicit about what offshore actions are planned so that these can be considered in the range of effects.
  - Total projected ice road use should be presented under development scenarios. It is expected that ice road use could increase greatly under Alternative B. Without assessments of ice road use under all alternatives, it is not possible to adequately conduct analyses of the impacts of development on vegetation, fish, other aquatic species, birds, soils, and water.
  - We recommend the feasibility of using freshwater resources (versus using groundwater or a seawater treatment plan) be more rigorously analyzed within the different alternatives. This information is necessary to develop an appropriate analysis of the impacts of development on water resources, fish, and other aquatic species.



## **Air quality**

- The DEIS states that the location, timing, and level of future oil and gas development on the Coastal Plain is unknown at this time and that a qualitative air analysis is being performed. In the other Alaska projects mentioned in this section, quantitative analyses have been performed using a low, medium, and high projected level of development. This type of air analysis has provided informative data to the decision makers and the public. Additionally, further project specific air analysis can tier off of the quantitative air analysis. We recommend that Appendix B., Reasonably Foreseeable Development Scenario for Oil and Gas Resources, which quantifies the most likely unconstrained projected oil and gas baseline development scenario for the Coastal Plain, be used as a basis for a quantitative air analysis and to serve as a general estimate to determine the air quality impacts due to leasing and development.

## **Hazardous Materials**

- F-18, F.4.11 Actions affecting the resource should include injection of hazardous fluids.
- Section 3.2.1, Page 3-5, first two lines: The DEIS states, “For example, a significant fraction of CO<sub>2</sub> emitted by human sources each year is taken up by the biosphere, which is gaining mass in response to the emissions.” Please remove this line as a significant fraction of human-sourced CO<sub>2</sub> is also not sequestered by the biosphere, resulting in increasing CO<sub>2</sub> atmospheric concentrations and increasingly obvious patterns of climate change effects, particularly in the Arctic.
- In multiple DEIS sections (e.g., Water Resources, Terrestrial Environment), description of impacts from “dust,” “fugitive dust,” “erosion,” “scour,” and “sedimentation” need to include the potential for exposure of terrestrial and aquatic biological communities, and subsistence users that rely on those, to contaminants of concern including heavy metals. Such exposure may occur through earth-disturbing activities (depending on the underlying geology) and along roadsides (from vehicle traffic).
- Thawing permafrost may also mobilize previously-sequestered contaminants, including mercury (Schuster et al. 2018, Ryder et al. 2010). Additionally, wetlands created through thawing of permafrost add to the mercury methylation potential of watersheds. Throughout the DEIS, many post-leasing activities are described as having the potential to thaw permafrost without mentioning these significant related potential effects. Please correct as appropriate throughout the document.
- Page 3-61, first bullet list: Clearly list other hazardous materials by chemical name, as has been done for methanol, propylene glycol, and ethylene glycol. Include the constituents of the industrial product types that are currently listed.
- Page 3-62, Paragraph 1: This analysis should use all of the most recent information to describe past spill frequency and volume, not just information in BLM 2014, Section 4.5.2, including all information in the National Response Center (NRC) database (at <http://nrc.uscg.mil/>).
- Oil or other hazardous spills within the Arctic National Wildlife Refuge Coastal Plain are low probability, but high consequence, events. We agree that the probability for a large oil or other hazardous material spill is low, as discussed on page 362. However, the consequences of even small (pages 3-61–3-62) spills in the otherwise pristine environment would result in significant changes from the environment as it is currently managed for non-extractive Refuge purposes. Except for areas outside the area boundaries (e.g., DEW Line sites, Kaktovik), the Coastal Plain of the Arctic Refuge is perhaps the only Arctic region on the planet that has not experienced industrial activity and subsequent contamination, as demonstrated by baseline contaminants data (Snyder-Conn and



Lubinski 1993, Vols. 2 and 3). Therefore, this EIS should discuss the consequences of an oil or hazardous material spill due to post-lease activities within the unimpacted portion of the action area, on all potentially impacted resources (water, soil and sediments, biota including microbes, invertebrates, plants, fish, and FWS trust resource birds and mammals).

- The DEIS does not clearly discuss the risk of spills in the marine shipping lanes, from Unalaska to Kaktovik, which were identified as part of the project area. Recommend expanding the discussion of spill risk to all identified parts of the project area, see Ryder et al. 2010; Schuster et al. 2018; Snyder-Conn & Lubinski 1993a & 1993b.

## **Vegetation and Wetlands**

- Page 3-71: Long-term impacts (>20 years) of ice roads and snow trails are described, but there is not a similar discussion describing the short-term impacts. Impacts lasting even one or two years will have effects on wildlife and visitors, and perhaps more significant indirect impacts on soils, hydrology, etc. Short-term impacts need to be identified and addressed in the document as appropriate.
- Page 3-65-66: Overall this section is very difficult to follow or interpret. The headings in the discussion section do not match those in the map. For example, in the text there is a section heading “Moist Herbaceous Meadow”, and there is no corresponding heading in the map legend. It appears this may be the “Herbaceous (mesic; northern and western Alaska)” on the map but there is no discussion that allows the reader to understand how the text translates to figure 3-10. Appendix J states the information was pulled from Boggs et al. (2016). We recommend rewriting Appendix J and Section 3.3.1 pages 3-65 and 3-66 to reflect the structure in Boggs et al. (2016) and provide descriptions in Appendix J of the “Fine Scale” cover classes in the original source. See the text below as an example:

### Herbaceous (mesic; Northern and Western Alaska)

Text describing this cover class.

