
Environmental Assessment

Shadura #1 Exploration Project

Prepared for



NORDAQ ENERGY, INC.

"KNOWLEDGE AND VISION FOR ALASKA"

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Glossary of Acronyms

AAC	Alaska Administrative Code
ACMP	Alaska Coastal Management Plan
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AOGCC	Alaska Oil and Gas Conservation Commission
AQ	Air Quality
ASH	Alaska Safety Handbook (2006 Ed.)
AST	Aboveground storage tank
BTC	Below top of casing
CIRI	Cook Inlet Region, Inc.
CISPRI	Cook Inlet Spill Response, Inc.
CPAI	Conoco Phillips Alaska, Inc.
DCOM	Division of Coastal and Ocean Management
DGGS	Division of Geological and Geophysical Surveys
DML&W	Division of Mining, Land and Water
EH	Environmental Health
EPA	United States Environmental Protection Agency
EWR	Electromagnetic wave resistivity
FLIR	Forward looking infrared
G&I	Grind and inject
GCD	Generally Consistent Determination
GR	Gamma ray
HAZWOPER	Hazardous Waste Operations and Emergency Response, OSHA
HSE	Health, Safety and Environment
Kenai NWR	Kenai National Wildlife Refuge
KPB	Kenai Peninsula Borough
LGPVs	Low ground pressure vehicles
LNO	Letter of non-objection
LUP	Land Use Permit
LWD	Logging while drilling
Nordaq	Nordaq Energy, Inc.
NPDES	National Pollutant Discharge Elimination System
NSEFH	North Slope Environmental Field Handbook (2005 Ed.)
OCTG	Oil country tubular goods
OD	Outside diameter
ODPCP	Oil Discharge Prevention and Contingency Plan
OSHA	Occupational Safety and Health Administration
OSRO	Oil Spill Response Organization
P&A	Plug and abandon
psi	Pounds per square Inch
RCRA	Resource Conservation and Recovery Act
ROW	Right-of-way
SHPO	State Historic Preservation Officer
SPAR	Spill Prevention and Response (ADEC-Division)
SPCC	Spill Prevention Control and Countermeasure Plan
SRF	Swanson River Oil and Gas Field
TD	Total depth
TVD	Total vertical depth
TWUP	Temporary Water Use Permit
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1. Introduction

1.1 Project Overview

Nordaq Energy, Inc. (Nordaq) is seeking a Special Use Permit from the United States Fish and Wildlife Service (USFWS) to conduct a winter exploratory drilling program at its Shadura #1 prospect for natural gas within the Kenai National Wildlife Refuge (Kenai NWR) in south-central Alaska (Figures 1 and 2). The proposed Shadura #1 prospect temporary drill pad and most of a proposed temporary access ice road would be located on surface lands managed by the USFWS, within the Kenai NWR, and on subsurface in-holdings owned by Cook Inlet Region, Inc. (CIRI).

The Special Use Permit is required for drilling an exploration well to evaluate natural gas resources. Nordaq would complete the proposed drilling program in a single winter season by constructing an ice road to access the inholdings and would drill a well from a temporary ice/rig mat drill pad. Ice road and pad construction would be by conventional construction methods that include pre-packing, water flooding, and ice chips.

After testing Shadura #1 for natural gas, Nordaq would plug/cement and abandon (P&A) or suspend the well, and then demobilize by mid-March 2011. During demobilization, Nordaq also would begin restoration activities related to clearing trees. In July 2011, Nordaq would return to inspect the former ice road route and drill pad footprint for damage, and complete restoration by replanting trees. Access to the route and site for restoration work would be by helicopter and covered under a separate special use permit.

Nordaq's exploration activities would be pursuant to agreement with CIRI, specifically CIRI Lease Agreements C061647, C061648 and C061649. *Section 1110(b)* of the *Alaska National Interest Lands Conservation Act (ANILCA)* allows for access to CIRI subsurface inholdings within the Kenai NWR for exploration, testing and development of hydrocarbons.

Because a portion of the proposed project are on Kenai NWR surface lands, an Environmental Assessment (EA) is being prepared under guidelines of the National Environmental Policy Act (NEPA), at the request of the USFWS, to document the project elements, assess the potential environmental impacts of the proposed project, and develop mitigation measures as required.

1.2 Project Schedule

The Shadura #1 exploration project would begin in December 2010 with a demobilization date of March 15, 2011 followed by a summer 2011 site inspection/restoration. Project highlights include the following:

- In late December 2010, after sufficient frost (>1.5 feet) and sufficient snow (>1.5 feet) accumulation; begin actual ice road construction.
- In early February 2011, begin drilling Shadura #1.
- By early March 2011, demobilize the drill rig and mobilize a truck-mounted wireline unit to test the well and a truck-mounted coiled tubing unit to plug and abandon (P&A) or suspend the well.
- By mid March 2011, demobilize all equipment, rig mats and supplies, and begin initial restoration in cleared areas.
- In mid July 2011, complete inspection and restoration by planting trees up to 8 foot in height and seedlings less than 1 foot in height in the cleared areas.

2. Purpose and Need

The purpose of the proposed action is to evaluate the potential natural gas resources in CIRI subsurface estate inholdings within the Kenai NWR through an exploration drilling program.

Southeast Alaska's natural gas reserves are in decline, and additional new sources of natural gas can help meet local demand in coming years.

3. Alternatives Considered

This EA considered two action alternatives and a no action alternative.

3.1 Action Alternatives

Access to CIRI inholdings for exploration drilling from a temporary ice/rig mat drill site will involve constructing a temporary ice road for winter access. Using an ice road combined with the rig mats will not alter the landscape nor adversely impact vegetation during winter along the temporary off-road transportation route. Ice road routing includes avoiding trees and standing deadwood whenever possible, and incorporating curves to minimize impact to the visual landscape, and help camouflage the former route after demobilization. Project ice roads would be constructed to have 18-foot wide driving surfaces. Therefore, for the purpose of analysis, a 25-foot wide impact area was assumed for all impacts.

The USFWS requested that potential ice routes cross primarily herbaceous wetlands to avoid clearing heavy brush and trees along the ice road route. Therefore, in July 2009, an ice road route site reconnaissance study was completed. The study first involved reviewing Google Earth® imagery to identify preliminary routes that avoided areas of shrub and tree cover as specified by the USFWS. Two preliminary routes were identified, and these preliminary routes were evaluated from the air and refined on the ground to ensure that live trees, heavy brush and standing deadwood would be avoided to the maximum extent practicable. These two routes are the basis for the two action alternatives, the East Route Alternative and the West Route Alternative. All other project components (staging, drilling, site restoration) are the same for these two alternatives.

3.1.1 East Access Route Alternative

The East Route will be constructed by using conventional methods and include interlocking rig mats in areas with limited subsurface frost conditions. The East Route Alternative (Figure 3) consists of a 6.6-mile ice road from the east, starting at the west end of the lease roads in the Swanson River Oil and Gas Field (SRF). The first 3.3 miles is along an 80-foot wide right-of-way (ROW) running west from SRF towards Nikiski. This ROW contains a buried oil transfer pipeline, a gas transfer pipeline and an overhead power line that runs along the north side of the ice road. The ice road would then cross under the overhead power line and head north for about 3.3 miles to the proposed drill site. The power line is about 25 feet above ground where the proposed ice road would cross under it. To gain access, up to 1,390 lineal feet of forest within the Kenai NWR would require clearing in several areas along the route to the drill site. Based on a 25-foot wide ice road footprint, this means up to 0.8 acres would be cleared. Restoration of the cleared area would take place to reduce impacts to the Kenai NWR.

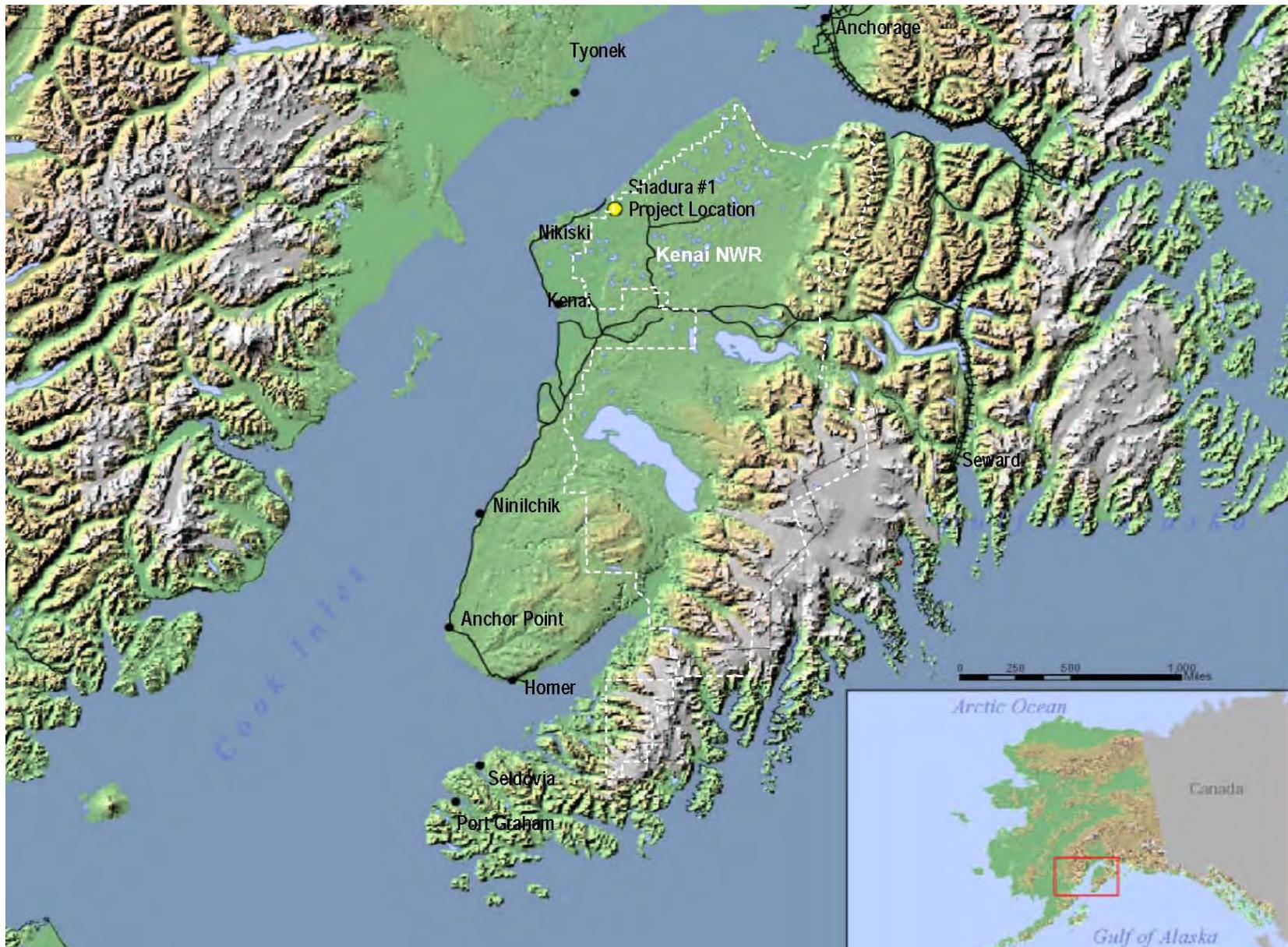


Figure 1: General Vicinity Map

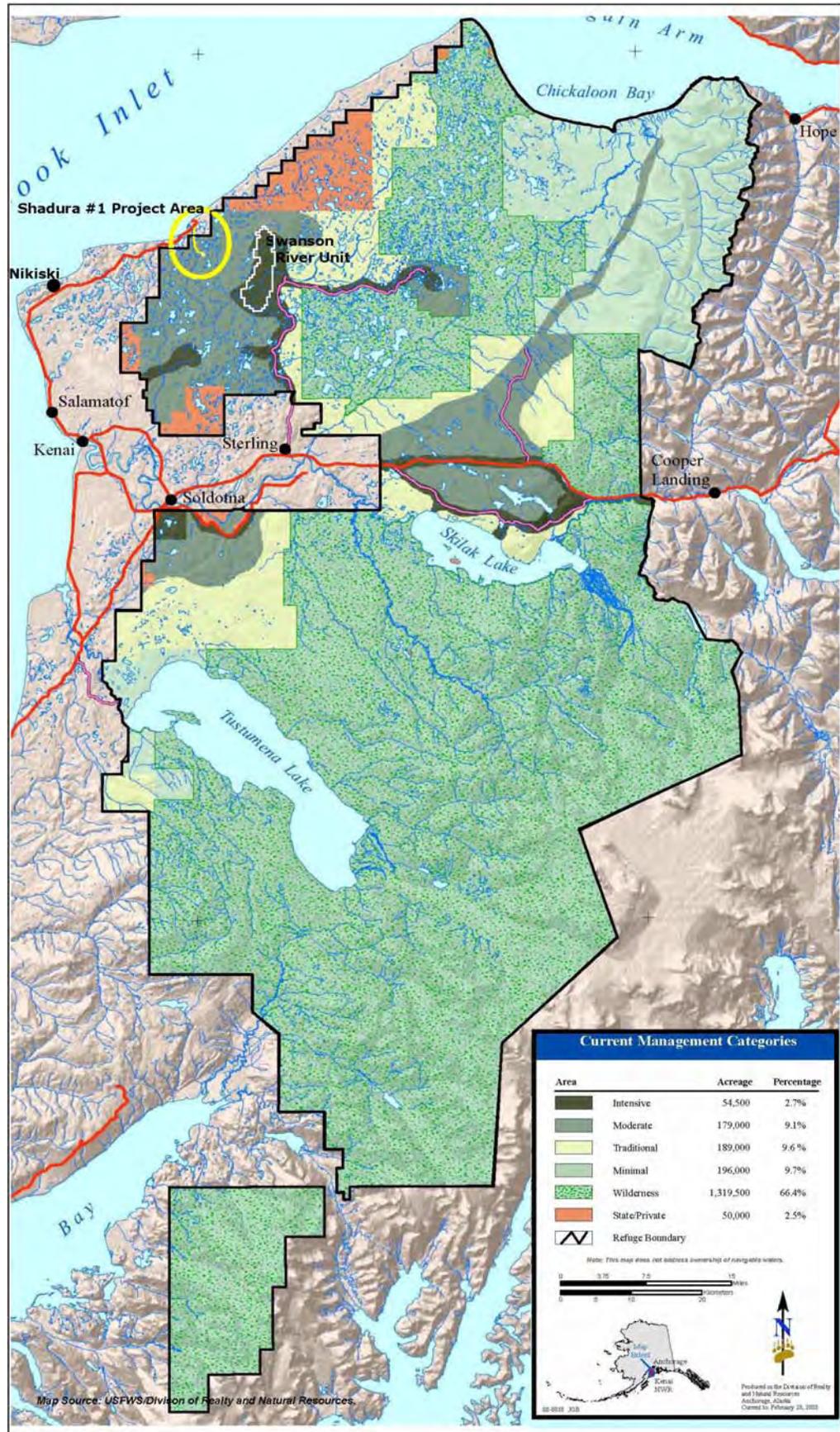


Figure 2:
Project Location
Within Kenai
NWR



Figure 3: East Route Alternative

Land Surface Ownership

Table 1 lists the present status of land surface ownership along the proposed East Access Route.

Table 1: Land Surface Ownership Along Proposed Access Route				
Segment	From	To	Owner/Operator	Access Approval
Kenai Highway.	Nikiski	SRF Lease Roads	ADOT&PF/ADOT&PF	ADOT&PF
SRF Lease Roads	Sterling	End of Road	Federal/Chevron	Chevron letter of non-objection (LNO)
Ice Road along ROW	SRF Lease Road	West of SRF Lease Road	Federal/Chevron & Tesoro	Chevron& Tesoro LNOs Kenai NWR Special Use Permit
Ice Road north of ROW	ROW	Drill site	Federal/USFWS	Kenai NWR Special Use Permit

Temporary Bridges

Two temporary bridges that cross small streams will be required on this route (Figure 3). The bridges will be constructed from rig mats that can span the entire channel of the streams.

3.1.2 West Access Route Alternative (Preferred)

The West Route consists of a 2.9-mile ice road from the west, starting at the north end of the North Kenai Spur Highway at the Captain Cook Recreation Area (Figure 4). The West Route first heads northeast for about 0.1 miles along an unimproved, 25-foot wide trail, and then east and south for 0.4 miles before crossing and entering the Nikiski Pipeline Company (Tesoro) and Conoco Phillips, Alaska Inc. (CPAI) ROW. The 25-foot wide ice road follows the ROW for 0.4 miles before exiting State Park lands, and heading southeast on State Lands for 0.5 miles before entering the Kenai NWR, where it heads southeast and south for another 1.5 miles to the proposed temporary drill site. About 600 lineal feet of forest would require clearing in one single segment within the Kenai NWR to gain access to the drill site. Based on a 25-foot wide ice road footprint, this means up to 0.3 acres will be cleared. The cleared area will be restored by using proposed tree removal and replacement procedures as a guideline (see Appendix A).

Land Surface Ownership

Table 2 lists status of land surface ownership along the proposed West Access Route.