### Fine Scale cover classes

Herbaceous – Dwarf Shrub

Vegetation description and relevant information

Leymus

Vegetation description and relevant information

Herbaceous Mesic

Vegetation description and relevant information

- Page 3-67 and 3-68: Recommend using 1:63,000 map to assess wetlands instead of coarse scale analysis. At a minimum there should be definitions included in Appendix J for each wetland class. “National Wetlands Inventory Notes to the Users for North Slope 1:63,000” information sheet has definitions and a key for map codes.
- Page 3-39, Wetland Functions and Values: We recommend the section be removed or revised. The section makes one statement at the beginning relative to the affected environment in the first line of the first paragraph. The remainder of the section refers to mitigation and wetland functional assessments that are a part of that mitigation and not the affected environment. Any statements as to the value of functional wetlands in the context of Berkowitz et al. (2017) should be reconsidered



since that reference states, “This method does not identify the importance of wetlands within a watershed, measure specific wetland functions, or determine sufficiency for mitigation on its own. This methodology can be used to inform project alternatives, assess unavoidable impacts, and aid in the determination of sufficiency for mitigation.” We suggest the author rewrite this section to describe the influence wetlands currently have on the system in general or cite specific papers that evaluate Arctic wetland functions and their role in Arctic systems. This will need to be done at a very high/coarse level given there was no analysis of the finer scale National Wetland Inventory products available at the 1:63,000 mapping scale.

- Page 3-69, Paragraph 6: “Relative to wetlands in temperate regions, North Slope wetlands tend to have low function for most of the hydrologic, biogeochemical, or social functions.” Please provide a citation for this statement. Additionally, this appears to be an inappropriate comparison as functional assessments are completed at the local scale and functional values are not comparable. If one uses the hydrogeomorphic classification (Brinson, 1993), a wetland is compared against another wetland characteristic of the same class so comparison with temperate regions would also be inappropriate.
- Page 3-72, Rare and Invasive Plants: For both the impact to rare plants and the probability of introduction of invasive plants, impacts might be equal across all alternatives for the actual disturbance footprint; however, the analysis should take into account the scale of each alternative. For example, under Alternative B there may be an equal probability across the entire program area for the introduction of invasive plants and destruction of rare plants, however, under Alternative D there is an extremely low probability in the no lease sale area for the introduction or destruction of plants because there will be no disturbance in this area.
- Page 3-72, Alternative B: “...Alternative B is herbaceous (mesic) tundra, ranging from 16.4 percent in high HCP to 39.9 percent in low HCP areas...” Maximum value is 42.5 under Medium HCP TL section of Appendix J table J-3. Please correct in the Table and text as appropriate.
- Page 3-73, Alternative B, Paragraph 4: “The NSO protections preferentially preserve wetter more vulnerable vegetation common to riparian areas ...” This statement runs contrary to “Impacts affected drier, well-drained, woody shrub vegetation types to a greater degree...” from the impacts common to all alternative section above. It is not clear where the author argued that wetter sites/riparian area were “more vulnerable”. Given that riparian areas tend to be high disturbance environments, a description of those vulnerabilities should be provided. Please provide further explanation of why and, or how NSOs preferentially preserve these areas.
- Page 3-73, Alternative B, Paragraph 5: The document states, “Because of the higher incidence of low shrub vegetation ...” but fails to provide any points of comparison. Suggest rewording to “... higher incidence of low shrub vegetation in the central and eastern portion of the project area...” or something similar.
- Page 3-73, Alternative B, Paragraph 6: “The wetter types occurring in the broad freshwater emergent class are often higher functioning wetlands but were not delineated separately in the NWI mapping used in this analysis.” Because “higher functioning” is not defined, we recommend rewording as “more productive,” if that is what the author intended. Additionally, it is likely many of these habitats are delineated by using the ATTRIBUTE designation instead of the WETLAND\_TY (type) in the NWI data layer. Also see previous comment on page 3-69, paragraph 6 regarding the use of “functioning” for wetland value.



- Page 3-73, Alternative C: The source of the following statement is unclear: "...herbaceous (mesic), ranging from less than 0.1 percent to 37.4 percent of the areas open for leasing, and tussock tundra, ranging from less than 0.1 percent to 41.1 percent ...". Appendix J table J-5 has Herbaceous (mesic) values ranging from 20.9 to 56.3 and Tussock tundra ranging from 4.7 to 44.2. Please correct if the values are inaccurate or provide a citation if values are from some other data source.
- Page 3-74, Alternative C, Paragraph 2: "The vulnerable wet tundra types in the NSO riparian areas under Alternative C are protected to a limited extent, depending on the specific design of an anchor oil field development and whether stream crossings are approved." The document will be clearer if a specific stipulation for the statement is cited given that Alternative B states, "This restriction, however, would not preserve vulnerable vegetation or wetland types because construction would be permitted outside the TL period and would still affect vegetation and wetlands" and it does not appear that any of the stipulations in Alternative C completely prevent development.
- Page 3-74, Alternative C, Paragraph 3: "The NSO requirements for Alternative C effectively protect high-value estuarine wetlands (see discussion under *Affected Environment* and *Alternative B* above)." Contradicts Alternative B "*Impacts Common to All Action Alternatives*" would likely occur throughout the NSO/high HCP areas but to a lesser extent than in the standard terms and conditions or TL areas." Additionally, neither of these statements address what "effectively protect" means and it is not defined in the Affected Environment section. Please clarify this statement or providing specific examples of how this protection is "effective".
- Page 3-74, Alternative D, Paragraphs 4-6: There are multiple references to high and low-value wetlands and habitats, however, these terms or the method with which the value was determined is not stated. Please elaborate on the methods for determining value of habitats.
- The type descriptions on page J-2 are incomplete. Within each of the four types described, not all subtypes (e.g., those show on the tables) are described. The descriptions should include ecological information, for example 'commonly occurs of low-centered polygons', or 'with lots of permafrost features such as frost boils'. Refer to the vegetation type descriptions in the Arctic Refuge CCP for examples.
- Tables J-1 to J-7. Please consider arranging the table a hierarchy, with land cover types divided into shrub-dominated, moist herbaceous, wet herbaceous, and other (barren, sparse and water), following the style of most vegetation classification systems, including The Alaska Vegetation Classification (Viereck et al. 1992) rather than listed in alphabetical order. For example, under wet herbaceous meadow would be listed 3 types: 'herbaceous (wet), herbaceous (marsh), and herbaceous (wet-marsh)'. It is typical to list the most common land cover type first. Then on page J-2, under the heading 'wet herbaceous meadow', all 3 types would be described, with the most common one described first. Right now, that paragraph on page J-2 describes only the 2 types that cover <1% of the study area. The third type that fits in this category (herbaceous (wet)), which covers 16% of the area as mapped, is currently not described. It includes large areas of wet tundra that are not in lakes or on edges of lakes or coast. Consider describing it first, followed by the two less common types.
- The category 'moist herbaceous meadow' includes moist tussock sedge tundra (26% of area) and 'herbaceous (mesic)', (31% of area). In the description on page J-2, the first two sentences describe the herbaceous (mesic), but most readers would not recognize or be familiar with that. Given that the type covers almost a third of the study area, consideration of a more detailed description is warranted.
- Appendix F, Section F.4.12, Vegetation Information: Information in the "Impact Indicator" is not consistent with how habitat changes are quantified for other resources throughout the DEIS. The