Table 2: Land Surface Ownership Along Proposed Access Route				
Segment	From	To	Owner/Operator	Access Approval
Kenai Spur Highway	Nikiski	End of Road	ADOT&PF	ADOT&PF
Ice Road on trail/lands w/in Captain Cook Recreation Area	End of Highway	ROW	ADNR/Parks	ADNR State Parks Special Use Permit
Ice Road on ROW within Captain Cook Recreation Area	ROW	State lands	ADNR/Tesoro & CPAI	ADNR State Parks Special Use Permit / Tesoro & CPAI LNOs
Ice Road on State lands	State lands	Kenai NWR Boundary	ADNR/Tesoro & CPAI	ADNR Land Use Permit /Tesoro & CPAI LNOs
Ice Road on Kenai NWR	Kenai NWR Boundary	Shadura #1 Drill Site	Federal/USFWS	Kenai NWR Special Use Permit

Temporary Bridges

One temporary bridge is required on this route (Figure 5).



Figure 4: West Route Alternative (Preferred)



Figure 5: Temporary Rig Mat Bridge Location

Rationale for Preferred Alternative

Both the East Route and the West Route Alternatives meet the purpose and need of the proposed action by providing access to the drill site while minimizing impacts to refuge resources.

Both routes maximize naturally open areas through wetlands to avoid creation of corridors or trails. The East Route would require a 6.6-mile ice road, while the West Route would require a 2.9-mile ice road. The East Route also would require at least twice as much clearing in forested areas than the West Route (0.8 acres versus 0.3 acres). The shorter route would minimize environmental impacts.

The power line crossing along the East Route is about 25 feet overhead. This does not meet minimum safe distance requirements for the mast and several rig modules. Therefore, the power line would have to be de-energized and the Swanson River Oil Field would probably have to go on standby power temporarily. This would have to be done during mobilization, and then again during demobilization.

3.2 Project Features Common to Both Action Alternatives

3.2.1 Staging Areas and Rig Camp: Off-refuge

Starting in late November 2010, equipment, drill pipe, and drilling muds will be staged on several Inlet gravel pads in Nikiski. After ice road construction, equipment and supplies will be hauled to the drill site only as needed and be removed from the site as soon as possible without hampering operations or jeopardizing safety. Construction and drilling operations personnel will be housed off-refuge in the Nikiski and Kenai area. Equipment will be fueled daily from commercial suppliers in Nikiski and Kenai. This will limit fuel storage on the pad to equipment and generator day tanks plus a single 200-barrel, doubled-walled aboveground storage tank (AST) staged in a bermed, HDPE-lined cell next to the drill rig floor. The AST will be used as an emergency fuel supply source in case daily deliveries are interrupted by limited road access (see Section 3.2.17). These measures will reduce the overall footprint of the temporary exploration pad.

3.2.2 Permanent Roads and Bridges

Existing public paved and unpaved roads will be used as much as possible. The public roads and bridges can support expected equipment loads.

3.2.3 Low Ground Pressure Vehicles (LGPVs)

Steiger tractors, Rolligons, C650 John Deere wide track bulldozers, or similar LGPVs will support this project by pre-packing an ice road route prior to ice road construction (see below) and supporting operations during unseasonable thaw conditions. LGPVs will only be used on sufficient frost (>1.5 feet) and snow (>1.5 feet) accumulation to avoid habitat damage.

3.2.4 Temporary Ice Road Construction

The 25-foot wide ice road will be constructed using accepted conventional methods of pre-packing, water flooding, and ice chips.

Route Pre-Packing

Pre-packing entails using LGPVs such as all-terrain vehicles (ATVs), Rolligons, Steiger Tractors or Tucker Sno-Cats with smooth track to drive the frost level deeper and earlier than normal. Pre-packing the route will occur only after 1.5 feet of frost and 1.5 feet of snow have accumulated. After pre-packing at least 1.5 feet of snow (to temporarily compress the underlying vegetative mat thereby removing its insulation value), a wide track, low ground

pressure bulldozer will be used to blade back any additional snow that may accumulate on the snow-packed trail. This will remove insulation cover and allow further frost level penetration at an increased rate.

Construction

The ice road will be built in 0.5-foot lifts by flooding ice chips with water and allowing the surface to freeze. Interlocking steel-reinforced rig mats will cover and support areas with suspect subsurface frost conditions.

The following practices are proposed to help minimize impacts during construction and operation of the temporary access ice road:

- Ice road and pad construction, including pre-packing, will start only after sufficient frost (>1.5 feet) and sufficient snow (>1.5 feet) accumulation.
- Rig mats will cover areas of minimal frost during construction and operation.
- The ice road route and pad will be located to minimize brushing and grubbing. This will include making minor route changes during construction with input from the USFWS.
- If unseasonable thaws occur during drilling operations and the ice road becomes non-passable, operations support will use LGPVs, and rig mats will be used to demobilize equipment if conditions have not changed by the end of drilling and testing. As a final contingency, several additional layers of rig mats will be added to stage the drill rig over summer until another ice road could be built the following winter for demobilization.
- The ice road will be designed, constructed and operated so that its former route does not become a permanent trail for motorized vehicles after breakup. This will include replanting trees and replacing/re-standing deadwood within the former footprint during demobilization (Appendix A).

Temporary Rig Mat Bridges Along Ice Road

Temporary bridge spans will be constructed by placing several rig mats across incised creeks, all less than 10 feet wide, at proposed crossings. Rig mats also will be placed along bridge approaches at least 200 feet on either side of the mat span to support the ice road through a bog. Bridge abutments will be constructed from either ice or from a double layer of rig mats placed perpendicular to the spans.

Ice Road Demobilization

Thermal blankets and tented heaters may be used to thaw rig mats before removal. Trees and standing deadwood cut and stacked during ice road construction will be replaced/re-stood to help create barriers and camouflage the former route.

Contingencies for Warm Weather

The following contingencies for warm weather will be implemented in the following order.

- Install rig mats in suspect areas, place snow on the road to act as an insulator and reduce albedo, and limit traffic to nightshift operations.
- Incorporate the above measures, but limit traffic to LGPVs such as Rolligons or Steiger tractor trains that are capable of crossing thawed wetlands without impact.

3.2.5 Temporary Exploration Pad

A double-lined temporary exploration pad, about 250-feet by 250-feet (Figure 6), will be constructed for drilling operations. The pad will not contain a camp, but will contain a 200-bbl AST for emergency fuel storage (Figure 6), and two 200-barrel upright roll-off ASTs for temporary drilling fluids storage.



Figure 6: Shadura #1 Temporary Drill Pad Layout and Construction

From ground surface up, the pad will be constructed of Herculite© liner, a 1-foot thick ice pad, and another Herculite© liner. A layer of interlocking rig mats will then be placed on the liner/ice/liner “sandwich,” and containment berms will be constructed around the pad perimeter by shoring up the liner edges with 2-foot high timbers (Figure 6). Both liners will be composed of a 20-millimeter thick, petroleum-resistant material rated for cold climate use.

Contingencies for Warm Weather

Contingencies for unanticipated warm weather will include placing additional rig mat layers on the pad beneath the rig sub-base and other rig modules to avoid settling.

3.2.6 Aviation Support

The Kenai Alaska Municipal Airport will receive personnel, freight and supplies during drilling. Freight and crew transport to and from camps will be by ground transportation.

3.2.7 Facilities and Equipment

Facilities

Construction and drilling personnel will be lodged in the Kenai and Nikiski area. Shelters placed at the Shadura #1 drill site will be limited to a break shack, doghouse for supervisor, and an enviro-vac trailer for sewage. Several Incino-Cans or other equivalent will be located along the temporary ice road route. These toilet facilities will require neither the discharge nor the withdrawal of water to operate. Additionally, no waste disposal (and no permit) will be required for these units. Nordaq also will place a security trailer checkpoint at the start of its ice road and a combined spill connex/guard shack immediately north of the temporary drill pad.

Equipment

Equipment that most likely to be used to support this project is presented in Table 3.

Table 3: Proposed Equipment			
Equipment	Gross Weight	Units	Notes
All Terrain Vehicles	<600 pounds	4	Pre-pack ice road route and ice pad
Cat 235 Excavator	22 tons	1	Pad/Road Const. & Drill Solids Program
Cat D6D LGP Bulldozer	19 tons	1	Pad/Road Const.
966C Front-end Loader	18 tons	2	Pad/Road Const. & Drill Solids Program
966C-Mounted Snow Blower	20 tons	1	Pad/Road Maintenance
Fuel Truck	18 tons (loaded)	1	All Project Activities
Mechanics Truck	3 tons	1	All Project Activities
Water Buffalos (water trucks)	20 tons (loaded)	2	Pad/Road Const. & Drill Solids Program
Cat 730 Articulated Haul Trucks	28 tons (ice heaped)	2	Pad/Road Const. & Drill Solids Program
Flatbed and Tractors Trailer	6 tons (empty)	2	Pad/Road Construction & Mob/Demob
Service Company Pickups	3 tons	5	Drilling Operations Support
Winch Tractor	10 tons	1	Mob/Demob.
Steiger or Rolligon Tractor & Trailer	10 tons (low ground pressure)	1	Pre-packing for Pad/Road Construction Emergency Access, & Mob/Demob
Cat 730 Articulated Haul Trucks	44 tons (solids heaped)	4	Drilling Operations Solids Program (on pad)
Vacuum Truck	28 tons (loaded)	1	Drilling Operations Support

Table 3: Proposed Equipment			
Equipment	Gross Weight	Units	Notes
Light Plants and Tioga Heaters	1 ton	7	Drilling Operations Support
Crew Bus	5 tons	1	Drilling Operations Support
Schlumberger Wireline Unit	18 tons	1	Drilling Operations Support
BJ Services Cement Trucks	40 tons	2	Drilling Operations Solids Program (on pad)
Trinidad #34E Drill Rig	48 tons	1	Drilling Operations - Heaviest Module
200 bbl, double-walled roll-off aboveground storage tank (AST)	18 tons	2	Drilling Operation – Temporary Downhole Drilling Fluids Storage
200 bbl, double-walled roll-off aboveground storage tank (AST)	18 tons	1	Drilling Operations Support (Emergency Fuel Cache)

3.2.8 Water Requirements and Sources

Ice chips used during pad construction and road maintenance will be from permitted, frozen, grounded lakes on surrounding State lands. Water supply will be from proposed groundwater sources, including a water well to be drilled on the CIRI leases within the Kenai NWR, and from existing and proposed wells in the Peak Construction, Inc. (Peak) shop yard in Nikiski.

All water sources will require ADNR under Temporary Water Use Permits (TWUPs). Appropriate testing of all wells and surface water sources will help ensure they meet ADEC and ADNR/DML&W water quality standards for discharge into the waters of the United States.

Table 4 provides water quantities calculated for use as part of the ADNR TWUPs.

Table 4: Estimated Shadura #1 Fresh Water Volumes		
Activity	Estimated Daily Volumes	Estimated Total Gallons
Shadura #1 Ice Road Construction		
West Route Ice Road (2.9 miles)	500,000 gal (1.5 acre feet/day)	1,150,000 gal (3.5 acre feet/year)
East Route Ice Road (6.6 miles)	500,000 gal (1.5 acre feet/day)	2,270,000 gal (8.3 acre feet/year)
Shadura #1 Ice Pad Construction		
Drill Pad (250' x 250')	100,000 gal (0.3 acre feet/day)	600,000 gal (0.9 acre feet/year)
Shadura #1 Drilling Operations		
Ice Road/Drill Pad Maintenance (45 days)	20,000 gal (0.12 acre feet/day)	900,000 gal (2.8 acre feet/year)
Drill Rig Makeup Water (35 days)	20,000 gal (0.12 acre feet/day)	700,000 gal (2.1 acre feet/year)
Totals		West Route: 3,350,000 gal (9.8 acre feet/year)
		East Route: 4,470,000 gal (14.1 acre feet/year)

3.2.9 Exploration Well Operations

Management Operations and Support Facilities

Nordaq will manage the project from its Anchorage office. Nordaq will have a full-time onsite manager/company representative (Company Man) and Health, Safety and Environmental (HSE) Compliance Officer. The Company Man will be responsible for management of all field operations. The HSE Compliance Officer will be responsible for ensuring compliance with all permit stipulations,

waste management procedures, and mitigation measures. The HSE Compliance Officer will be responsible for submitting daily reports to the Kenai NWR.

The Alaska Safety Handbook (ASH; 2006 ed.) and the North Slope Environmental Field Handbook (NSEFH, 2005 ed.) when applicable, have been adopted as guidance, reference, standard operating procedures and workplace "best" safety practices for all Nordaq operations. Nordaq HSE plans, standard operating procedures and practices also will supplement ASH or NSEFH procedures.

The oil field services contractors are familiar and experienced in working and using the procedures and practices contained in the ASH and NSEFH.

Project Supply Operations and Support

The remote site location and short project schedule will help control public access. Nonetheless, project personnel will be required to carry valid identification and obtain transit authorizations to access the temporary ice road. All major equipment and rig moves will be coordinated with Chevron Oil Company (Chevron) and Marathon Oil Company (Marathon) operations. "Secure Worksite" signs will be posted at the start of the temporary ice road and at the drill site, with instructions for visitors and contractors to check in before entering the project area. Authorized site visitors will attend a safety briefing before being allowed in operational areas and will be escorted while on site.

Crew change-outs will involve ground shuttles to the site from either Kenai or Nikiski, using crew buses or contractor vehicles with appropriate company identification, field security and transit authorizations. All project personnel will operate their vehicles in compliance with the vehicle safety rules and foul weather contingency plans as presented in the 2006 ASH. All project and vendor vehicles using the temporary roads will have the ability to communicate with Anchorage and/or the rig at all times. This is especially important under adverse weather and light conditions. Personnel will remain offsite in the event of inclement weather. The rig site facilities will also have adequate instrumentation and communications equipment (radios, satellite phone, etc.) compatible with local industry and aviation frequencies to allow for communications with Kenai, Nikiski, Anchorage, and local aircraft vendors.

Drilling Program

The following summarizes the drilling program within the limits of public information.

Shadura #1 drilling targets include Beluga Formation sands between 6,000 and 11,000 feet total vertical depth (TVD), and upper and middle Tyonek Formation sands between 11,000 and 14,500 feet TVD. The Trinidad #34E mobile drill rig will be used to drill these potential natural gas resources. The Trinidad #34E has a 400,000-pound force rated cantilevered triple mast capable of drilling to 15,000 feet during winter in south-central Alaska. The unit is comprised of 18 truck-transportable modules and loads that are assembled and rigged-up at the drill site. The modules connect to create an enclosed drill rig with a steel floor that acts as secondary containment. The mast rises via rig hydraulics, thus the rig-up will not require the assistance of a heavy-lift crane.

The heaviest rig module load is the derrick that weighs 34 tons. This is within the rated load capacities of existing road bridges, ice road, and proposed temporary ice/rig mat bridge.

Testing Program

A testing program based on known downhole conditions will be approved by the AOGCC prior to testing. To minimize impacts, testing will be done by using truck-mounted wireline unit after the drill rig is demobilized. Natural gas zones will be flow tested by running a 4-inch liner from surface to total depth (TD), cementing to isolate and then perforating gas intervals. Separated gas will be flared during testing. Therefore, an air quality minor general permit (MG1) will be requested from the ADEC to allow for flaring.

Prospect Geologic Evaluation Plan

The following is the preliminary formation evaluation plan that is planned at Shadura #1.

- **Mud Logging:** from surface to total depth (TD) to provide full-computerized mud logging and drilling technology services.
- **Logging While Drilling/Directional:** Gamma ray, electromagnetic wave resistivity and directional measurements (GR/EWR/DIR) from the 9-7/8 inch casing shoe to TD.
- **Wireline Logging:** Triple-Combo w/ Sonic from the 13-1/2 inch casing shoe to TD.

Casing/Completion and Cementing Programs

Table 5 presents a proposed “slim hole” casing program including drill depths, casing types and sizes. Figure 7 presents a preliminary well schematic. The casing and cementing programs for the well will be consistent with sound oilfield practice and is in accord with AOGCC rules. All casings will be cemented from total depth to surface.

Table 5: Shadura #1 Slim Hole Casing Design			
Hole Dia.	Casing	Activity	Type
20"	Structural Conductor Casing	Driven to 100' Measured Depth (MD)	20" Outer Diameter (OD); protected with 8-foot diameter well cellar
13-1/2"	10-3/4" Surface Casing	Set Casing Shoe at 3,200' MD	10-3/4" OD; 68 pounds per foot, K-55 below top of casing (BTC), cemented
9-7/8"	7-5/8" Intermediate Steel Liner Casing	Set Liner Shoe at 14,500' TVD	7" OD; 26 pounds per foot L-80, BTC, cemented
6-3/4"	4-1/2" Bottom Casing	Perforate Zones of Interest	4-1/2" OD, 4 perms/1-foot interval for testing

Plugging and Abandonment (P&A) Program or Well Suspension

When all operations are completed, the Shadura #1 well will either undergo plugging and abandonment or suspension per 20 AAC 02, as administered by the AOGCC. Plug and abandonment procedures will be submitted to the AOGCC for approval prior to drilling operations. A P&A includes cutting the casing and retrieving the stub, and sealing each string with cement and mechanical plugging devices. To minimize impacts, it is proposed that a truck-mounted coiled tubing unit perform P&A after the Trinidad #34E is demobilized. The AOGCC usually has a portion of the P&A witnessed and approved by their field inspectors.

Well suspension will include installing a “Christmas Tree” with subsurface valves.

3.2.10 Drilling Waste/Fluids Management Programs

The drilling program includes muds, cuttings, additives, and formational waters. The program will conform to the discharge stipulations set forth by the United States Environmental Protection Agency (EPA) and the ADEC covering oil and gas exploration, development, and production facilities in the Cook Inlet area. Oil-based drilling fluids will not be used.

The onsite HSE Compliance Officer will handle drilling waste and fluids management activities and be responsible for proper manifesting for transport and off-site disposal. Figure 8 presents the project’s waste and fluid management profile and flowchart, including drilling wastes.