same difficulties exist for quantifying habitat changes for migratory birds (see page F-26) and caribou, but different wording is used. Please consider quantifying habitat changes similarly, and using common language, for the different resources impacted (e.g., vegetation, birds, and caribou).

- Tables starting on page F-19 repeatedly state “no indicator available to assess possible plant community changes.” When “no indicator available”, is stated in the DEIS, we recommend indicators be developed when practicable. For example, plant community composition can be quantified with field work.

### **Soil Resources**

- The DEIS does not mention the importance of intact soil and sediment microbial communities, which form the base of the food chain. As an example, during cleanup of oil spills (especially to land) natural remediation of unrecovered petroleum products is dependent upon soil microbes. We recommend that the DEIS evaluate practices that affect soil microbes, including compaction, gravel and sand extraction, and any intentional (chlorinated domestic water) or unintentional (hazardous material) spills that affects the soil microbial biome and could diminish recovery processes.
- Recommend including “Massive Ice” map from Jorgenson et al. (2015).

### **Physiography**

- There is no discussion about the difference in gradient and terrain between the 1002 and NPR-A and we recommend this information be included in the document. Differences in physiography are highly relevant given that the area is to be managed in a manner similar to the NPR-A yet the physiography is significantly different. Additionally, a comparative discussion between the two areas is appropriate given that there is significant comparison of water availability in Section 3.2.10.

### **Invasive Species**

- The Service has management authority for the conservation of a variety of trust resources including migratory birds, inter-jurisdictional fish, threatened and endangered species, and their habitats. Invasive species have the potential to negatively impact these resources. Therefore, we recommend the incorporation of appropriate control and management actions be taken to avoid and minimize adverse impacts associated with invasive species and encourage the development of an invasive species control plan for all phases of the proposed project. Additional general and specific recommendations for incorporation into the EIS are provided below:
- Recommend additional information about certified weed-free gravel and supplies for road corridor construction (e.g., hay bales, wattles, blankets) and pipeline construction should be recognized throughout the document where appropriate.
- The DEIS does not adequately address the threat of aquatic invasive species (e.g., Elodea) and how the transfer of aquatic plants from other infested water bodies in the state will be prevented. Please include a description of the prevention plan and describe the planned response to an invasive species introduction.
- Additionally, we recommend the EIS state how the proponent will prevent and respond to the introduction of the following types of invasive species that may be brought in on construction supplies and equipment:
  - invasive terrestrial invertebrates;



- invasive terrestrial vertebrates (e.g., rodents); and
  - marine invasive species.
- Page 2-36, Operating Procedure: Objective - Invasive Species Prevention: Please include the list of supplies in the requirements (not just equipment and vehicles). Please add boats, planes, and helicopters to the description of what is considered a vehicle as these are all considered vectors for introduction. We also recommend adding language related to monitoring at ports for invasive species at barges, air strips, and landing pads. Additional consideration and language specific to response to invasive species other than weeds should be considered in the EIS; the paragraph in the DEIS currently only discusses "weed control measures".
  - Page 3-67, Paragraphs 4 and 5, Nonnative and Invasive Plants: The statement "According to the ecological risk analysis conducted by Carlson et al. (2015), none of the documented species listed above are regarded as a significant ecological threat" is not accurate. Canada thistle and white sweetclover are ecosystem changers that stakeholders across the state are trying to prevent from spreading. The AKEPIC invasiveness rankings for those species are 76 and 81, respectively. A value of 70 or higher is recognized as a species of high concern that managers agree need action. The other species have rankings of 63 or less. This section also lacks any acknowledgement of species that are not yet in the Arctic or the Dalton Highway Corridor but could easily make it here. It is inaccurate to suggest that we are only concerned about the few species listed in the DEIS, and the concerns about species currently provided are downplayed. Please correct this information as appropriate.
  - D-3: Please add the National Invasive Species Act (Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (As amended through the National Invasive Species Act (NISA))). The NISA mandates the Service to provide leadership on national efforts to prevent the spread of aquatic invasive species. The NISA furthered Aquatic Nuisance Species (ANS) activities by calling for ballast water regulations, the development of State management plans and regional panels to combat the spread of ANS, and additional ANS outreach and research. Section 1204 of the Act authorizes the ANS Task Force to provide funding to states that have an ANS management plan. The NISA established the ANS Task Force to coordinate nationwide ANS activities.
  - Page D-6, Executive Orders: There is a newer Executive Order (EO) related to invasive species that should replace or be added to the current reference. Please use EO 13751.
  - Action Affecting Resources, Project Construction and Operations: The section appears to be focused on terrestrial plants. Recommend this section be expanded to include aquatic plants and terrestrial invertebrates.
  - Action Affecting Resources, Barging of Materials: Recommend this section be expanded to discuss possible introduction of rodents.

## **Visitor Use**

- Section 3.4.6: Preservation of recreational hunting, fishing, hiking and boating values and opportunities is an original purpose of the Arctic Refuge and is continued under ANILCA. The majority of visitors to the Refuge recreate within the project area. Recreational access and prohibitions before, during, and after leasing and surface activity (where people can/cannot expect to be able to go, and what they expect to be able to do/not do) is not adequately addressed for Alternatives B-D, though Alternative D minimizes indirect and cumulative effects upon visitor



experiences. The EIS should further explain how recreational access before, during and after leasing will be addressed under each of the Alternatives.

## **Visual Resources**

- Appendix A: We recommend that maps and figures be developed as part of a computer-assisted viewshed analysis using the BLM visual resource management system. Maps and figures should model foreseeable potential effects of typical layouts by showing expected changes in viewshed form, line, color, and texture of landform, vegetation, and water from: (1) suitable river corridors (including the Kongakut River, which is outside the project area, but which was found to have a scenic ORV); (2) Kaktovik; and (3) popular recreation areas. These models should identify the distances from which vertical structures could be detected. Maps modeling areas where changes to dark skies and wildlife abundance and, or distribution are foreseeable and could also be provided.

## **Acoustic Environment**

- Within the Acoustic environment, we recommend that the effects to natural quiet and the attempts to maintain natural quiet be discussed wherever natural sounds and noise are addressed.

## **Fish and Aquatic Communities**

The following corrections should be made to Table K-1, Appendix K-4 and K-5:

- Arctic Cisco habitat use description should delete the words "...freshwater and...", it is extremely rare to find an Arctic Cisco in freshwater at any time except during their spawning runs up the Mackenzie River. Here, it appears to read that one would be equally likely to find them in freshwater or marine environments, which is not accurate.
- Arctic Grayling spawn in the program area. While, they have rarely been encountered in the fyke net sampling programs that have been operated along the coast, all life stages are abundant in the freshwater drainages that support overwintering fish, including the Canning, Hulahula, and Sadlerochit, as well as in some lakes in the program area.
- The Arctic Grayling habitat use section should clarify that they live during all seasons in the program area. There are some streams such as the Tamayariak and Okpilak that they occupy during summer only, but those are rivers that share deltas with the Canning and Hulahula rivers, respectively.
- Burbot likely spawn in the program area. It is true that burbot have never been captured in the fyke net sampling programs that have been operated for more than seven years in the lagoon habitats of the program area and we are not aware of them being captured in the long-term fyke netting programs in Prudhoe Bay. However, they are present in the Canning River and large rivers to the west. Therefore, it is highly likely they spawn in the Canning River. They may spawn upstream from the 1002 Area boundary, but if that uncertainty is a concern, then the answer should be "probably" as to whether burbot spawn in the program area.
- Burbot habitat use description should indicate that as a freshwater fish they are present during all seasons in the Canning River, but not elsewhere in the program area. They do not migrate anywhere else for the winter as the column in the table currently reads.



- Chinook Salmon lifespan should be modified to read “4-7”, and age at maturity should be the same. They do not mature at age-1 or age-2, a small fraction may mature at age-3, but for the purposes of this general life history table, maturity at “4-7” would be appropriate.
- Chum Salmon lifespan and age at maturity should both read “3-6”. Age-4 and age-5 are the most common ages at maturity, but ages 3-6 are almost always represented as well in spawning runs.
- The Chum Salmon habitat use section should be modified by deleting the words “...and foraging...”. Similar to Chinook Salmon, Chum Salmon might forage a little in coastal marine water as they approach a spawning stream, but they would not be feeding if they were migrating upstream in freshwater.
- The Dolly Varden habitat use section reads as though Dolly Varden are common during summer and winter months in coastal and marine waters. This should be reworded to indicate that they are only found in coastal and marine waters during summer months.
- Least Cisco likely do not spawn in the program area. They occur only rarely in fyke net catches in the region and no lake bound or riverine populations have been discovered in the area.
- In the Ninespine Stickleback habitat use section, the wording suggests that they are common during summer and winter months in both marine and freshwaters, but this is not likely. The species is classified as anadromous and does venture into coastal and nearshore marine water during summer but overwinters in freshwater ponds and if available, the lower reaches of rivers. However, none of the rivers in the program area provide brackish interfaces with the sea. Ninespine Stickleback are capable of spawning in both freshwater ponds and in brackish areas.
- The Pink Salmon habitat use section should be modified by deleting the words “...and foraging...”. See related comments on Chum Salmon habitat use above.
- Round Whitefish likely spawn in the program area. Round Whitefish is a freshwater species found only in the Canning River within the program area, and both adults and juveniles are found there. We have not captured them in the coastal lagoons and bays of the area, but they do spawn in the Canning River. They may spawn in the Canning River upstream from the 1002 Area boundary, but if uncertainty is a concern, then the answer should be “probably” as to whether Round Whitefish spawn in the program area.
- The Round Whitefish habitat use section should reflect that Round Whitefish is common in the Canning River throughout the year, but not found elsewhere in the program area.

## Maps

- Page 2-30: Map references aerial observations as coming from “North Slope Eider aerial survey and Arctic Coastal Plain breeding waterbird aerial survey”; however, the point location to the northeast (Beaufort Lagoon) and in the northwest (Brownlow Point) are not within the sampled area of the aerial breeding surveys. Instead, the Brownlow Point observation came from the Common Eider breeding pair survey in 2000 (referenced in Maps 3-15 through 3-20). The eastern point in Map 3-14 (Beaufort Lagoon) is misplaced and should be near Demarcation Point, which is outside of the project area. Please correct the map as appropriate. The map should also indicate that the area in white was not sampled in the aerial breeding pair surveys.
- Page 2-30: The upper panel of each of these maps should be labeled breeding survey, not post-breeding survey. The survey was timed for early incubation of common eiders. Birds observed during this survey may also include non-breeding or failed breeding birds.