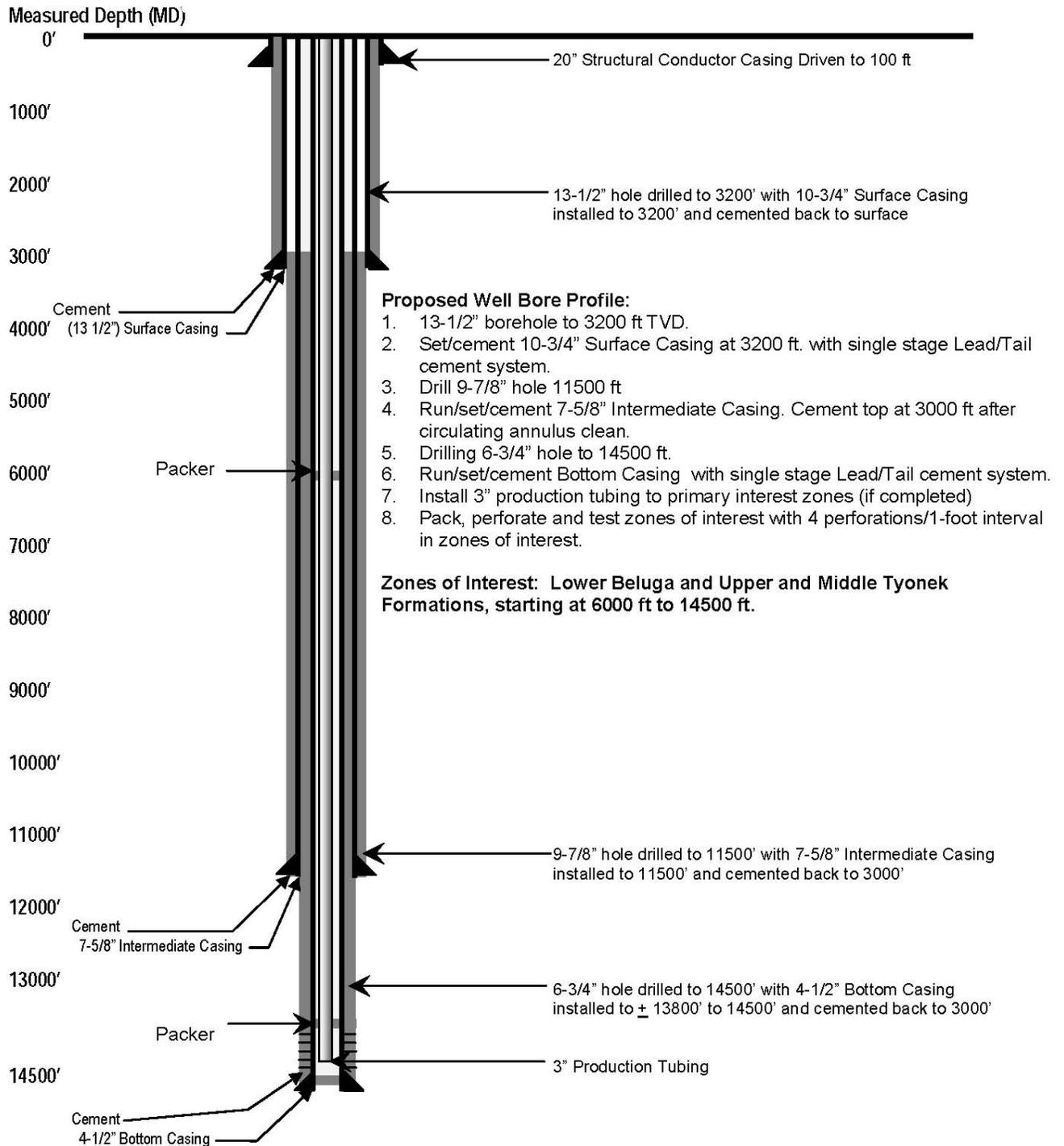


Figure 7: Proposed Slim Hole Well Schematic (Preliminary Design)

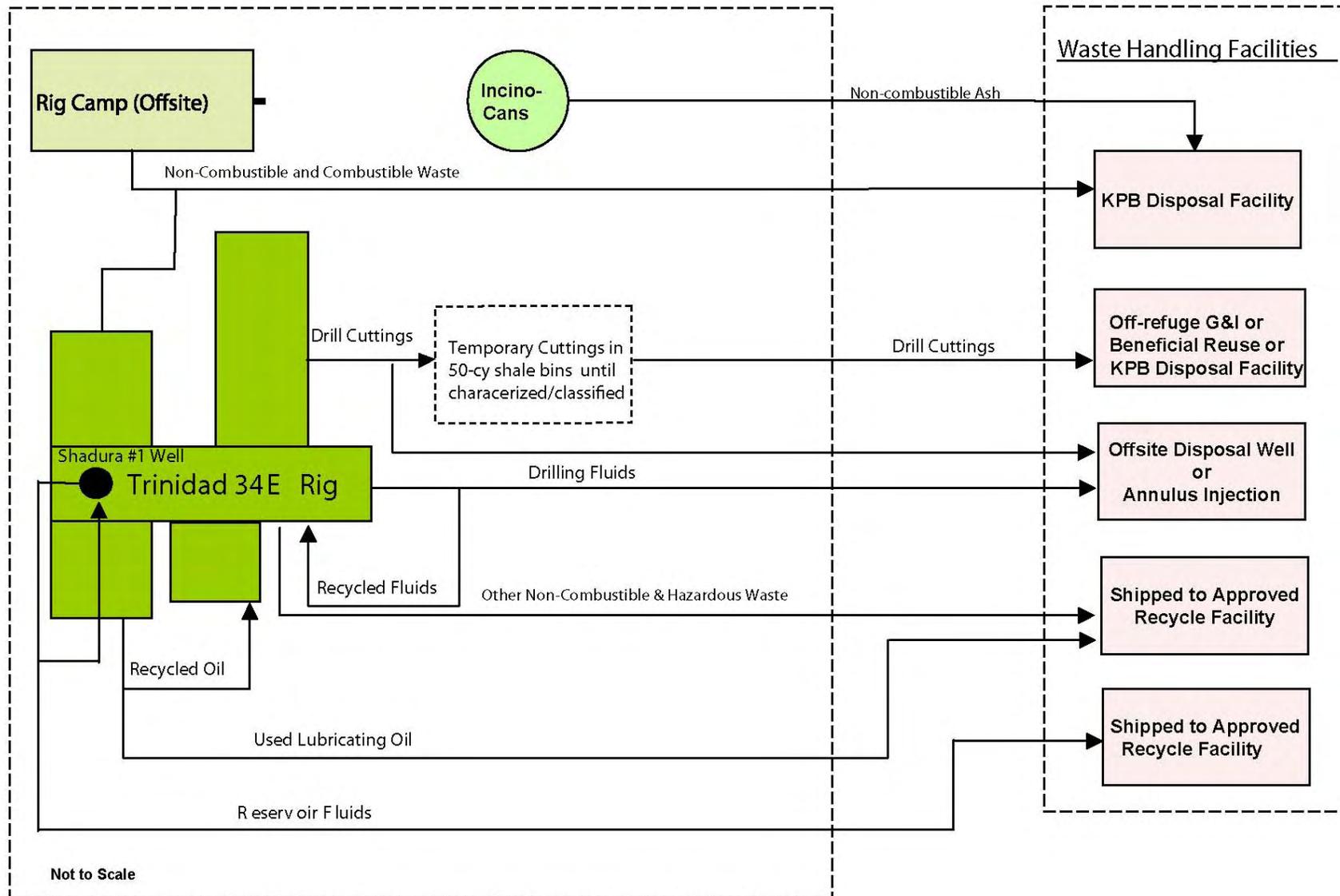


Figure 8: Overall General Waste Management Flow Diagram

Management of Drilling Fluids

Drilling fluids are RCRA-exempt exploration fluids that consist of residual drilling muds, formational waters and completion brines. The drilling fluids, which do not contain hydrocarbons, will be re-circulated out of the hole during drilling, and temporarily stored in two 200-bbl, double-walled upright roll-off tanks pending downhole reuse or off-refuge disposal. Incidental spillage during transfer operations will be contained by staging these tanks in a bermed, HDPE-lined cell adjacent to the drill rig, and using “duck ponds.”

Management of Muds and Cuttings

During drilling, the onsite toolpusher, driller and qualified mud engineers also will direct and maintain desired mud properties, and maintain the quantities of basic mud materials on site as dictated by State and federal law, and good oilfield practices.

A best management practice plan outlining normal operations and ancillary activities will be developed and followed to help prevent or minimize the generation and potential for the release of pollutants from the facility to the waters of the State of Alaska and United States.

The best management practice plan also will ensure a sufficient inventory of barite and lost circulation materials be maintained on the drilling site to minimize the possibility of a well upset and the likelihood of a release of pollutants to waters of the State and United States. Note these materials can be re-supplied, if required, from Nikiski, Kenai or Anchorage. In consideration that adverse weather could prevent immediate resupply, however, sufficient materials will be available on site for completely rebuilding the total circulating volume.

Drilling wastes (drill cuttings and residual fluids) will be temporarily stored onsite in 50-cubic yard shale bins while awaiting characterization that will determine final off-refuge disposition or reuse. Depending on characterization, drilling wastes will then be ground and injected (G&I), back-hauled and disposed at an approved disposal site (KPB Central Landfill), or used in beneficial reuse.

3.2.11 Ice Road and Pad Rehabilitation and Restoration

A field reconnaissance during the summer of 2009 resulted in finding a route for the ice road and ice/rig mat pad location that minimize impacts to Kenai NWR habitat. Preliminary recommendations on procedures to camouflage the former ice road route and to provide natural barricades so that it does not become a permanent trail are in Appendix A. The preliminary recommendations were developed by AlaskaEnviro, Inc., which is a landscaping company with similar experience. The preliminary recommendations will be reviewed and finalized by a credentialed agronomist and the USFWS before implementation.

Restoration of areas where trees will need to be cleared for the ice road will include planting seedlings and planting trees up to 8 feet in height. Planting the trees will be accomplished by drilling and casing small diameter holes during ice road demobilization, and then planting trees in these holes during summer 2011 with helicopter support. Cut and stacked trees and standing deadwood will be placed in holes drilled during demobilization. These actions would help create a standing barricade and camouflage the former route. Care will be taken to insure that the holes do not create a danger to wildlife by entrapment or stumbling/tripping hazards.

The remainder of the former ice routes and pad location are in wetlands. The USFWS would inspect this vegetation for damage, and any damage would be repaired/re-vegetated in summer 2011. The damage assessment and restoration activities planned for summer will be completed at an appropriate time to avoid disturbance to wildlife.

3.2.12 Contingency Plans

Wildlife Awareness Interaction and Bear Avoidance Plan (Appendix B)

The training plan will include a description of the area wildlife and seasonal activity. Project personnel will be instructed on how to avoid attracting, harassing, or injuring wildlife. Common human-wildlife interactions include unintentional attraction due to improper containment or disposal of anthropogenic food sources; deliberate feeding of wildlife; approaching sick, injured or apparently orphaned wildlife to give assistance; or unintentional injury of wildlife due to collisions with vehicles. Improper garbage handling or foods left in pickup beds may attract ravens, red foxes, wolves, coyotes, weasels, or mink. If feeding of wildlife occurs, animals will likely change their behavior and willingly approach humans, potentially exposing project personnel to wildlife diseases or aggression.

Project personnel should also be aware of and sensitive to local trapping activities that focus on the harvest of beaver, muskrat, river otter, mink, coyote, lynx, and fox. Wintering moose use river valleys in the refuge to find food and relief from deep snow, therefore personnel should be aware of the potential for moose-vehicle collisions along roads to the exploration site. Safe driving practices and speeds will be implemented. Project personnel should also be aware of, and sensitive to, local winter subsistence harvest. Wetland and vegetation damage assessment and restoration activities after completion of the winter exploration program will be scheduled to avoid disturbance to wildlife.

A major focus of wildlife training will be on brown and black bears. Project personnel will become familiar with bear avoidance training provided in the plan along with instruction, on how to avoid attracting, harassing, or injuring bears. Plan objectives will include preventing bears from associating humans and drilling operations with food, preventing human-bear interactions, understanding controls used to prevent this interaction, protecting both workers and bears, and implementing bear monitoring and reporting. Bears will probably be in hibernation during the winter exploration period; however, project personnel will be aware of potential denning habitats along the ice road route.

Oil Discharge Prevention and Contingency Plan and Spill Prevention Control and Countermeasure (SPCC) Plan

An ADEC-approved Oil Discharge and Contingency Plan (ODPCP) will not be required due to drilling for natural gas and limited onsite fuel storage. Nordaq, however, is preparing a program-wide ODPCP for other proposed, off-refuge drilling prospects. As contingency, plan measures will followed as if responding to a fuel spill or other accidents at Shadura #1. Both Peak and the Trinidad 34E hold SPCC plans for their day tanks and refueling procedures. Additionally, well service and well testing companies will be required to hold SPCC plans for any double-walled ASTs or tanker trucks brought to the well site.

ADEC/AQ Air Quality Minor General Permit MG1 Application and Surveillance Plan

This drilling project will require an Air Quality Minor Permit from the ADEC Division of Air Quality as set out by 18 AAC 50.502(c)(2)(A). To apply to operate under the MG1, the operator is required to submit the MG1 Notification of Intent to Operate. Terms and conditions of the permit also require exclusion of the public from within 230 meters of the pad edge, and compliance with a surveillance plan adequate to ensure that the public is excluded from the area.

3.2.13 Non-Drilling Solid Waste Management Program

Table 6 summarizes anticipated types, handling and disposition of non-drilling wastes, plus notes on recycling and handling to minimize generation of non-drilling wastes. Figure 9 presents the project's non-drilling solid waste management profile and flowchart. With the exception of batteries, drilling and drilling support operations will probably generate only non-hazardous wastes. These will include "non-drilling" wastes related to ice road/pad construction and drilling support, and drilling wastes generated downhole during drilling. The onsite HSE Advisor will handle waste management

activities and be responsible for proper manifesting of waste for transport and off-site disposal. All contractors working on the project will be encouraged to use waste minimization and recycling practices where applicable.

Solid waste will be classified, segregated and labeled as general refuse, hazardous, Resource Conservation and Recovery Act (RCRA) exempt or non-exempt. Afterwards, it will be stored in designated satellite accumulation, recycle accumulation, and universal waste accumulation areas, or appropriately labeled dumpsters.

Table 6: Non-Drilling Waste Management Summary		
Type	Handling	Notes
Metal	Segregate, package (crush palletize), transport to appropriate landfill.	Drill pipe, wire, metal banding, "RCRA-empty" drums, aerosol cans and oilcans, and transport for off-refuge beneficial reuse (preferred) or disposal in KPB Central Landfill.
Combustibles (paper, cardboard, wood)	Reduce volume by compacting.	Package and transport to KPB Central Landfill.
Oily Waste Rags, Spill Absorbent Pads.	Reduce volume by first burning in "Smart Ash" incinerator offsite.	Analyze incinerator bottom ash and provide results to KPB Central Landfill for approval prior to packaging and transport
Litter, and Kitchen Garbage	Containerize (in sealed boxes or plastic garbage bags) and transport off-refuge for disposal at the KPB Central Landfill.	Collect litter, household garbage on an as-needed basis to maintain the site in an orderly condition. Transport off-refuge for disposal at the KPB Central Landfill.
Batteries	Separate and place in designated hazardous waste containers.	Manage batteries through the KPB hazardous waste program.

3.2.14 Operational Considerations

Designated Natural Hazards

The ADNR, Division of Geological and Geophysical Surveys (DGGS) responsibilities include supporting Alaska Coastal Management Program (ACMP) personnel and coastal district planners on natural hazard issues by reviewing natural hazard aspects of proposed coastal projects and recommending State designation of hazard areas during consistency reviews. The Kenai Peninsula Borough (KPB) also designates natural hazards in its coastal district plan. Additionally, KPB also has prepared an All-Hazard Mitigation Plan that addresses the hazard threat posed by floods, wildfires, earthquakes, weather and tsunamis and seiches.¹

To date, DGGS or KPB coastal district planners have not designated any natural hazards in the project area.

Non-Designated Natural Hazards

A lack of basic field data and baseline information on geologic hazards in Alaska has made it difficult to designate natural hazard areas in the KPB coastal district plan. Therefore, possible non-designated and/or undetermined natural hazards in the project area are addressed.