## Appendix D. Laws and Regulations

- Page D-3, Section D.2.2: The fourth bullet discusses the ESA. The first part of this paragraph addresses section 7(a)(2), the consultation provision of the ESA. We suggest also inserting the following language which is contained in section 7(a)(1) of the ESA: “The ESA requires federal agencies, in consultation with and with the assistance of the Secretary, to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species.
- Page D-3, Section D.2.2: Bullet 5 addresses MMPA. We suggest adding the following to this paragraph: The USFWS may authorize the incidental take of small numbers of marine mammals of a species or stock only if it can be found that such take will have a negligible impact on a species or stock and will not have an unmitigable adverse impact on the availability of such species or stock for subsistence purposes.
- Page D-4, Section D.2.2: Bullet 2 addresses the Bald and Golden Eagle Protection Act. Please add the following language between the two existing sentences to ensure the full prohibitions of the Act are clear: “The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.”
- Page D-4, Section D.2.2: Bullet 3 addresses the Fish and Wildlife Coordination Act. We recommend replacing the existing language to clearly explain the legal authorities of the act: “The Fish and Wildlife Coordination Act provides one of the basic legal authorities for assessing the impacts on fish and wildlife resources at water resource development projects. Under the FWCA, any public or private agency under federal permit or license to modify or control for any purpose any stream or other water body is required to consult with the Service with the view to the conservation of wildlife resources by preventing loss of and damage to such resources. The term wildlife resources is explicitly defined to include birds, fishes, mammals, and all other classes of wild animals and types of aquatic and land vegetation upon which wildlife is dependent. Further, the FWCA states that reports determining the possible damage to wildlife resources and an estimation of wildlife loss “shall be made an integral part of any report prepared or submitted by any agency with the authority to authorize” water projects (16 U.S.C. 662 (b),(f)).
- Page D-4, Section D.3, Executive Orders: This list should include Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.



## Literature Cited

- Avian Power Line Interaction Committee. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Unpublished report, Edison Electric Institute and APLIC, Washington, DC 2012.
- Barr, J. F., C. Eberl, and J. W. McIntyre. 2000. Red-throated Loon (*Gavia stellata*), version 2.0. In *The Birds of North America* (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.513>
- Bart, J., S. Brown, B. A. Andres, R. Platte, and A. Manning. 2012. North Slope of Alaska. Pages 73-74 in J. R. B. a. V. H. Johnston, editor. *Arctic shorebirds in North America: a decade of monitoring*. University of California Press.
- Bayne, E. M., L. Habib, and S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology* 22:1186-1193.
- Becker, M. S., and W. H. Pollard. 2016. Sixty-year legacy of human impacts on a high Arctic ecosystem. *Journal of Applied Ecology* 53(3):876-884.
- Bentzen, R., J. Liebezeit, M. Robards, B. Streever, S. Strindberg, and S. Zack. 2018. Bird Use of Northern Alaska Oilfield Rehabilitation Sites. *Arctic* 71:422-430.
- Bollinger K. S. and R. M. Platte. 2012. Aerial population surveys of common eiders and other waterbirds during the breeding season - Northwest Alaska, 2006–2009. U. S. Fish and Wildlife Service, Fairbanks, Alaska.
- Brown, S., J. Bart, R. B. Lanctot, J. A. Johnson, S. Kendall, D. Payer, and J. Johnson. 2007. Shorebird abundance and distribution on the coastal plain of the Arctic National Wildlife Refuge. *The Condor* 109:1-14.
- Brown, S., S. Kendall, R. Churchwell, A. Taylor, and A. M. Benson. 2012. Relative shorebird densities at coastal sites in the Arctic National Wildlife Refuge. *Waterbirds* 35:546-554.
- Chaulk, K. G., and M. L. Mahoney. 2012. Does spring ice cover influence nest initiation date and clutch size in common eiders? *Polar Biology* 35:645-653.
- Church J. A., P. U. Clark, A. Cazenave, J. M. Gregory, S. Jevrejeva, A. Levermann, M. A. Merrifield, G. A. Milne, R. S. Nerem, P. D. Nunn, A. J. Payne, W. T. Pfeffer, D. Stammer, and A. S. Unnikrishnan. 2013: Sea Level Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. In: Stocker, T. F. D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (Editors). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013, pp. 1137-1216.
- Churchwell, R. T. 2015. Stopover ecology of Semipalmated Sandpipers (*Calidris pusilla*) at coastal deltas of the Beaufort Sea, Alaska. University of Alaska Fairbanks, Fairbanks, Alaska.