¹ KPB Coastal Management Program, Final Plan Amendment. KPB. April 2007

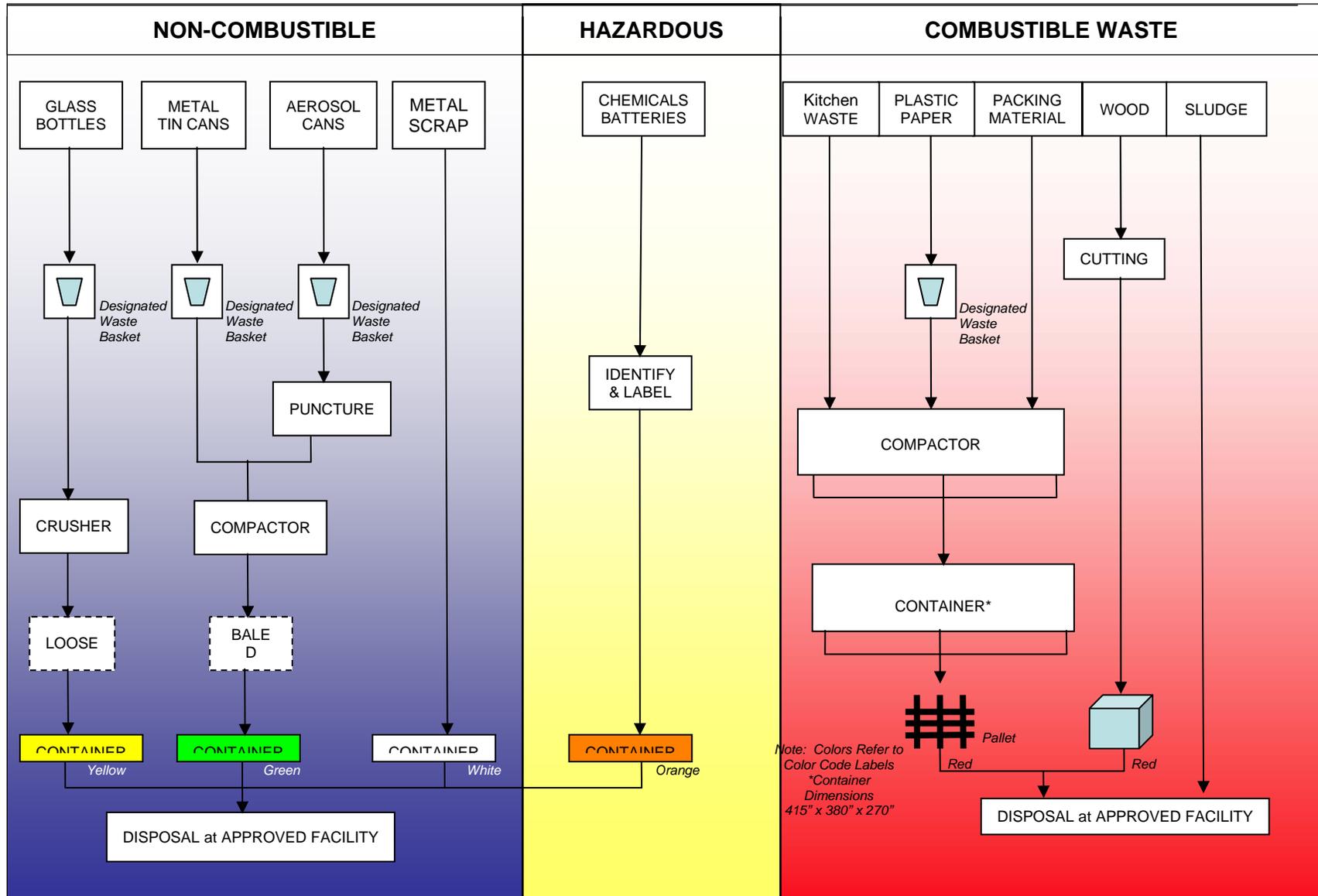


Figure 9: Off-refuge (Camp) and On-refuge (Shadura #1) Non-Drilling Waste Flow Diagram

Primary non-designated natural hazards in the project area during the proposed project timeline include flooding, weather, earthquakes, and volcanoes.^{2, 3 and 4} Each hazard is described below along with mitigation measures proposed to help prevent harm to the environment or public if a natural hazard event occurred during exploration.

Flooding

The Swanson River is about one mile west of the proposed Shadura #1 drill site. The 100-year flood plain of the Swanson River and surrounding drainages are not mapped or surveyed.⁵ Hydrographic studies and observations by field teams, however, found that the proposed Shadura #1 drill pad and ice road route are in an area near the Swanson River that is not tidally influenced.

Zone D Flood Hazards

The KPB Floodplain Administrator and the Federal Insurance Administration have mapped KPB lands around the Kenai NWR as being Zone D and Zone V flood hazards. These are “areas of undetermined, but possible flood hazard.” The sources of Zone D flood hazards in the project area are (in decreasing order of frequency) from ice jams and stream-icings, glacial outburst (jökulhlaups), and high rainfall.

- **Ice jams** floods in late winter or early spring occur from stream-icing (aufeis) or from ice cover on a river disrupted by rapidly changing temperatures.⁶ Stream-icing zones in the Swanson River area or surrounding unnamed streams or sloughs are not mapped.⁷ Few large ice deposits and overflow zones are present in the South-central region, however, and most icings are limited to streams of floodplains of braided streams in or near uplands or mountains. The Swanson River and surrounding streams are meandering and in lowlands; therefore, the hazard from this type of flooding is very limited.

Ice jams also occur during spring breakup when the ice cover breaks into pieces and jams at bridges, bends or other natural constraints in a river. Heavy damage can occur when ice jams give way, sending surges of ice and rapidly moving water downstream. Because of the unpredictable nature of ice jams, flooding can be worse than 100 or 500-year events. The location of the proposed ice road and drill pad, however, again precludes impact from this type of ice jams.

- **Glacial outbursts (jökulhlaups)** occur when glacial movement opens a pathway for water trapped behind or under a glacier to escape.⁸ This can occur anytime during the year. Rivers are then subject to large magnitude outburst floods from the sudden drainage of large, glacier-dammed lakes, particularly on the west side of Cook Inlet. Rivers also are subject to flooding from the catastrophic release of large quantities of water being stored under or within a glacier, even though no surface lake is visible.⁹ There are no known or inferred glacial outburst flood courses in the project area of the Swanson River drainage.¹⁰

² Final Finding of the Director: Cook Inlet Areawide 1999 Oil and Gas Lease Sale. ADNR/Division of Oil and Gas. January 20, 1999

³ Geologic Hazards In and Near Proposed State of Alaska Oil and Gas Lease Sale 85A (Cook Inlet). PDF 95-36. DGGs. November 1995

⁴ Kenai Peninsula Borough All-hazard Mitigation Plan. Kenai Peninsula Borough. June 2004

⁵ Ibid. John Williams, KPB (July 10, 2008) and Jane M. Gabler, KPB (July 11, 2008)

⁶ Stream-Icing Zones in Alaska. RI 84-16, Plate 82 of 102. DGGs. 1984

⁷ Ibid

⁸ Peninsula Borough All-hazard Mitigation Plan. Kenai Peninsula Borough. June 2004

⁹ Glacier Dammed Lakes and Outburst Floods in Alaska. HA-455. USGS. 1971

¹⁰ Ibid

- **Excessive rainfall** is the least frequent cause of flooding because it usually results from unusual combinations of extreme meteorological conditions. Flooding caused by excessive rain generally occurs during summer and fall, and ends when the rain turns to snow in late fall. Spring floods, however, may occur from above normal snowfall combined with an unusually cold spring and then rapid snowmelt.

Proposed mitigation measures focus on reducing vulnerability to flooding hazards. They include the following:

- Schedule construction and drilling operations in January and February when the Swanson River is either mostly frozen or water levels are usually very low.
- Coordinate activities and monitor potential flooding hazards with the KPB Office of Emergency Management and through the United States Geological Survey (USGS).

Weather

Weather hazards in the project area include prolonged warm spells or cold spells, fog, high winds, and winter storms (either rain or snow).

Proposed mitigation measures to mitigate warm temperatures include the following:

- Install rig mats, place snow on the road to act as an insulator and reduce albedo, and limit traffic to nightshift operations.
- Incorporate the above measures, but limit traffic to LGPVs such as Rolligons or Steiger tractor trains that are capable of crossing thawed wetlands with limited impact.
- Place several additional layers of rig mats directly under the drill modules and utilize jacks to level rig modules if settling occurs.

Proposed mitigation measures to mitigate extreme cold temperatures include employing a drill rig designed to operate in arctic conditions and following Alaska Safety Handbook and North Slope Environmental Field Handbook guidelines for working in cold weather conditions.

Proposed mitigation measures necessary during high winds and/or heavy fog and whiteouts include curtailing drilling operations. Measures for winter storms also will include keeping all roads and pads clear of snow, and creating positive drainage for surface runoff from rain.

Additionally, project personnel will operate their vehicles in compliance with the vehicle safety rules and foul weather contingency plans as presented in the 2006 Alaska Safety Handbook.

Volcanoes

Four active volcanoes on the west side of Cook Inlet (Augustine, Iliamna, Spurr and Redoubt) are between 50 and 90 miles of the project area.^{11, 12, 13 and 14} Hazards from all are limited to the distal hazards of volcanic ash clouds and ash fallout. Distal hazards are those caused by eruptions that affect distant sites; therefore, they allow for adequate warning times. The potential for heavy ash fall is likely to be the primary hazard associated with future eruptions. Heavy ash fall can disrupt many human activities, interfere with power generation, affect visibility, and could damage electrical components and equipment. Secondary hazards include fine ash fall that generally is a nuisance causing respiratory problems in some humans.

Proposed mitigation measures for volcanic hazards include the following:

¹¹ Preliminary Volcano-Hazard Assessment for Redoubt Volcano, Alaska, OFR 97-857. USGS, 1998
¹² Preliminary Volcano-Hazard Assessment for Augustine Volcano, Alaska, OFR 98-106. USGS, 1998
¹³ Preliminary Volcano-Hazard Assessment for Iliamna Volcano, Alaska, OFR 99-373. USGS, 1999
¹⁴ Preliminary Volcano-Hazard Assessment for Mt. Spurr Volcano, Alaska, OFR 01-482. USGS, 2002

- Receive timely warnings by monitoring for bulletins from the USGS Alaska Volcano Observatory of volcanic unrest and potential eruptions at <http://www.avo.alaska.edu>.
- Curtail construction or drilling operations during heavy ash fallout to avoid damaging motorized equipment.
- Evacuate project personnel with compromised or weakened respiratory systems during fine ash fallout, and curtail aircraft traffic.

Earthquakes

The project area is in a very seismically active region and is bounded to the west by the Bruin Bay fault and to the east by the Border Ranges fault. Based on the USGS probabilistic seismic hazard assessment mapping,¹⁵ the probability of ground shaking one or more times within the next year with a moment acceleration magnitude of >8 with an epicenter within 76 to 82 miles is 0.00052.

Proposed mitigation measures for earthquake hazards include the following:

- Design and build all structures to meet or exceed the Uniform Building Code specifications for Seismic Zone 4 (highest earthquake hazard). Seismic Zone 4 potential effects include ground motion amplification, soil liquefaction, and other earthquake induced ground failures.
- Provide earthquake safety training
- Site facilities and the drill rig to avoid potentially hazardous geologic faults.

3.2.15 Qualifications of Key Personnel (Training)

Well site operations will be under the direct supervision of a site manager/company-man. An HSE officer will support the site manager/company-man at the rig site. The drill contractor will supervise drilling operations with assistance from the toolpusher. They are responsible for the safe operation of the drill rig and directing drill crew activities during the various phases associated with the exploration well. Additional technical personnel (geologists, engineers, service technicians, etc) will be on site for specific tasks associated with casing, cementing, formation logging and well testing.

General

All project personnel will successfully complete the North Slope Training Cooperative Unescorted Training Program with the H2S Awareness module. The Unescorted Program consists of the following six courses: Camps & Safety Orientation, Alaska Safety Handbook, Hazard Communication, HAZWOPER Awareness, Personal Protective Equipment, and Environmental Excellence. The training course is provided by certified third party instructors, takes 9 hours to complete, and provides an ID card and certificate of successful completion. Additionally all service company or contractor employees must also have completed all other applicable regulatory (OSHA) and technical training specific to their assigned job task prior to commencing work. Project contractors will be required to have their training records available upon request.

Drilling Operations

Company and contractor personnel involved directly in drilling operations will be trained in well control methods. Such training will be completed in approved company or industry schools before drilling is commenced. Blowout prevention drills will also be conducted as required by the AOGCC. A list of personnel and their completed training will be maintained on the drilling rig and will be available upon request.

¹⁵ 2002 Earthquake Probability Mapping. USGS EHP. July 2008 at <http://earthquake.usgs.gov/research/hazmaps>

Supervisors, toolpushers, drillers, motormen, derrick men, and pit watchers will have extensive training, including International Association of Drilling Contractors Well Cap-Approved Blowout Prevention Training School. Blowout prevention certifications are refreshed every two years.

Spill Response

All personnel engaged on the project will receive Oil Spill Containment and Cleanup Training as specified in SPCC plans.

Project-Specific Orientation Training

Employees and contract personnel will receive Project-Specific Orientation Training before beginning work on this exploration project.

The orientation will include those topics listed in this EA. Qualified lecturers in a classroom environment will conduct instructed training on each topic. Participants will be provided with appropriate documentation of the training (guidelines and procedures) pertinent to environmental, social, and cultural concerns for their reference during the project. Relevant law, regulation, and permit stipulations will also be provided.

Drilling support/project specific orientation training. Training will be provided to cover all phases of the project, including but not limited to the following.

- Mobilization/demobilization of the rig /camp to the staging areas and then to the Shadura #1 pad.
- Rig operations during drilling of the exploration well.
- Resupply and refueling operations.
- Transport of fuel, supplies, and waste materials, and all other operations that occur through demobilization.

Training will be mandatory for all personnel (including agents, contractors, and subcontractors) and will maintain a record of all personnel who attend the program. This record will include the attendee names and date(s) of attendance, and kept onsite for inspection. An identification card including proof of training certification will be carried to each trainee at all times during the exploration project.

Environmental and cultural project specific orientation training in support of relevant permit stipulations. Classroom presentations and discussions will be presented to ensure that orientation participants understand the relevance of environmental law, as well as how performance affects operations in Alaska. Presentations will include identifying and discussing regulatory stipulations, and how they apply to the tasks assigned on the project. Environmental and cultural training will include the following.

- **Archaeological Resources and Protection of Archaeological Resources:** The project area is generally thought to have a low potential for cultural resources as no sites were identified during a field survey (see Section 4.3). As an additional measure, however, instruction will be provided on identification and protection of archaeological and cultural resources that could be encountered during ice road construction and drilling support activities.
- **Biological Resources and Habitats:** There will be a presentation on the biological resources, wildlife, and habitats that may be encountered in the Kenai NWR. Additionally, a Wildlife Interaction and Bear Avoidance Plan (Appendix B) has been prepared to follow during project activities.
- **Endangered and Threatened Species:** At least 66 species of amphibians, birds, and mammals permanently reside in, seasonally use, or are casual or rare visitors to the project area (see Section 4.3). None of these species are known to be threatened or endangered. Nonetheless, there will be a presentation on endangered and threatened species, introducing concepts of conservation and protection of listed species and designated critical habitats.

- **Avoidance and Non-Harassment of Wildlife Resources:** A Wildlife Interaction and Bear Avoidance Plan (Appendix B) has been prepared based on information from documents provided by the USFWS and ADF&G. Discussions on moose and bear interaction and encounters will be included as part of project orientation, along with a review of pertinent laws and regulations.

3.2.16 Safety Meetings

Safety is the most important issue during all construction and drilling operations. All work crews will conduct daily safety meetings to discuss upcoming tasks and identify potential hazards and ways to mitigate them. The rig crews also will conduct well control safety drills on a routine basis. Safety meetings will be held frequently during the duration of the project to ensure that field personnel are constantly aware of the potential sources of accidents and the means to prevent them.

3.2.17 Fuel Storage and Transfers

All fuel storage and transfers will comply with the *USFWS Region 7 Fuel Storage Policy*. A Copy of the policy is included in Appendix C. On-refuge fuel storage will be limited to engine and generator day tanks, plus one double-walled, upright 200-barrel AST on skids. The roll-off tank will be placed on 30-mil oil-resistant liner within 16-foot wide concrete jersey barriers for splash and puncture protection in an effort to reduce the temporary pad footprint, and to reduce the potential for a large diesel spill.

All drilling and construction equipment will use diesel fuel. Fueling of vehicles and equipment, including monitoring of fuel quantities, will take place daily. In an effort to eliminate fuel spills, fueling will be conducted using established fuel transfer procedures including secondary containment beneath fueling ports and a minimum of two qualified personnel will always be present during fuel transfer operations. Spill response kits will also be staged along the ice road when ice road construction begins. All other small fuel containers at project operational sites will have secondary containment.

3.2.18 Security

To maintain safety and meet the air quality permit requirements, a 230-meter exclusion zone around the well site will be enforced. This will be done by posting perimeter signage on all four sides of the well site, at least 280 meters away. The signs will note that the exclusion zone is a restricted area and only authorized personnel are allowed to enter after approval by the drilling supervisor. It is proposed that use of the route be limited to drilling support activities, to prevent the ice road from becoming a well-used access road and in turn, a permanent trail.

To limit access to the ice road and temporary drill pad, security checkpoints will be established at the start of the ice road and at the entrance to the temporary drill pad. Watchmen also will provide surveillance along the road to intercept any unauthorized visitors. All authorized, untrained personnel will sign-in at the guard shacks before entering the ice road or drill pad, and attend a 30-minute safety, project orientation, and environmental awareness briefing before being allowed in operational areas.

3.2.19 Community Outreach and Local Hire

Community Outreach with Local Villages, Towns, Native Population, Non-Governmental Organizations. A dialog will be established with these entities through consultation with Cook Inlet Region, Inc. (CIRI), Kenai Peninsula Borough, and local cities, villages, tribes and affected public. Local news releases will be periodically given to inform the public about the project and include any access restrictions in place due to safety concerns.

The purpose of these consultations will be to identify and implement measures that will help to minimize any adverse effects on the availability of fish and wildlife for commercial and subsistence

uses, and to ensure that drilling operations have no negative effect on the quality of life for Alaskans. Efficient and effective communications will be maintained with concerned and affected communities for the duration of the project.

Employment of Alaska Residents and Local Hire. The majority of exploration project service and support contractors have local hire programs and a history of effective local employment provided to residents of south central Alaska.