- Churchwell, R. T., S. Kendall, S. C. Brown, A. L. Blanchard, T. E. Hollmen, and A. N. Powell. 2018. The first hop: Use of Beaufort Sea deltas by hatch-year semipalmated sandpipers. *Estuaries and Coasts* 41:280-292.
- Curatolo, J. A., and S.M. Murphy. 1986. The effects of pipelines, roads, and traffic on movements of caribou, *Rangifer tarandus*. *Canadian Field-Naturalist* 100:218 –224.
- Dale, B. C., T. S. Wiens, and L. E. Hamilton. 2009. Abundance of three grassland songbirds in an area of natural gas infill drilling in Alberta, Canada.
- Day, R. H., A. E. Gall, T. C. Morgan, J. R. Rose, J. H. Plissner, P. M. Sanzenbacher, J. D. Fenneman, K. J. Kuletz, and B.H. Watts. 2013. Seabirds new to the Chukchi and Beaufort seas, Alaska: response to a changing climate? *Western Birds* 44, 174–182.
- Devink, J. M. A., H. G. Gilchrist, and A. W. Diamond. 2005. Effects of water salinity on growth and survival of common eider (*Somateria mollissima*) ducklings. *Auk* 122:523-529.
- Dickey, M.-H., G. Gauthier, and M.-C. Cadieux. 2008. Climatic effects on the breeding phenology and reproductive success of an arctic-nesting goose species. *Global Change Biology* 14:1973-1985.
- Divoky G. J. 1978. Breeding bird use of barrier islands in the northern Chukchi and Beaufort seas. Partial Final Report. Environmental Assessment of the Alaskan Continental Shelf, Annual Reports. 1: 482-569
- Esler, D., T. D. Bowman, T. A. Dean, C. E. O'Clair, S. C. Jewett, and L. L. McDonald. 2000. Correlates of harlequin duck densities during winter in Prince William Sound, Alaska. Volume 102.SPIE.
- Flydal K., P. Jordhoy, C. Nellemann, E. Reimers, O. Strand, and I Vistnes. 2002. Rapport fra REIN-posjektet. The Research Council of Norway.
- Frost, G., T. Christopherson, M. T. Jorgenson, A. K. Liljedahl, M. J. Macander, D. A. Walker, and A. F. Wells. 2018. Regional Patterns and Asynchronous Onset of Ice-Wedge Degradation since the Mid-20th Century in Arctic Alaska. *Remote Sensing* 10(8), 1312
- GAO (General Accounting Office). 2002. Alaska's North Slope: requirements for restoring lands after oil production ceases. Washington, D.C.: U.S. General Accounting Office; Resources, Community, and Economics Development GAO/RCED-02-357.
- Gilbert, M. M., and A. D. Chalfoun. 2011. Energy Development Affects Populations of Sagebrush Songbirds in Wyoming. Volume 75. SPIE.
- Guillemette, M., A. Reed, and J. H. Himmelman. 1996. Availability and consumption of food by common eiders wintering in the Gulf of St Lawrence: Evidence of prey depletion. *Canadian Journal of Zoology-Revue Canadienne De Zoologie* 74:32-38.
- Halas, Gabriela. 2015. Caribou migration, subsistence hunting, and user group conflicts in northwest Alaska: a traditional knowledge perspective. University of Alaska Fairbanks, Fairbanks, Alaska.



- Hjort, J., O. Karjalainen, J. Aalto, S. Westermann, V. E. Romanovsky, F. E. Nelson, B. Etzelmuller, and M. Luoto. 2018. Degrading permafrost puts Arctic infrastructure at risk by mid-century. *Nature Communications* 9(1), 5147.
- Holt, D. W., M. D. Larson, N. Smith, D. L. Evans, and D. F. Parmelee. 2015. Snowy Owl (*Bubo scandiacus*), version 2.0. In *The Birds of North America* (P.G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.10>
- Humphries, G.R.W. and F. Huettmann. 2014. Putting models to a good use: a rapid assessment of Arctic seabird biodiversity indicates potential conflicts with shipping lanes and human activity. *Diversity and Distributions*, 1–13.
- Jones, B. M., C. D. Arp, M. S. Whitman, D. Nigro, I. Nitze, J. Beaver, A. Gädeke, C. Zuck, A. Liljedahl, R. Daanen, E. Torvinen, S. Fritz, and G. Grosse. 2017. A lake-centric geospatial database to guide research and inform management decisions in an Arctic watershed in northern Alaska experiencing climate and land-use changes. *Ambio*. Volume 46 (7):769-786. DOI:10.1007/s13280-017-0915-9 <https://link.springer.com/article/10.1007/s13280-017-0915-9>
- Jorgenson, M. T., M. Kanevskiy, Y. Shur, J. Grunblatt, C. L. Ping, and G. Michaelson. 2015. *Permafrost Database Development, Characterization, and Mapping for Northern Alaska*. U.S.F.W.S Arctic Landscape Conservation Cooperative Retrieved from <http://alaska.portal.gina.alaska.edu/catalogs/9630-2014-permafrost-database-development-charact>
- Jorgenson, M. T., Y. L. Shur, and E. R. Pullman. 2006. Abrupt increase in permafrost degradation in Arctic Alaska. *Geophysical Research Letters*, 33(2).
- Kalyn Bogard, H. J., and S. K. Davis. 2014. Grassland songbirds exhibit variable responses to the proximity and density of natural gas wells. *The Journal of Wildlife Management* 78:471-482.
- Kane, D.I., K. Yoshikawa, J.P. McNamara. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). *Hydrology Journal* 21:41-52.
- Kanevskiy, M., Y. Shur, T. Jorgenson, D. R. Brown, N. Moskalenko, J. Brown, D. A. Walker, M. K. Reynolds, and M. Buchhorn. 2017. Degradation and stabilization of ice wedges: Implications for assessing risk of thermokarst in northern Alaska. *Geomorphology*, 297, 20-42.
- Kendall, S. J. 2005. Surveys of breeding birds on barrier islands in the Arctic National Wildlife Refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U. S. Fish and Wildlife Service.
- Kendall, S. J. 2006. Distribution and abundance of post-breeding snow geese on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2003-2004. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service.
- Kendall, S., and C. Villa. 2006. Nesting ecology of tundra-nesting birds at the Canning River Delta, Arctic National Wildlife Refuge, Alaska, June-July 2005. Pages 57 in Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service, Unpublished Report.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). Version 2.0. In *The Birds of North America* (A. F. Poole, and F. B. Gil, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.684>