3.3 Alternatives Considered but Eliminated

3.3.1 Directional Drilling from Off-Refuge

Directional drilling from off-refuge using an extended reach drill (ERD) rig was also considered. This alternative, however, would not be technically practicable. The proposed Shadura #1 drill site is located over the center of the natural gas play, and is at least 4.3 miles from an off-refuge area capable of staging an ERD rig. The Shadura #1 drilling targets multiple pay zones extending from Beluga Formation sands at 6,000 feet total vertical depth (TVD) to middle Tyonek Formation sands at 14,500 feet TVD. This means an ERD rig capable of directional drilling over five miles would be required. There is no ERD drill rig capable of drilling this distance in existence. Therefore, this alternative was not carried forward for consideration as an action alternative.

3.4 No Action Alternative

Under the No Action Alternative, no drilling of CIRI inholdings would occur. The purpose and need for the proposed action of exploring and testing the CIRI subsurface estate for natural gas within Kenai NWR in CIRI Leases C061647, C061648 and C061649 would not be met.

4. Affected Environment

4.1 Physical Environment

Most of the proposed project features and operations will occur within the Kenai NWR on surface lands managed by the USFWS (Figures 1 and 2). In 1985, under provisions of ANILCA, the USFWS published the Final Comprehensive Conservation Plan, Environmental Impact Statement, and Wilderness Review, Kenai National Wildlife Refuge (CCP).¹⁶ This document describes in detail the physical, biological, and human environments of the refuge. Unless otherwise noted, the following information presented in this section was derived from this document.

4.1.1 Climate

The climate of South-central Alaska is subarctic with temperatures ranging between -30°F and 80°F on the Kenai Peninsula. Historical climate from nearby Kenai¹⁷ is summarized in Table 7.

Table 7: Kenai Peninsula Climate						
	Average		Average		Average	
	Temp.	High/Low Temp	Snowfall	Precipitation	Days <32°F	Days <0°F
December	13°F	21°F/5°F	13.6 in.	1.1 in.	30.6	12.7
January	12°F	21°F/3°F	12.5 in.	0.9 in.	30.6	14.9
February	16°F	26°F/6°F	10.9 in.	0.9 in.	27.8	10.2

¹⁶ USFWS 1985. Final Comprehensive Conservation Plan, Environmental Impact Statement, and Wilderness Review, Kenai National Wildlife Refuge (CCP)

¹⁷ Source: Weatherbase.com, based on 26 years of data. <http://www.weatherbase.com> (as of 11 October 2009)

March	21°F	32°F/10°F	9.8 in.	0.9 in.	30.7	7.8
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4.1.2 Air Quality

Although there is minimal ongoing monitoring in the Kenai Peninsula Borough, air quality is generally considered to be good. The land in and surrounding the project area is classified as a Class II air shed by the ADEC.¹⁸ Class II air sheds are generally pollution free and allow some industrial development. Class I air sheds are designed to protect pristine areas such as parks and wilderness areas. The Chisik Island area, within the Alaska Maritime National Wildlife Refuge, is the only area within the Borough that has been classified as a Class I air shed at this time.

Several industrial and energy processing facilities located in the Cook Inlet and Kenai/Nikiski area emit air pollutants including particulate matter, sulfur oxides, carbon monoxide, nitrogen oxides and hydrocarbons. The impact of these emissions tends to be localized. Prevailing winds from the north and east tend to move any pollutants towards the Lower Cook Inlet and the open sea. Temperature inversions, which could trap pollutants, are not common in this area. Low visibility due to snowfall or fog is occasionally a problem in the Cook Inlet area.

4.1.3 Landforms

The project site is located within the physiographic feature known as the Kenai Lowlands. These lowlands consist of ground moraine and stagnant ice terrain with low ridges, hills, and muskeg. Relief ranges from 50 to 250 feet and most of the land is less than 500 feet above mean sea level. This area contains thousands of lakes.

4.1.4 Geology and Soils

The geology of the project area consists of Tertiary rock formations covered by glacial deposits. Collectively known as the Kenai Group, it is mostly siltstone, fine sandstone, and shale with some petroleum-bearing sandstone and conglomerate, and locally abundant coal beds. Thick, unconsolidated glacial moraine and outwash cover this rock in most areas. The project area is in a very seismically active region and is bounded to the west by the Bruin Bay fault and to the east by the Border Ranges fault. Based on the USGS probabilistic seismic hazard assessment mapping,¹⁹ the probability of ground shaking one or more times within the next year with a moment acceleration magnitude of >8 with an epicenter within 76 to 82 miles is 0.00052%.

Glacial deposits that are overlain by well drained to poorly drained silt loams mantle the Kenai Lowlands. Low-lying areas are usually covered by peat soils produced by decomposing organic materials. Most soils are considered sub-marginal for agriculture production. Sloped areas are vulnerable to erosion, especially if the vegetation cover is removed.

4.1.5 Water Resources

Surface Water

The Swanson River, about one mile to the west, is the largest flowing water in the area. Several small, incised streams are within project area, and intersect both the West Route Alternative and the East Route Alternative. The streams are less than 10-feet wide. All the streams and the Swanson River drainage are non-glacial, lowland streams with only moderate flows in later summer and fall.

Some of the significant lakes in the project area include Crane Lake, Snipe Lake and Hungry Lake. Thousands of other small lakes and ponds also dot the Kenai Lowlands and several of them are located within the project area. Most of these lakes are frozen from November to May; the Swanson

¹⁸ Kenai Peninsula Borough Coastal Management Plan. Kenai Peninsula Borough. June 2008

¹⁹ US Geological Survey. 2002 Earthquake Probability Mapping. USGS EHP. July 2008 at <http://earthquake.usgs.gov/research/hazmaps>

River freezes later and thaws earlier. Summer water temperatures rarely exceed 68°F. The high-flow period for streams is in the summer. The combination of cold water, reduced light, and low mineral content limits the productivity of waters in the area. These characteristics are partially offset by high oxygen content, lack of pollution, and a wide diversity in the physical characteristics of the aquatic habitats.

Groundwater

Groundwater from the unconfined (water table) aquifer will be the main source of water used to construct the ice road and temporary drill pad and the majority of the ground water will come from off-refuge sites. Groundwater is part of the North Kenai Groundwater System.²⁰ There are three distinct water-bearing aquifers in this system. An unconfined water table aquifer (UA) found 20- to 60-feet below the surface in nearby Nikiski. It is followed by a confining clay stratum separates the unconfined aquifer from an underlying semi-confined aquifer and a lower, confined aquifer. Known and estimated characteristics of each aquifer at nearby Nikiski are summarized in Table 8. Both the water table and the upper artesian aquifers in the central peninsula receive recharge primarily from local precipitation. Principle areas of recharge occur on well-drained soils underlain by glacial drift.

Table 8: North Kenai Groundwater System Characteristics					
Relative/Spatial Location		Hydraulic Characteristics			
Type	Thickness (ft)	Direction	Gradient (ft/ft)	Conductivity (cm/sec)	Yield (gpm)
Unconfined (Water Table) Aquifer (UA)					
Continuous, non-artesian	2 to 21	West/Northwest	0.007 to 0.01	7×10^{-3}	50 to 1000
Semi-confined Aquifer (SCA)					
Continuous, non-artesian	72 to 96	West	Unknown	7×10^{-2}	200 to 1300
Lower Confined Aquifer (LCA)					
Continuous, artesian	>86 ft	West	Unknown	Unknown	50 to 2000

4.1.6 Fire

Many fires have occurred on the Kenai NWR in the past 100 years. A 1969 fire occurred in the area of the project site that resulted in the natural replacement of mature spruce forests with a mosaic of brush and young forest in various stages of succession. This mixture of vegetation provides habitat for species of wildlife such as moose. The areas have now aged, however, where hardwood re-growth no longer provides high quality food for moose. The project area is partially included in a fire management zone where all fires are suppressed to protect human life and property.

4.2 Biological Environment

4.2.1 Vegetation

The vegetation of Kenai NWR is divided into three major classes: 1) humid coastal forests dominated by Sitka spruce (*Picea stichensis*), 2) interior forests of white and black spruce (*Picea glauca*, *P. mariana*) with a mixture of birch (*Betula papyrifera*), and 3) mountain tundra, including glaciers and snowfields.

²⁰ Hydrogeologic Investigation, Ammonia-Urea Plant, North Kenai, Alaska. ENSR, June 1990

Based on the Kenai NWR CCP mapping, the project site is within the interior forest zone and consists of a mosaic of spruce forest, swampy black spruce, peat bogs, and grassy mires. Quaking aspen (*Populus tremuloides*) also is found, along with white spruce and birch.

4.2.2 Terrestrial Habitats

The Kenai NWR includes a variety of wildlife habitats and species. Fires, and (to a much lesser degree) human influenced habitat modifications have affected the distribution of these habitats. At least 199 species of amphibians, birds, and mammals permanently reside in, seasonally use, or are casual or rare visitors to the Kenai NWR; 68 of these species can be found within the project area. None of these species are listed as threatened or endangered. The ecologically dominant and representative species for habitats in the project area are summarized in Table 9.

The project area, as mapped and presented in the 1985 Kenai NWR CCP, was intermediate stage forest habitat comprised of primarily 20- to 40-year old trees. Unless fires have occurred since 1985, this same habitat would now be considered intermediate forest habitat with 40- to 70-year old trees. The Kenai NWR CCP also states that with smaller trees and fewer snags, this habitat is not as productive for wildlife as older, more mature forests on the refuge. Moose do not favor this habitat.

Table 9: Terrestrial Habitats and Representative Species			
Wildlife Habitat Type	Diversity Index ^a	Ecologically Dominant Species ^b	Representative Species
Wetlands	96	Caribou, sandhill crane, common snipe, wood frog, bog lemming, arctic tern, least sandpiper, northern harrier, greater yellowlegs, mew gull, red-necked phalarope	Greater yellowlegs
Mature Forest (70-200 years)	68	Black bear, masked shrew, red squirrel, black-capped chickadee, spruce grouse, yellow-rumped warbler, hairy woodpecker, three-toed woodpecker, great horned owl	Three-toed woodpecker
Intermediate Stage Forest (40-70 years)	66	Black bear, lynx, wolf, porcupine, red-back vole, spruce grouse, yellow-rumped warbler, gray jay, dark-eyed junco, great horned owl.	Yellow-rumped warbler
^a Diversity Index is the total number of species using the habitat for breeding. ^b Ecologically dominant species are species having significance from a human (hunting or viewing) or ecological (biomass, food or occur in large numbers) standpoint.			

Wetlands in the project area have been mapped as part of the National Wetlands Inventory (NWI). NWI maps for Kenai Quads C-3 and D-3 were used to develop Figure 10. Figure 10 shows approximate proposed ice road routes and the Shadura #1 temporary drill pad. Both routes generally follow PSS1/EM5F – Patterned bog wetlands as much as possible to avoid clearing trees. According to the USFWS Wetlands Outline Mapper, these wetlands are composed of saturated shrub bog with 30 percent or more of the canopy consisting of broad-leaved deciduous shrubs. The remaining portion of the canopy consists of persistent emergent vegetation. Dominant shrubs include dwarf birch, bog blueberry, mountain cranberry, Labrador-tea, leatherleaf, cloudberry, crowberry, bog rosemary, and sweetgale. Dominant emergent species include cotton grass, sedge, bluejoint grass, and horsetail. The saturated, peaty soils in this wetland type are covered with a dense mat of moss.



Other types of wetlands mapped in the project area as part of the National Wetlands Inventory (NWI) for NWI maps Kenai C-3 and D-3 include the following along with descriptions.

- *L10WH* – Lakes
- *POWH* – Small ponds
- *PEM5B* - Saturated, Emergent Bog-Type Marshes. These areas are generally on saturated peat soils with a sphagnum mat covering the soil surface. Sedges and cotton grass dominate this wetland type.
- *PEM5C* - Seasonally Flooded, Persistent Emergent Marshes. Usually occurs on the floodplain of small streams and creeks. Standing water resulting from stream overflow is present for approximately one month during the growing season. Sedges, bluejoint grass, and marsh cinquefoil are the dominant plants. Associated species include meadow horsetail and Jacob's ladder. Willow shrubs often occur as a sparse cover.
- *PEM5F* - Semi-permanently Flooded, Emergent Marshes. These are deep marshes that exhibit standing water usually throughout the entire growing season. The dominant emergent vegetation consists of water horsetail, sedges, cotton grass, buckbean, spikerush, and rush in patterned bog pools.
- *PSS4B* – Saturated Black Spruce Bog with black spruce less than 20 feet tall. Low shrubs form an understory, and the ground is usually composed of a moss mat. Shrub species include dwarf arctic birch, Labrador-tea, bog cranberry, mountain cranberry, leatherleaf, and crowberry
- *PSS4/1B* – Shrub bog that has 30 percent or more of the canopy consisting of needle-leaved evergreen shrubs.
- *PSS4/1C* - Seasonally flooded shrub bog that generally occurs adjacent to streams and small rivers and is dominated by black spruce; willow and alder are also common.
- *PSS1/EM5F* – Patterned bog composed of bog ridges and wet hollows. Broad-leaved deciduous shrubs, such as dwarf birch, Labrador-tea, bog rosemary, and sweetgale dominate the ridges. The bogs are semipermanently flooded and dominated by emergent vegetation, such as sedges, and a dense sphagnum mat.
- *PSS4/EM5B* - Saturated black spruce bog with an emergent ground layer dominated by black spruce less than 20 feet tall and emergent species such as sedges, horsetail, and marsh cinquefoil.

4.3 Fisheries

No anadromous fish streams within ice road alternatives and the drill site are listed in the *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes- South-central Region*.²¹

The ADF&G, however, noted in an email communication that focused on the West Route Alternative that “*project activities include building an access ice road across a non-cataloged stream along the West Route*.”²² Since a temporary bridge crossing will be constructed by using rig mats and ice, this crossing, according to the ADF&G, does not appear to inhibit fish passage.

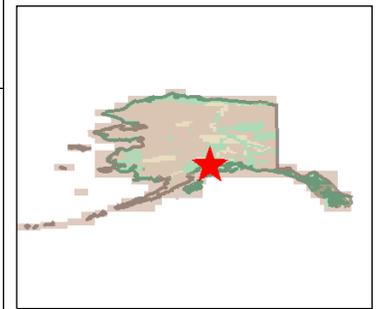
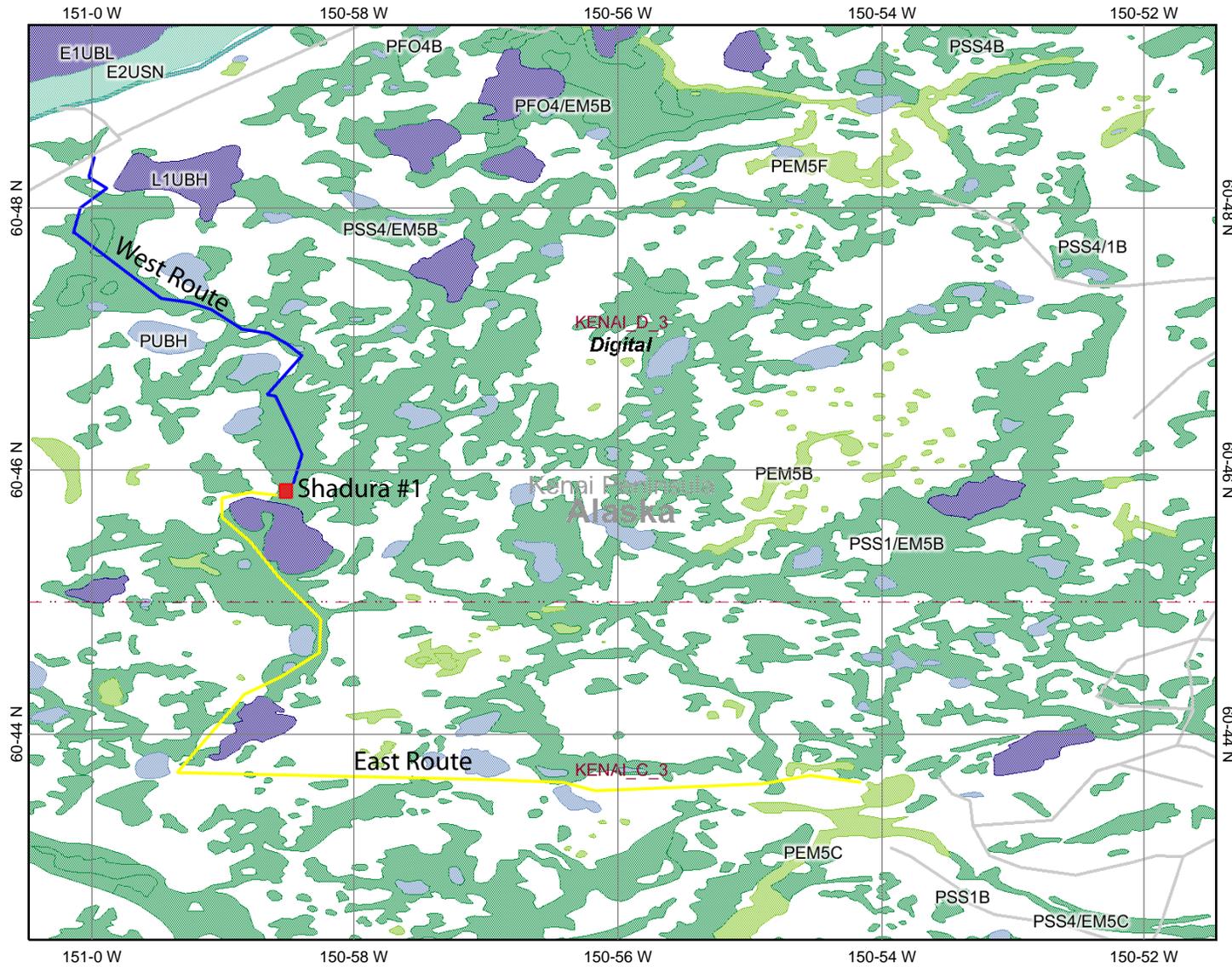
The Swanson River also provides spawning and rearing habitat for coho salmon, sockeye salmon, rainbow trout, and Dolly Varden. Threespine sticklebacks are common in lakes within the project area, and Dolly Varden and arctic char also occur in the Swanson River watershed.²³

²¹ ADF&G, <http://www.sf.adfg.state.ak.us/SARR/AWC/index.cfm/FA/main.overview>. 2009

²² Email correspondence with Ginny Litchfield, VLitchfield@borough.kenai.ak.us. ADF&G, 1 October 2009

²³ East Swanson River Seismic Survey, Final Environmental Assessment, Kenai National Wildlife Refuge. MacTec, April 2007

Figure 10: Wetlands in Shadura #1 Project Area



Legend

Major Roads

- Other Road
- Interstate
- State highway
- US highway

Roads

- AK USGS Quad Index 63K

AK Wetland Polygons

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Map center: 60°45' N, 150°55' W

Scale: 1:90,101

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

Notes: Source: USFWS Wetlands Online Mapper (http://wetlandsfws.er.usgs.gov/imf/imf.jsp?site=NWL_AK)

4.4 Human Environment

4.4.1 Cultural Resources and Historical Resources

Archeological studies have revealed approximately 10,000 years of human history in the area, including occupation by Kachemak Eskimo and Athabascan Indian peoples. Most known archeological sites are on dry terraces adjacent to major rivers and lakes in Kenai NWR. Based on the geography and characteristics of the terrain at the project site location, and previous archaeological surveys, there is a low probability of finding new sites of cultural significance in the project area.