- Kubelka V., M. Šálek, P. Tomkovich, Z. Végvári, R. P. Freckleton, and T. Székely. 2018. Global pattern of nest predation is disrupted by climate change in shorebirds. *Science* 362: 680-683.
- Kuletz, K. J., M. Renner, E. A. Labunski, and G. L. Hunt. 2014. Changes in the Distribution and Abundance of Albatrosses in the Eastern Bering Sea: 1975-2010. *Deep Sea Research II* 109: 282 – 292.
- Kuletz, K., M. Ferguson, A. Gall, B. Hurley, E. Labunski, and T. Morgan. 2015. Seasonal spatial patterns in seabird and marine mammal distribution in the eastern Chukchi and western Beaufort Seas: Identifying biologically important pelagic areas. *Progress in Oceanography* 136: 175-200.
- Kuletz, K. J. and E. A. Labunski. 2017. Seabird Distribution and Abundance in the Offshore Environment, Final Report. US Dept. of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region. OCS Study BOEM 2017-004. Provided to BOEM by the U.S. Fish and Wildlife Service, 59 pp, plus 400 pages of Appendices. <https://www.boem.gov/2017-004/>
- Larsen, J. K., and M. Guillemette. 2000. Influence of annual variation in food supply on abundance of wintering common eiders *Somateria mollissima*. *Marine Ecology Progress Series* 201:301-309.
- Lehner, N. S. 2012. Arctic fox winter movement and diet in relation to industrial development on Alaska's North Slope. University of Alaska Fairbanks.
- Liebezeit J., E. Rowland, M. Cross, and S. Zack. 2013. Assessing climate change vulnerability of breeding birds in arctic Alaska. a report prepared for the arctic landscape conservation cooperative. Wildlife Conservation Society, North America Program, Bozeman, MT. pp. 167.
- Liljedahl, A. K., J. Boike, R. P. Daanen, A. N. Fedorov, G.V. Frost, G. Grosse, L. D. Hinzman, Y. Iijma, J. C. Jorgenson, N. Matveyeva, M. Necsoiu, M. K. Raynolds, V. E. Ramonovsky, J. Schulla, K. D. Tape, D. A. Walker, C. J. Wilson, H. Yabuki, and D. Zona. 2016. Pan-Arctic ice-wedge degradation in warming permafrost and its influence on tundra hydrology. *Nature Geoscience* 9(4), 312.
- Lintern D. G, R. W. Macdonald, S. M. Solomon, and H. Jakes. 2013. Beaufort Sea storm and resuspension modeling. *Journal of Marine Systems* 127: 14-25.
- Love, O. P., H. G. Gilchrist, S. Descamps, C. A. D. Semeniuk, and J. Bêty. 2010. Pre-laying climatic cues can time reproduction to optimally match offspring hatching and ice conditions in an Arctic marine bird. *Oecologia* 164:277-286.
- Ludlow, S. M., R. M. Brigham, and S. K. Davis. 2015. Oil and natural gas development has mixed effects on the density and reproductive success of grassland songbirds. *The Condor* 117:64-75.
- Lysne, L., E. Mallek, and C. Dau. 2004. Near shore surveys of Alaska's arctic coast, 1999-2003. U.S. Fish and Wildlife Service.
- Manville II, A. M. 2005. Bird strike and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science-next steps toward mitigation. Bird Conservation Implementation in the Americas: Proceedings 3<sup>rd</sup> International Partners in Flight Conference 2002, C. J. Ralph and T. D. Rich, Editors. U.S.D.A. Forest Service General Technical Report PSW-GTR-191, Pacific Southwest Research Station, Albany, CA: 1051-1064



- Murphy, S. M. 1988. Caribou behavior and movements in the Kuparuk oil field: Implications for energetic and impact analyses. Proceedings of the Third North American Caribou Workshop. Alaska Department of Fish and Game, Juneau, Alaska. Wildlife Technical Bulletin 8:196 – 210.
- Murphy, S. M., and J. A. Curatolo. 1987. Activity budgets and movement rates of caribou encountering pipelines, roads, and traffic in northern Alaska. *Canadian Journal of Zoology* 65:122–128
- National Research Council. 2003. Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. Washington, DC: The National Academies Press.  
<https://doi.org/10.17226/10639>.
- Pamperin, N. J. 2008. Winter movements of arctic foxes in northern Alaska measured by satellite telemetry. University of Alaska Fairbanks
- Pearce, J. M., P. L. Flint, T. C. Atwood, D. C. Douglas, L. G. Adams, H. E. Johnson, S. M. Arthur, and C. J. Latty. 2018. Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17. U.S. Geological Survey. Report 2331-1258.
- Perreault, N., E. Lévesque, D. Fortier, D. Gratton, and L. J. Lamarque. 2017. Remote sensing evaluation of High Arctic wetland depletion following permafrost disturbance by thermo-erosion gully processes. *Arctic Science* 3:237-253.
- Petersen M. R. and P. L. Flint. 2002. Population structure of Pacific common eiders breeding in Alaska. *Condor* 104: 780-787.
- Purdue, J. R., and H. Haines. 1977. Salt Water Tolerance and Water Turnover in the Snowy Plover. *The Auk* 94:248-255.
- Raynolds, M. K., D. A. Walker, K. J. Ambrosius, J. Brown, K. R. Everett, M. Kanevskiy, G. P. Kofinas, V. E. Romanovsky, Y. Shur, and P. J. Webber. 2014. Cumulative geoeological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global change biology*, 20(4), 1211-1224.
- Renner, M. and K. J. Kuletz. 2015. A spatial-seasonal analysis of the oiling risk from shipping traffic to seabirds in the Aleutian Archipelago. *Marine Pollution Bulletin* 101: 127-136.  
<http://dx.doi.org/10.1016/j.marpolbul.2015.11.007>
- Rode, K. D., J. W. Olson, D. L. Eggett, D. C. Douglas, G. M. Durner, T. C. Atwood, E. V. Regehr, R. R. Wilson, T. S. Smith, and M. St. Martin. 2018. Den phenology and reproductive success of polar bears in a changing climate. *Journal of Mammalogy* 99(1):16-26.  
<https://doi.org/10.1093/jmammal/gyx181>
- Ryder, J., J. Klaminder, P. Rosen, R. Bindler. 2010. Climate driven release of carbon and mercury from permafrost mires increases mercury loading to sub-arctic lakes. *Sci Tot Environ* 408:4778-4783
- Schuster, P. F., K. M. Schaefer, G. R. Aiken, R. C. Antweiler, J. F. Dewild, J. D. Gryziec, A. Gusmeroli, G. Hugelius, E. Jafarov, D. P. Krabbenhoft, L. Liu, N. Herman-Mercer, C. Mu, D. A. Roth, T. Schaefer, R. G. Striegl, K. P. Wickland, and T. Zhang. 2018. Permafrost stores a globally significant amount of mercury. *Geophysical Research Letters* 45:1463-1471.