In September 2009, Charles Mobley and Associates conducted an archaeological clearance survey of the temporary pad location and West Route of the ice road route.²⁴ The survey found nothing of significance.

Several sites within Kenai NWR have been selected as historical or cemetery sites under Section 14(h)(1) of the Alaska Native Claims Settlement Act (ANCSA). Additionally, numerous historic cabins are also found on Kenai NWR. Many of these sites and structures may meet the criteria for listing in the National Register of Historic Places; however, none of these sites and structures are found within the project area.

4.4.2 Social and Economic Characteristics

The project site lies within the Kenai Peninsula Borough (KPB) with an approximate population of 54,000 people.²⁵ More than half of the people in the Borough live in or near the cities of Kenai, Soldotna, Sterling, Kasilof, and Nikiski. Kenai, KPB's largest city, is the center of oil and gas industry on the KPB, and Nikiski, located approximately five miles from the project area, is the nearest community. KPB has one of the state's most diverse economies. KPB's oil and gas industry is composed of exploration, extraction, storage, processing/manufacturing, and transportation and accounts for approximately one-third of the labor force. Commercial harvest and processing of fish in the borough traditionally includes five species of salmon, halibut, and three species of crab, as well as shrimp, clams, scallops, herring, and various groundfish. New markets are presenting themselves in farmed oysters, mussels, seaweed, sea urchin, sea anemone, and various other seafood products. Tourism is the fastest growing industry in the borough. The timber industry is an emerging part of the local economy with an automated lumber mill on the eastern peninsula and a large chipping operation located on the southern peninsula.

4.4.3 Scenic Resources

Scenic views of the highest order are found on the Kenai Peninsula. This quality is noted in ANILCA as a concern for Kenai NWR planning. The scenic character of Kenai NWR has been altered along the first 3.3 miles of the East Route Alternative by the SRF ROW (Figure 3). This ROW contains overhead power lines and buried pipelines. The scenic character of the Kenai Peninsula has been altered along a 0.4-mile portion of the West Route Alternative by the Nikiski Pipeline ROW (Figure 5) that adjoins the Kenai NWR boundary on State land. This ROW contains a buried multi-product transfer line. Other visual features in the refuge include electric transmission lines, roads, recreation facilities, wildlife habitat management activities, oil and gas operations, and research areas. These features and practices may create artificial focal points that can interrupt the otherwise natural appearance of the landscape.

²⁴ Mobley and Assoc. Letter Report. October 6, 2009

²⁵ Kenai Peninsula Borough, <http://www.borough.kenai.ak.us> (last updated 16 September 2009) and US Census Bureau, <http://quickfacts.census.gov/qfd/states/02/02122.html> (last updated on 4 September 2009)

4.4.4 Recreational Resources

Kenai NWR supports more recreational use than all other refuges in Alaska combined for specific recreational activities, primarily fishing, camping, hiking, canoeing, hunting, and wildlife viewing. The accessibility of Kenai NWR is influenced by natural features such as lakes and rivers, and by human influences such as roads, trails, and seismic lines. Kenai NWR has more roads and trails and is accessible to more people using aircraft, because of its close proximity to Anchorage, than any other refuge in Alaska. Oil and gas exploration and development have greatly increased the access to Kenai NWR. Over 1800 miles of historic seismic lines also traverse Kenai NWR lands through the extended area making access easier for hikers and snow machines. The general area is also open to snow machine use and trapping by the public in winter.

Impacts similar to the old seismic lines could occur if the temporary ice road route becomes a permanent trail for motorized vehicles. Additionally, State air quality permitting regulations require a closed zone around the temporary drill site. Therefore, it is proposed to restrict access to the ice road and drill site during construction and operations, and then use natural barriers to restrict access to the former ice road route after demobilization. As noted in Section 3.2.14, natural barriers will include planting trees and re-installing standing trees so that the former road alignment cannot be seen (thus restoring the scenic view) nor followed (thus minimizing the impact of a permanent trail).

4.4.5 Subsistence

Much of the Kenai Peninsula is considered non-rural under federal subsistence management regulations and little subsistence activity occurs in the area today.²⁶ Four communities (Ninilchik, Port Graham, Nanwalek, and Seldovia), have been determined to have customary and traditional use of moose in ADF&G Game Management Unit 15(a) where the project is located.²⁷ This determination, and subsequent federal regulations, established a special moose hunting opportunity that allows qualified subsistence users several more days to hunt (before the regular hunting season opens in August). Hunting season, however, will be closed for moose during project activities.

Additionally, all qualified rural residents within the State of Alaska (regardless of whether they reside on the Kenai Peninsula or not) are currently eligible to subsistence fish on the Kenai NWR for traditional species, such as trout and salmon. Current subsistence fishing regulations, however, employ the same seasons and bag limits, and restrictions on methods and means, as the regular State fishing regulations, providing no special benefits to qualified users beyond being excused from requiring a State fishing license. These seasons also will be closed during project activities.

Finally, there is no known subsistence fishing activity currently taking place within the project area.

4.4.6 Oil and Gas Commercial Activity

Kenai NWR lies within the Cook Inlet hydrocarbon basin, and has been identified as a Favorable Petroleum Geologic Province in accordance with Alaska National Interest Lands Conservation Act (ANILCA). Refuge lands were classified in the 1950s to identify areas that would not be subject to oil and gas leasing. Since that time, leases for the SRF, Beaver Creek and Birch Hill oil and gas fields were issued under the authority of the Minerals Leasing Act of 1920. A total of 13,252 acres have been leased and developed.

Based on the most recent available information, CIRI has received entitlements to about 200,000 acres of subsurface estate adjacent to these leases, under provisions of ANCSA, with development rights to oil, gas and coal resources on these lands. Nordaq's exploration activities are pursuant to

²⁶ Office of Subsistence Management (2008/2010). Management Regulations for the Harvest of Wildlife on Federal Public Lands in Alaska. Anchorage, Alaska

²⁷ Alaska Department of Fish and Game, <http://www.subsistence.adfg.state.ak.us/geninfo/regs/subhunt.cfm> (last updated 15 September 2009)

CIRI Lease Agreements C061647, C061648 and C061649. Combined these three leases include 10,800 acres of CIRI subsurface estate inholdings.

5. Environmental Consequences

The following sections describe the environmental effects that would result from the proposed project by specific impact categories.

5.1 Eliminated Issues

The following issues were considered, but eliminated from further discussion; they are considered non-relevant issues because they are not found in the area that would be affected by the proposed project:

- Coastal barriers
- Wild and scenic rivers
- Threatened and endangered species
- Farmlands

5.2 Issues Considered

The environmental effects of the proposed project are summarized by specific impact categories in Table 10. With limited exceptions, impacts from either a West Ice Road or an East Ice Road that ends at the same temporary drill pad location generally would be similar. Exceptions are limited to Vegetation (Section 5.2.5) and are described separately.

Impact Category	West Route Alternative	East Route Alternative	No Action Alternative
Air Quality	Negligible impact	Negligible impact	No change
Geology & Soils	Negligible impact	Negligible impact	No change
Hydrology	Negligible impact	Negligible impact	No change
Water Quality	Negligible impact	Negligible impact	No change
Vegetation	Temporary loss of 600 ft. x 25 ft forested area (0.3 acres). Overall negligible impact	Temporary loss of 1,390 ft. x 25 ft (5 segments) forested area (0.8 acres). Overall negligible impact	No change
Wetlands	Minor to moderate impact	Minor to moderate impact	No change
Fisheries	Negligible impact	Negligible impact	No change
Wildlife	Moderate impact	Moderate impact	No change
Land Use & Ownership	Negligible impact	Negligible impact	Negative Impact
Economy & Socioeconomics	Negligible impact	Negligible impact	Negative Impact
Cultural Resources	Negligible impact	Negligible impact	No change
Scenic Resources	Negligible impact	Negligible impact	No change
Recreational Resources	Negligible impact	Negligible impact	No change

5.2.1 Air Quality

The proposed project will not add any long-term stationary emission source(s) and has short-term, limited impact to local air quality. Air emissions related to this project would be from mobile sources using internal combustion engines that use diesel. These engines are used to power the drill rig, light plants, boilers, and heavy equipment. Only low sulfur diesel (<0.5% sulfur by weight) will be used as fuel to further avoid causing violations of National Ambient Air Quality Standards and to meet a State Air Quality Minor General Permit (MG-1). The contractor has requested a 230-meter public exclusion zone around the drill pad to meet air quality. Additionally, most activities will take place during winter with all waste hauled offsite for disposal in existing permitted facilities. Therefore, fugitive dust will be negligible and there will be no open burning as part of the proposed action.

Therefore, the overall proposed project is expected to have a negligible impact on air quality.

Under the No Action Alternative, no changes to air quality would occur in the project area.

5.2.2 Geology and Soils

The proposed action would not involve clearing, stripping, or significant disruption of soils as both temporary road routes and temporary drill pad will be located on ice and/or rig mats. Drilling the well itself will involve disturbing a 10-foot diameter area for the well cellar, which will be backfilled with the same material that was removed, during demobilization, with subsidence taken into consideration.

Holes drilled for the replacing trees will be backfilled with organic soil to supplement growth. Holes drilled for replacing cut trees and deadwood to create a barricade and camouflage the former route will be backfilled with additional soil as required.

Therefore, the proposed project is expected to have a negligible impact on topography and soils

Under the No Action Alternative, topography and soils in the area would remain unchanged.

5.2.3 Hydrology and Water Quality

Hydrology

Impacts from the estimated volumes of groundwater to be withdrawn will be limited to temporary drawdown immediately around the planned well at the Peak storage yard north of Nikiski and at the water well planned to be drilled at the exploration pad within the CIRI subsurface estate. The drawdown will not impact other surrounding water wells. Surface water will not be withdrawn from lakes, and temporary rig mat bridges across streams will be removed (following ADNR permit conditions) during demobilization.

Therefore, there will be negligible impact to groundwater or surface water hydrology.

Water Quality

Groundwater discharged during ice road construction will meet State and federal water quality standards for discharge. There will be no in-water crossing of streams or lakes by equipment, nor will ice road construction or other significant activities contribute to erosion of soils and sedimentation to water bodies since most operations will take place during winter when streams and lakes are frozen/grounded and the vegetation would not be removed. Therefore, these activities will not impact water quality.

Drilling for natural gas would not likely encounter hydrocarbon-bearing formations containing fluids prior to target depths, and the well be at least 2,700 feet from streams and lakes known to support fisheries. Therefore, a crude oil spill that could impact surface water is unlikely.

While there will be an increased chance of a surface release from drilling support activities (especially fueling), prevention measures and practices will be in place and personnel will undergo training and

use best practice methods to reduce this potential. Additionally, winter operations generally result in spills cleaned up more quickly with less impact since surface water and near-surface soils are frozen, and snow acts as an efficient absorbent that is easily removed.

Prevention of petroleum contamination from diesel spills will include storing bulk fuel outside the refuge within bermed and lined secondary containment areas, and fuel trucks placed inside “duck pond” secondary containment during fueling. Peak, as fuel contractor, also will implement fuel transfer procedures that include best management practices such as two-man fueling crews and hazard communication training prior to fueling. SPCC Plans will be updated before the project begins to respond to spills and will have spill control equipment, sorbents, drip pans, etc., onsite. Therefore, overall impact to water quality from the proposed project is expected to be negligible.

Under the No Action Alternative, hydrology and water quality in the area would remain unchanged.

5.2.4 Vegetation and Wetlands

Vegetation

East Route Alternative. About 1,390 lineal feet of forest in five segments within the Kenai NWR (Figure 3) would require clearing to gain access to the temporary drill site. This would encompass an area of 0.8 acres for a 25-foot wide road.

Downed trees would be replaced as part of restoration by trees up to 8 feet in height, and seedlings planted. Downed trees and deadwood also would be replaced during demobilization to help create a standing barricade. A combination of these mitigation measures would help restore and also barricade/camouflage the former route to avoid it becoming a trail. Therefore, the east route alternative is anticipated to have a temporary impact to vegetation that would not be significant.

West Route Alternative. About 600 lineal feet of forest in one single segment, encompassing 0.3 acres for a 25-foot wide road, would require clearing within the Kenai NWR to gain access the drill site.

Downed trees would be replaced as part of restoration by trees up to 8 feet in height, and seedlings planted. Downed tree and deadwood also would be replaced during demobilization to help create a standing barricade. A combination of these mitigation measures would help restore and also barricade/camouflage the former route to avoid creation of a trail. Therefore, the West Route Alternative is anticipated to have a temporary impact to vegetation that would not be significant.

Temporary Drill Pad (both alternatives). No trees or standing deadwood are found within the footprint of the proposed drill pad location. Therefore, vegetation would not be impacted.

No Action Alternative. The No-Action Alternative would not result in impacts to vegetation.

Wetlands

Figure 10 suggests that most of the West Route and about 3.3 miles of the East Route traverse wetlands within the Kenai NWR. The proposed temporary drill pad also is within wetlands. If a 25-foot wide road is built, then along the West Route, there is a potential to impact about 8.8 acres of wetlands as compared to 10 acres along the East Route. The temporary drill pad would impact 1.4 acres. Impacts to wetlands from ice road and pad construction or operation could result from compression of the vegetative mat, vegetation damage, and petroleum spills.

Recent construction and operation of ice roads in south-central Alaska suggests that at least 1.5 feet of frozen ground covered by a 1-foot lift of ice generally results in limited compression of the underlying vegetative mat and standing dead vegetation. Nonetheless, the limited compression could temporarily reduce habitat availability and suitability for grassland nesting associated birds; but this generally does not persist beyond one or two growing seasons. Compression would be most

prominent in areas with a layer of moss or peat matting that could lead to longer-term habitat changes such as reduced vegetation cover or altered plant composition. Therefore, the ice road and pad will be routed and located as much as possible to avoid areas covered by moss or peat matting.

Construction across scrub shrub habitats can cause breakage and reduced survival of perennial shrubs. Shrubs would generally be expected to recover and/or re-establish, but recovery would be expected to occur over three to five growing seasons. Therefore, the ice road and drill pad should be routed and located primarily within herbaceous vegetation to avoid longer-term damage to scrub shrub vegetation.

While there will be an increased chance of a diesel fuel surface release from drilling support activities (especially fueling), prevention measures and practices will be in place and personnel will undergo training and use best practice methods to reduce this potential. Additionally, winter operations generally result in spills cleaned up more quickly with less impact since near-surface soils are frozen, and snow acts as an efficient absorbent that is easily removed.

Overall, the above factors and mitigation measures suggest there would be a minor to moderate impact to wetlands from ice road and ice pad construction and drilling operations.

The No-Action Alternative would not result in impacts to wetlands.

5.2.5 Fisheries

As a conservative approach, all small streams crossed in the project area are considered to support fisheries. There will be no in-water use of equipment or vehicles and temporary bridges would span the streams, which most likely will be frozen/grounded during the proposed winter schedule. Lakes in the project area also most likely will be frozen grounded. As described earlier, there will be no ground-disturbing activities that might introduce sediments into fish bearing waters. Therefore, stream crossings will have negligible impact to fisheries in the project area.

There is a remote possibility that diesel could be released during a spill on frozen soil next to a stream or lake. The likelihood of this occurring, however, will be greatly reduced by storing most bulk fuel outside the refuge within bermed and lined secondary containment areas, and fuel trucks placed inside "duck pond" secondary containment during fueling. Fuel transfer procedures would include best management practices such as two-man fueling crews and hazard communication training prior to fueling. SPCC Plans will be updated before the project begins to respond to spills and will have spill control equipment, sorbents, drip pans, etc., onsite. Additionally, winter operations generally result in spills cleaned up efficiently with less impact because near-surface soils are frozen, and snow acts as an efficient absorbent easily removed. Therefore, overall impacts from drilling support activities and ice road construction to fisheries also are expected to be negligible.