- Smith, L. C., Y. Sheng, G. M. MacDonald, and L. D. Hinzman. 2005. Disappearing Arctic Lakes. *Science* 308:1429-1429.
- Smith, M. A., M. S. Goldman, E. J. Knight, and J. J. Warrenchuk. 2017. *Ecological Atlas of the Bering, Chukchi, and Beaufort Seas*. 2nd edition. Audubon Alaska, Anchorage, AK.
- Smith, M. A., N. J. Walker, C. M. Free, M. J. Kirchhoff, G. S. Drew, N. Warnock, and I. J. Stenhouse. 2014. Identifying marine Important Bird Areas using at-sea survey data. *Biological Conservation* 172:180-189.
- Smith, W. T. and R. D. Cameron. 1983. Responses of caribou to industrial development on Alaska's Arctic Slope. *Acta Zoologica Fennica* 175:43-45.
- Smol, J. P. and M. S. V. Douglas. 2007. Crossing the final ecological threshold in high Arctic ponds. *Proceedings of the National Academy of Sciences* 104:12395-12397.
- Snyder-Conn, E. and M. Lubinski. 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 2. Raw Data. NAES-TR-93-03. 305pp.
- Snyder-Conn, E. and M. Lubinski. 1993. Contaminant and water quality baseline data for the Arctic National Wildlife Refuge, Alaska, 1988-1989. Volume 3. Quality Assurance / Quality Control Statistics. NAES-TR-93-03. 109pp.
- Stephensen, S.W. and D. B. Irons. 2003. A comparison of colonial breeding seabirds in the eastern Bering Sea and Gulf of Alaska. *Marine Ornithology* 31: 167-173.
- Stickney, A. A., T. Obritschkewitsch, and R. M. Burgess. 2014. Shifts in fox den occupancy in the greater Prudhoe Bay Area, Alaska. *Arctic* 67:196-202.
- Uher-Koch, B. D. 2017. Satellite telemetry data of red-throated loons (*Gavia stellata*) breeding on the Copper River Delta, Yukon-Kuskokwim Delta, Seward Peninsula, and Arctic Coastal Plain of Alaska, 2000-2011: U.S. Geological Survey data release, <https://doi.org/10.5066/F7TH8KVH>.
- USFWS (U.S. Fish and Wildlife Service). 2014. North Pacific Seabird Colony Database. <http://axiom.seabirds.net/maps/north-pacific-seabirds>. (accessed 08/05/14).
- USFWS (U.S. Fish and Wildlife Service). 2015. Arctic National Wildlife Refuge, Alaska; revised Comprehensive Conservation Plan and Final Environmental Impact Statement. US Fish and Wildlife Service, Anchorage, Alaska, 2015.
- USFWS (U.S. Fish and Wildlife Service). 2017. Alaska seabird die off Fact Sheet, U.S. Fish and Wildlife Service. Available at: [www.fws.gov/alaska/pdf/BeringSea\\_DieOff\\_Info\\_September2017Update.pdf](http://www.fws.gov/alaska/pdf/BeringSea_DieOff_Info_September2017Update.pdf)
- USFWS and BLM (U.S. Fish and Wildlife Service and Bureau of Land Management). 2018. Rapid-response resource assessments and select references for the 1002 area of the Arctic National Wildlife Refuge in anticipation of an oil and gas exploration, leasing and development program, per the Tax Act of 2017, Title II Sec. 20001. Prepared for Alaska Regions of the U.S. Fish and Wildlife Service and Bureau of Land Management, Anchorage, Alaska.



USGS Alaska Science Center, Polar Bear Research Program. 2018. Denning phenology, den substrate, and reproductive success of female polar bears (*Ursus maritimus*) in the southern Beaufort Sea 1986-2013 and the Chukchi Sea 1987-1994: U.S. Geological Survey data release, <https://doi.org/10.5066/F7DF6PC9>.

U.S. Shorebird Conservation Plan Partnership. Shorebirds of conservation concern in the United States of America. 2016. In: Andres B, editor. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 2016. 12 pp.

Vermaire J. C, M. F. J. Pisaric, J. R. Thienpont, C. J. C. Mustaphi, S. V. Kokelj, and J. P. Smol. 2013. Arctic climate warming and sea ice declines lead to increased storm surge activity. *Geophysical Research Letters*. 40(7): 1386-1390.

Viereck, L. A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 pp.

Vistnes, I. and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology*, 31(4):399-407.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Volume 71. SPIE.

Walker, D. A., M. T. Jorgenson, M. Kanevskiy, A. K. Liljedahl, M. Nolan, M. K. Reynolds, and M. Sturm. 2019. Likely impacts of proposed 3D-seismic surveys to the terrain, permafrost, hydrology, and vegetation in the 1002 Area, Arctic National Wildlife Refuge, Alaska. Alaska Geobotany Center Publication AGC 19-01. University of Alaska Fairbanks, Fairbanks, Alaska, USA.

Wauchope, H. S., J. D. Shaw, Ø. Varpe, E. G. Lappo, D. Boertmann, R. B. Lanctot, and R. A. Fuller. 2017. Rapid climate-driven loss of breeding habitat for Arctic migratory birds. *Global Change Biology* 23:1085-1094.

Young, D. D., C. L. McIntyre, J. B. Peter, T. R. McCabe, and E. A. Robert. 1995. Nesting by Golden Eagles on the North Slope of the Brooks Range in Northeastern Alaska. *Journal of Field Ornithology* 66:373-379.