The No Action Alternative would have no impact on fisheries.

5.2.6 Wildlife

Impacts to moose, wolves, lynx, black and brown bear, snowshoe hares, and possibly bald eagles could stem from noise and other disturbances created by ice road construction, drilling, and drilling support operations, and demobilization during winter 2010/2011 operations. These impacts may include additional physiological stress and temporary or seasonal displacement from preferred feeding, nesting, and denning habitat and protective cover.

Impacts to moose, wolves, lynx, black and brown bear, snowshoe hares, and possibly bald eagles could stem from noise of the use of helicopters to transport equipment and crews over a period of about one week during summer 2011 restoration.

During certain times in the winter, moose may concentrate in overwintering habitat. This habitat is generally forested areas. If ice road construction, drilling and drilling support operations are occurring

in the same area, moose may be driven out. This is especially critical during periods when heavy snowfall covers the ground, or late in the winter. During these times, moose have little energy reserves and may not respond well to additional stress. Alternately, the ice road may attract moose that will use it as a path to follow during heavy snowfall cover, thereby saving energy. In these cases, moose/vehicle collisions must be considered and safe driving limits implemented to mitigate them.

Reduction of impacts to moose would be achieved by developing and implementing a wildlife interaction plan (Appendix B) that addresses both scenarios. Additionally, the Kenai NWR Manager may delay ice road traffic if snow depth and temperatures are such that additional stress created by the project is likely to have significant negative effects on concentrations of wildlife.

Disturbance to bear denning is another possible impact of the proposed action. The contractor will coordinate with the Kenai NWR staff to ensure that known bear denning locations are avoided during the survey. If bear dens are discovered during operations, then the contractor will cease activities in that area, communicate the den location the Kenai NWR, and relocate operations to not less than 660 feet (1/8 mile) away. Additionally, the contractor will implement bear avoidance (Appendix B) to help mitigate impacts during drilling operations. Because the activities are transitory, they should not result in any permanent impacts to bear habitat use.

Wolves and lynx may be temporarily displaced from areas where activities are occurring; this impact would likely be short term and without permanent consequences. The Kenai NWR Manager may delay operations in a particular geographic area to avoid disturbance of wolves at a kill site. No eagle nests were identified during a site reconnaissance in July 2009. Nonetheless, during winter, a 330-foot operational setback will be maintained from bald eagle nest sites that are found during ice road construction or drilling support operations.

Therefore, overall there moderate impacts to wildlife in the project area could occur.

The No-Action Alternative would have no impact on wildlife.

5.2.7 Land Use and Ownership

The Kenai NWR CCP allows for the exploration for oil and gas in the project area of the Kenai NWR. Site-specific permit conditions and mitigation measures to protect fish and wildlife, reduce impacts to their habitats, maintain recreational use and aesthetics, and protect cultural resources will be required by Kenai NWR Manager for on-refuge activities and by the State for off-refuge activities. The resulting impacts to land use and ownership are considered to be negligible. The results of the proposed exploratory drilling would define the likelihood of future development of portions of the area for oil and/or gas.

The No-Action Alternative would have a negative impact to CIRI's proposed land use if exploration for gas on subsurface estate inholdings does not occur.

5.2.8 Economy and Socioeconomics

The project would provide a temporary economic benefits for the local and State economy. In the short term, there will be increased employment related directly to the execution of the program. There will be a related economic benefit for those who provide services and goods to support the program. Successful natural gas exploration results, however, could lead to longer term economic benefits to the surrounding community if additional recoverable reserves of gas are developed. Successful natural gas exploration also leads to increasing natural gas reserves available to South-central Alaska.

The No-Action Alternative for this project would not provide short-term economic benefit for the local economy. Potential long-term benefits from future gas production would not be realized.

5.2.9 Cultural Resources

As noted in Section 4, a cultural resources and archeological survey completed by Mobely and Associates found no significant cultural or archeological resources. In the event that the cultural or historic resources are identified during project construction and operation, work in that area will immediately cease and the Kenai NWR and the State Historic Preservation Officer (SHPO) will be contacted for direction on how to proceed. Therefore, impact to cultural resources will be negligible.

The No-Action Alternative would have no impact to cultural resources.

5.2.10 Scenic Resources

The scenic resources in the project area along the East Route Alternative will be temporarily altered by clearing an area of 1,390 feet x 25 feet (0.8 acres) of forest. The scenic resource along the West Route will be temporarily altered by clearing an area of about 600 x 25 feet (0.3 acres).

In forested areas, temporary alterations will first be minimized by timber crusing and surveying curved routes through each cleared segment that avoid cutting trees while still allowing access of the rig modules along a 25-foot wide ice road. Therefore, long, sweeping zigzags will be staked/cleared instead of a straight, linear path. In wetlands containing low shrubs interspersed with an occasional standing deadwood, long sweeping curves will be staked to avoid a linear path. A combination of these initial mitigation measures will help camouflage the route during operations as well as after demobilization.

In cleared areas and within the footprint of the temporary drill pad, the scenic landscape will be restored at the end of project activities by replanting trees and seedlings, as well as replacing felled trees. In wetlands with low brush, standing deadwood that was cut will be replaced. This combination of planting and replacing will help restore altered scenic landscape and will help barricade and camouflage the former ice road route. Therefore, the impact to scenic resources will be negligible.

The No-Action Alternative would have no impact to scenic resources.

5.2.11 Recreational Resources

Winter recreational use in the project area is characterized by snow machining, cross-country skiing, wildlife trapping, and ice fishing. Any of these activities may be disturbed by ice road construction and drilling operations. The contractor will take steps to notify the public of the schedule and location of activities to ensure that public safety is not compromised, as well as to make sure that recreational use can be planned to avoid areas of conflict. Methods to notify the public may include notices in local newspapers, public service announcements, and signs placed on the ice road into the Kenai NWR. The contractor will mark snow machine trails and roads with warnings where the ice road may be intersected. An effort will be made to contact trappers individually that are known to be using the area to inform them of project activity. Under such scenarios, recreational impacts would be negligible.

The No-Action Alternative would have no impact on recreational resources.

6. Cumulative Impacts

The Council on Environmental Quality regulations (*Title 40, Code of Federal Regulations, Part 1508.7 [40 CFR 1508.7]*) define a cumulative impact as “... *the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future action... Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*”

Although the impacts of the proposed activity will be temporary and negligible after mitigation and restoration, successful exploration for natural gas by the program could result in additional natural gas development in the project area. This would only occur if natural gas development is practical and economical. If this is this case, the impacts of additional natural gas development would need to be assessed on a case-by-case basis but generally would result in the following:

- Increased economic activity in the area
- Increase in air emissions
- Increased disturbance of wildlife and their habitats
- Possible impacts to water quality and fisheries
- Possible alteration of scenic resources
- Possible increases in recreational opportunities
- Possible impacts to recreational activities

7. ANILCA Section 810 Subsistence Determination

The USFWS, acting for the Secretary of the Interior, is required by *Section 810* of the *ANILCA* to evaluate the effects on subsistence uses and needs in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands on national wildlife refuges in Alaska. The evaluation of effects of this proposed action/use on subsistence uses and needs is documented below. If this evaluation concludes with a finding that the proposed action would result in significant restriction to subsistence uses and needs, and project proponents wish to proceed, the project proponents and the Kenai NWR must initiate further procedural requirements of Section 810. This evaluation concludes that the Proposed Project will not result in a significant restriction of subsistence uses or access to subsistence resources.

7.1 Subsistence Resources, Uses and Needs in the Affected Area

Evidence from archeological investigations demonstrate that both Indian and Eskimo cultures existed in the area for extended periods, using the abundant fish, game, and vegetation resources for their survival. Early Russian and American miners, fur trappers, traders, and others settled the area in the late 18th, 19th, or early 20th centuries.

Subsistence use of natural resources was commonly practiced during this period as well and was largely responsible for the survival of many early settlers on the Kenai Peninsula. As the area grew in population and urban infrastructure during the 20th century, subsistence lifestyles were altered but still practiced in some form in many areas.

Important resources included salmon, trout, char, moose, bear, caribou, ptarmigan, grouse, ducks, sheep, and goats, as well as berries, firewood, shellfish, furbearers, and other natural resources. While interest in harvesting all of these resources still exists, primary interest today focuses on moose and salmon.

Federal subsistence regulations for the Kenai area currently provide for a preferential moose hunt for qualified rural residents living in Ninilchik, Nanwalek, Port Graham, and Seldovia. Harvest from this special season has resulted in no more than a few moose each year in recent years, and no known harvest has occurred within the proposed project area. A small harvest of black bears also occurs by residents of Port Graham and Nanwalek under a preferential federal season, but at considerable distance from the proposed project area. Subsistence fishing opportunity exists in the area for all qualified rural residents in Alaska; however, harvest must be in accordance with State of Alaska seasons, bag limits, and methods restrictions. Currently, little subsistence fishing is reported under the federal subsistence regulations anywhere within the Refuge.

7.2 Effects of the Proposed Action or Use on Subsistence Uses and Needs

Because of the timing of the activity and level of subsistence uses occurring in the project area during the proposed time frame, the proposed activity is not likely to result in a significant reduction in subsistence use as a result of direct impacts on the resource or habitat, changes in availability of the resource, or limitations on access to the resource. Restrictions to access moose or other potential subsistence resources of the project area will not be imposed by the applicant or USFWS. The proposed activity is not likely to increase competition for any subsistence resource.

7.3 Availability of Other Lands for the Purposes Sought to be Achieved

Other lands are not suitable to accommodate the proposed activity because subsurface estate inholdings owned by CIRI, and the geologic location of existing and potential reserves of natural gas predetermine the location of the natural gas exploration well.

7.4 Other Alternatives that Would Reduce or Eliminate Use of Public Lands Needed for Subsistence Purposes

Of the proposed alternatives that meet the project purpose and need, the preferred alternative would have no greater impacts on subsistence uses than any other alternatives. The proposed action would not result in a significant restriction to subsistence uses and needs on the Kenai NWR. The proposed action is consistent with Section 810 of ANILCA as determined herein.

8. Mitigation Measures

The following describes mitigation measures and permit conditions that are to be adopted as part of the proposed action. Implemented mitigation measures will help to minimize the likelihood of any aspect of the program creating a significant environmental effect.

8.1 Requirements Before Construction/Operation

1. Prior to commencement of any activities authorized under this permit, the permittee will provide to the Service (attention Chief, Division of Realty, Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, AK 99503-6199) a minimum \$50,000 surety bond. This bond assures compliance with mitigation measures and satisfactory performance of construction/operation by the permittee, and if abandonment occurs, it assures cleanup of all debris and facilities and restoration activities as required. Liability is not limited to the dollar amount of the surety bond. This bond must meet the requirements of *31 U.S.C. 9301-9309*.
2. The permittee, contractors, and key employees will, before beginning operations or use of Refuge lands under this permit, meet with the Refuge Manager or his designee to discuss the extent of the project, work schedules, equipment and materials involved, and responsibilities of each party.
3. The permittee shall, before any operations under this special use permit, inform the Refuge Manager in writing of the name and address of a local employee who will represent the permittee in all matters contained in this permit.
4. Before program commencement, a map will be required that accurately depicts the ice road route and pad location. All camp and storage sites located on Refuge lands must be approved by the Refuge Manager before onset of field operations.
5. A letter of non-objection from CIRI must be obtained by the permittee and submitted to the Refuge Manager before any operations over the conveyed subsurface estate, on Native-selected or conveyed lands.

8.2 General Permit Procedures

6. The Refuge Manager or his designee must be kept informed in a timely manner of all operations conducted on Refuge lands. A progress report of field operations must be submitted daily (faxed or email copy of Daily Reports is acceptable) to the Refuge Manager or his designee. In the

- event of a spill, the spill and corrective action taken shall be described in the daily report. All spill reporting shall be in accordance with state and federal regulations.
7. The permittee is responsible for ensuring that all personnel associated with this program, especially those conducting activities authorized under this special use permit, are familiar with and adhere to the conditions of this permit. Particular emphasis should be placed on wildlife avoidance requirements.
 8. Surface vehicles will not be used off the agreed upon ice road route without prior approval of the Refuge Manager. Snowmobile use may be authorized provided the Refuge Manager determines sufficient snow cover is available to protect natural resources along the routes of travel.
 9. The permittee will not use any water source within the permit area without advance approval or use equipment under conditions and in manner that will, in the opinion of the Refuge Manager, damage lakes or streams or other wildlife resources.
 10. Permittee must report without delay any surface damage along or beyond the agreed ice road route and reclaim surface damage as rapidly as practicable to the Refuge Manager's satisfaction.
 11. The Refuge Manager, or his designee, may conduct inspections of ongoing activities, including a final inspection of the permit area to determine compliance with the terms of this permit.
 12. The permittee shall comply with the Archaeological Resources Protection Act (*16 USC 470aa*). The disturbance of archaeological or historical sites and the removal of artifacts from Federal land is prohibited. 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 SHPO and the Refuge shall be contacted immediately.
 13. Permittee will not disturb or remove any public land survey monument or project boundary monument and will act to perpetuate the location of aforesaid monument.
 14. The permittee will do everything reasonably within its power to prevent and suppress fires on or near lands to be occupied under this permit, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires.
 15. The permittee shall be held liable and will indemnify and hold harmless the government, its agents, and employees against all actions or claims for all damages to persons or property, including death arising or resulting from the fault, negligence, or wrongful act, or wrongful omission of the permittee, his agents, property of a third person, or injury including death, to such persons in accordance with the Federal Tort Claims Act, *U.S.C. 2671-2680*.
 16. Endorsement of this permit signifies the permittee's complete understanding and concurrence with all the conditions set forth in the General Stipulations found on the reverse side of the permit, the special conditions in this document, procedures described in the Environmental Assessment completed for this project, and other appropriate conditions/stipulations as they may apply. The Refuge Manager must approve any amendments or modifications to these special conditions or to the special use permit in writing.
 17. The permittee agrees and recognizes that this permit does not alter, change, amend, relieve, or eliminate the necessity for the permittee to fully comply with all other federal, state, or local statutes and regulations applicable to the conduct of exploratory operations. The permittee herein agrees to comply with all federal statutes and regulations requiring the consent of mineral owner, mineral lease offeror, or mineral lease holder concerning exploratory operations on leases or mineral acreage within the permit area.
 18. Failure to comply with state or federal regulations or any conditions of this permit could result in immediate revocation of this permit and possible denial of future permit requests for land administered by the U.S. Fish & Wildlife Service (USFWS).
 19. Failure by the USFWS to enforce any of the conditions or requirements of the permit does not constitute a waiver by the USFWS of such conditions or requirements.
 20. During all phases of construction and exploration, seasonal constraints and weather may require temporary suspension of activities within the permit area to protect public health and safety, or the environment. If the Refuge Manager determines that an immediate temporary suspension of

all or a portion of activities within the permit area is necessary, he/she may suspend such activities without administrative proceedings.

8.3 Wildlife Conservation Measures

21. The permittee shall not conduct operations under this permit that may unduly damage any wildlife habitat or wildlife resource or interfere with wildlife concentrations. Wildlife will not knowingly be harassed or approached closely enough to disrupt the animal's activity or to endanger human life. Any problems or concerns about the wildlife will be reported as soon as practical to the Refuge Manager. This permit may be canceled or revised at any time by the Refuge Manager to protect wildlife habitat and wildlife resources on the Refuge. There shall be no taking of any animal except in the case of Defense of Life and Property (DLP). In the case of DLP, the permittee shall report the taking to the ADF&G and the Refuge.
22. In the case that a bear den is found by the permittee, the permittee shall contact the Refuge. The contractor shall not operate within a 1/8-mile (660 feet) radius of any known bear dens.
23. All food wastes shall be stored in animal-proof containers and disposed of regularly at a permitted offsite facility.
24. All activity shall be prohibited within a 330-foot radius of eagle nests during February and March. During other months of the year, the Refuge Manager may require separation distances of up to 1/2 mile if activities conflict with nesting activities of bald eagles. Disturbance and destruction of eagles' nests or nesting trees is strictly prohibited.
25. If the permittee must cross an open-water anadromous or resident fish stream with a motor vehicle, the permittee shall contact Alaska Department of Fish & Game (ADF&G) and obtain the correct authorization.

8.4 Requirements During Construction

26. The ice road route and pad will be located to minimize brushing and grubbing. No additional roads or trails may be constructed other than the agreed upon ice road and pad. Clearing routes of travel, felling or cutting of trees, or blazing of trails in other areas is not permitted without prior approval of the Refuge Manager. Existing roads, trails, and natural clearings must be used wherever possible.
27. Low ground pressure vehicles will be used for pre-packing and for supporting operations during unseasonable thaw conditions. LGPVs will only be used on sufficient frost (>1.5 feet) and snow (>1.5 feet) accumulation to avoid habitat damage.
28. Areas of minimal frost will be covered with rig mats during road and pad construction, and drilling operations.
29. If unseasonable thaws occur during drilling operations and the ice road becomes non-passable, low ground pressure vehicles will be used for operations support. LGPVs and rig mats will be used to demobilize equipment if conditions have not changed by the end of drilling and testing.
30. The permittee will design, construct and operate the ice road so that, after demobilization and breakup, the former route does not become a permanent trail for motorized vehicles. This will include replacing cleared trees and re-installing standing deadwood within the former footprint.
31. Water used during construction and drilling operations will be from off refuge sources and from groundwater sources at the pad, specifically a water well drilled at the pad to support drilling operations. Groundwater sources will be approved by the ADNR under a TWUP.
32. The temporary drill pad will be constructed as described in the Environmental Assessment completed for this project.

8.5 Fuel and Hazardous Material

33. Fueling of vehicles and equipment will be conducted using established fuel transfer procedures including secondary containment beneath fueling ports and a minimum of two qualified personnel

will always be present during fuel transfer operations. Monitoring of fuel quantities will take place daily.

34. All bulk hazardous material containers and fuel drums must be marked with the contents and contractor's name.
35. The permittee shall develop and have onsite a SPCC Plan. A copy of this plan will be submitted to the Refuge Manager before construction begins.
36. Spill response equipment and supplies necessary to implement initial spill response will be available at all times on site during construction and drilling activities. Sorbent material in sufficient amount to handle operation spills must be on hand at all times both in the field and at staging areas for use in the event of an oil or fuel spill.
37. Fuel storage facilities and/or refueling of equipment shall not occur within 100 feet of the annual floodplain of a watercourse or within than 100 feet to a water body and must be placed within an impermeable barrier providing 110 percent capacity of the largest fuel storage container.
38. Soils contaminated with petroleum products shall be reported immediately to the Refuge Manager. In addition, the appropriate notification to the ADEC will be made on the basis of reporting criteria. Cleanup and removal of contaminated soil will take place before the completion of the project.
39. All RCRA hazardous wastes shall be stored, transported, and disposed of in accordance with regulation requirements.
40. All gray and black water, or chemical toilet refuse, generated will be transported off site to a permitted treatment or disposal facility.
41. All trash and non-petroleum solid waste generated on the project site will be hauled off site and disposed of in accordance with 18 AAC 60 Solid Waste Regulations and 18 AAC 62 Hazardous Waste Regulations.

8.6 Restricted Use of Road

42. The road is closed for use by anyone except employees and contractors of the permittee and the refuge. Any associated gates must be closed and locked at all times except during moments of ingress or egress. The permittee is responsible for enforcing this restriction.
43. Road construction and drilling operations support are the only activities allowed under this permit. Employees and contractors of the permittee are prohibited from fishing, hunting, and trapping when access to the area is obtained by use of the road.

8.7 Requirements During Drilling

44. The permittee will place several additional layers of rig mats directly under the drill modules and package to avoid settling if a prolong thaw occurs. As an additional measure, the permittee also may utilize rig mats and jacks to level the rig as needed.
45. All drilling wastes, depending on its classification, will be either injected into the well annulus (AOGCC Annular Injection), ground and injected at an offsite source, or back-hauled and disposed of at an approved offsite source. Drilling wastes will not be disposed of on the surface of Refuge lands.
46. Measures to mitigate extreme cold temperatures include employing a drill rig designed to operate in arctic conditions and following Alaska Safety Handbook and North Slope Environmental Field Handbook guidelines for working in cold weather conditions.
47. Project personnel will operate their vehicles in compliance with the vehicle safety rules and foul weather contingency plans as presented in the 2006 Alaska Safety Handbook.

8.8 Requirements Upon Completion

48. All survey flagging, stakes, wire, or other debris associated with this program must be removed from Refuge lands. However, rehabilitation points may remain identified to assist the required

summer crew until that project has been completed and final approval is received from the Refuge Manager.

49. About 600 feet of the ice road route will require clearing trees. Once the project is complete, cleared trees will be replaced and standing deadwood will be re-installed within the former road footprint as described in Appendix A of this EA. Care will be taken to insure that the holes do not create a danger to wildlife by entrapment or stumbling/tripping hazards. A separate Special use permit will be issued for the restoration work.
50. In the event of unanticipated impacts to the Refuge resources, including those caused by introduced invasive plant species, the permittee must take such soil and resource conservation and protection measures, including weed control, as the Refuge Manager may require.
51. The permittee shall provide the Refuge Manager with a project report summarizing field operations and an electronic shape file containing the ice road and pad location within 30 days of permit expiration.

9. Consultation and Coordination

Nordaq met with the Kenai NWR on several occasions to discuss the project and identify issues of concern. In addition, permits will be obtained from the appropriate regulatory agencies before the start of fieldwork.

9.1 Permits and Authorizations Required

Nordaq is contacting local, State and Federal agencies regarding this gas exploration project. Table 11 provides an initial list of applicable regulatory agencies, specific permits, approvals, review, and agency contacts.

Table 11: Permits, Authorizations, and Reviews	
Deliverables Description	Contacts
United States Fish and Wildlife Service (USFWS)	
Special Use Permit A Federal Special Use Permit for use of Kenai NWR lands is required. Stipulations in this permit will regulate natural gas exploration activities to protect wildlife and their habitat.	Claire Caldes. (907) 262-7021 Ski Hill Road, P. O. Box 2139 MS 519 Soldotna, Alaska 99669-2139
United States Environmental Protection Agency (EPA)	
EPA NPDES Storm Water Discharge Permit (not required). Per 40 CFR §122.26(c)(1)(iii): <i>"The operator of an existing or new discharge composed entirely of storm water from an oil or gas exploration, production, processing, or treatment operation, or transmission facility is not required to submit a permit application in accordance with paragraph (c)(1)(i) of this section, unless the facility:</i> <i>(A) Has had a discharge of storm water resulting in the discharge of a reportable quantity for which notification is or was required pursuant to 40 CFR 117.21 or 40 CFR 302.6 at anytime since November 16, 1987; or</i> <i>(B) Has had a discharge of storm water resulting in the discharge of a reportable quantity for which notification is or was required pursuant to 40 CFR 110.6 at any time since November 16, 1987; or</i> <i>(C) Contributes to a violation of a water quality standard."</i> Shadura #1 will not require a NPDES storm water discharge permit unless it meets above criterion (A) through (C).	Anita Frankel, (206) 553-2963 1200 Sixth Ave, OWW-130 Seattle, WA 98101
SPCC Plan Drill rig and well test contractors will submit SPCC plans to ADEC for review.	Matt Carr, (907) 271-1481 222 West 7 th Ave, #19 Anchorage, AK 99513

Table 11: Permits, Authorizations, and Reviews	
Deliverables Description	Contacts
United States Army Corps of Engineers	
<p>ACMP – Review The U.S. Army Corps of Engineers will review the Plan of Exploration to ensure project consistency.</p>	<p>Dave Casey, (907) 753-2712 P. O. Box 6898 Elmendorf AFB, AK 99506-0898</p>
Alaska Department of Natural Resources (ADNR)	
<p>ADNR/DML&W Land Use Permit (LUP) The ADNR Division of Mining, Land, and Water (DML&W) authorizes the use of State land for commercial purposes as set out by 11 AAC 96.010.</p>	<p>Cliff Larson, (907) 269-8508, 550 W 7th Ave., Ste 900c Anchorage, AK 99501-3577</p>
<p>ADNR/DML&W Temporary Water Use Permit (TWUP) The ADNR/DML&W authorizes the use of State waters for commercial and non-commercial purposes as set out by AS 46.15. Nordaq will obtain temporary water use permits for the rig and ice road construction.</p>	<p>Mike Walton, (907) 269-8609 550 West 7th Ave., Ste 1020 Anchorage, AK 99501</p>
<p>ADNR/DCOM ACMP Consistency Determination The ADNR/DCOM uses a multiple agency-coordinated system for reviewing and processing resource-related permits that are required for proposed projects affecting coastal areas of Alaska. This "project consistency review," is based on the ACMP. The DCOM reviews a project to determine the project's consistency with the State ACMP standards and the enforceable policies of approved district coastal management programs.</p>	<p>Josephina Delgado-Plikat, (907) 269-7472 550 West 7th Ave., Ste 705 Anchorage, AK 99501</p>
<p>ADNR/SHPO Section 106 Historic Preservation Section 106 of the National Historic Preservation Act requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties. The agencies must allow the SHPO and the Advisory Council on Historic Preservation, a federal agency, to comment on a project. The Alaska Historic Preservation Act contains a provision similar to Section 106 that mandates projects with state involvement reviewed in a similar manner. Through the Section 106 review process, Nordaq will work with agencies during the early stages of project planning to protect cultural resources by providing information on the location of sites and on cultural resources surveys previously done in an area.</p>	<p>Judith Bittner, (907) 269-8722, 550 West 7th Ave, Ste 1310 Anchorage, AK 99501-3565</p>
<p>ADNR/Division of Parks and Outdoor Recreation (Parks) Special Parks Use Permit Special Use Permits are issued by ADNR/Parks for a wide variety of special event. A complete list of commercial and non-commercial activity fees is provided in the Director's Order No. 247, per 11 AAC 05.010.</p>	<p>Pamela Russell, (907) 714-2471 514 Funny River Rd Soldotna, AK 99669</p>
Alaska Department of Environmental Conservation (ADEC)	
<p>ADEC/SPAR/IPP Oil Discharge Prevention and Contingency Plan (ODPCP) Exemption Due to limited storage on site and exploration for natural gas, Nordaq plans to submit a request for a waiver from the requirement to submit an ODPCP</p>	<p>Shannon Dewandel, (907) 269-7541 Betty Schorr, (907) 269-3054 555 Cordova St Anchorage, AK 99501</p>
<p>ADEC/AQ Minor General Permit Drilling an onshore exploration well will require an Air Quality Minor Permit from the ADEC Division of Air Quality as set out by 18 AAC 50.502(c)(2)(A). More specifically, Nordaq's operations qualify for the Minor General Permit MG1 issued on December 15, 2005 because Nordaq will drill the well onshore from an ice/rig mat pad in winter using a mobile drilling rig. To apply to operate under the MG1, Nordaq will submit the MG1 Notification of Intent to Operate.</p>	<p>John Kuterbach, (907) 269-7541 410 Willoughby Ste 303, PO Box 111800 Juneau, AK 99811-1800</p>

Table 11: Permits, Authorizations, and Reviews	
Deliverables Description	Contacts
Nordaq may construct and operate under the permit immediately after the ADEC receives a completed notification form (as set out by 18 AAC 50.560), and Nordaq meets all of the qualifying criteria.	
ADEC/Environmental Health (EH) Waste Storage Plan Drill cuttings will be stored per an ADEC EH approved temporary waste storage plan using conventional construction, storage, and disposal techniques.	Bob Blankenburg, (907) 269-7690 555 Cordova Street Anchorage, AK 99501
ADEC/Environmental Health Treatment Facility Permit Temporary drill cuttings may be handled, processed and managed under a treatment permit whereby other options besides G&I can include land filling and/or beneficial reuse.	Bob Blankenburg, (907) 269-7690 555 Cordova Street Anchorage, AK 99501
Alaska Department of Administration, Alaska Oil & Gas Conservation Commission (ADA, AOGCC)	
ADA/AOGCC Permit to Drill The AOGCC regulates the drilling for and production of oil and gas resources, the principles of oil and gas conservation, and the underground injection for both waste management and enhanced recovery. In accordance with AOGCC regulations in 20 AAC 25, Nordaq will submit and obtain the commission's approval of an application for a Permit to Drill. Nordaq also will request AOGCC confirmation that formations penetrated during drilling do not contain liquid hydrocarbons. T	Tom Maunder, (907) 279-1433 333 West 7 th Ave, Ste 100 Anchorage, AK 99501
Alaska Department of Fish and Game (ADF&G)	
ADF&G/ Habitat Management Title 16 Permit (not required). Ice road and pad construction will begin under GCD 5 for equipment crossing a small stream. ADF&G has ruled that a Title 16 permit is not required.	Virginia Litchfield (907) 260-4882 ADF&G, Habitat Biologist 43961 Kalifornsky Beach Rd, Suite B Soldotna, AK 99669-8276
Kenai Peninsula Borough (KPB)	
KPB /KPB Coastal Management Program and KPB Enforceable Policies This project is within the Kenai Peninsula Borough Coastal Zone. Nordaq will contact and work with the KPB Coastal Program Coordinator.	Gary Williams, (907) 714-2216 Kenai River Center 514 Funny River Road Soldotna, AK 99669
Kenai River Center Multi-Agency Permit Application. Required for all activities that encompass the KPB 50-foot Habitat Protection Area and any in-water use (including activities or structures that cantilever over the ordinary high water mark) of anadromous rivers and/or lakes, or activities that take place in wetlands.	Gary Williams, (907) 714-2216 Kenai River Center 514 Funny River Road Soldotna, AK 99669
Letters of Non-objection (LNOs) for Crossing ROWs	
Nordaq will obtain all required LNOs.	Shawn Brown, (905) 776 3520 Tesoro Corporation 11120 Kenai Spur Highway Kenai, AK 99611 Mike Spangler (907) 776-2038 Conoco Phillips Alaska, Inc. Kenai Spur Highway Kenai, AK 99611

Appendix A

Proposed Tree Removal and Replacement Procedure

Memo

From:

Zane Henning
Alaska Enviro, Inc.
1230 Woodcrest Drive
Wasilla, Alaska 99654

To:

Rob Crotty
ENTRIX
1600 A. Street, Suite 304
Anchorage, AK 99501 USA

RE: Nordaq Energy LLC Reforestation of 600' Segment 5 and Segment 11

Segment 5 of the proposed Shadura #1 snow road, Waypoint W10 (60.78812°N/ 150.99092°W) to W11 (60.78812°N/ 150.99092°W), is the one of two areas that trees cannot be avoided to build the 2.9 mile winter trail for Nordaq Energy LLC. The second in Segment 11, will entail removing about five trees for the ice road route. Approximately 30' in width by 600' in length of trees will need to be cut down in the winter with reforestation to take place in the spring. A five-task process using the BLM Gold Book reclamation guidelines in Chapter 6 to ensure that a clear-cut, seismic trail-look does not remain when transplanting of trees are complete.

Task 1

Catalogue and mark tree inventory to be removed in Segments 5 and 11 before pre-packing activities begin. The trees will be marked in such a way as to not make a straight seismic-looking trail. The route will be chosen carefully so as few trees as possible will need to be cut down.

Task 2

Cut trees down on chosen route. The trees will be cut as close to the ground as possible so stumps do not protrude above the surrounding vegetation. All cut trees will be inventoried next to the trail so they will be available in the spring.

Task 3

After winter drilling operation demobilization is complete and before the road starts to melt, a machine with auger attachment will be mobilized to drill holes for summer tree replacement. The diameter and depth of each hole will be based on the tree root bulb and on guidance provided by the Alaska Department of Natural Resources/Division of Forestry.¹ This guidance is attached to this

¹ *Plant a Tree, An Alaskan Guide to Tree Selection, Planting and Care*. ADNR/Forestry, April 2000.

memo. Therefore, for the largest trees, a 36" auger will be used to drill into the soil approximately two feet in depth. A 5 gallon bucket or other casings means will be placed in each drilled hole so soil will not slump into it during spring break up.

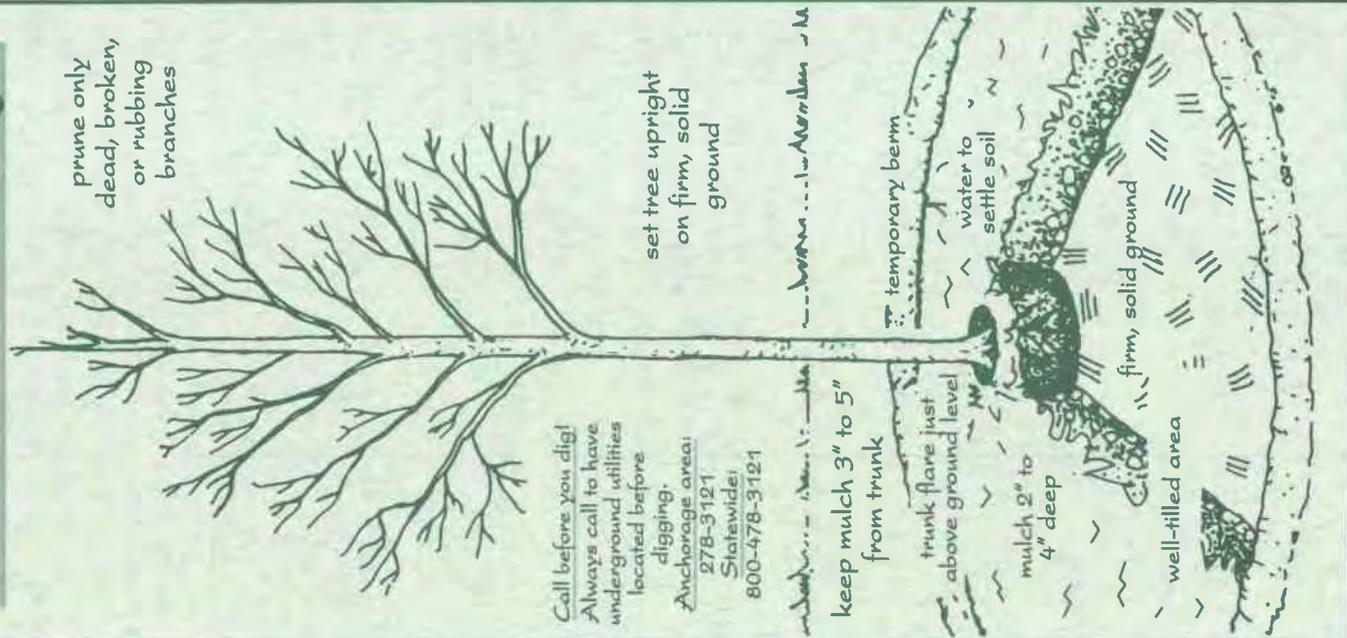
Task 4

Three to six foot tall black spruce, birch and soil will be procured for replacement. Trees and soil will be packaged for helicopter sling loading operations.

Task 5

A helicopter will sling load trees and soil after spring break up. The 5 gallon buckets will be removed and trees will be planted. Deadwood and several trees cut down during winter also will be stood up by hand digging holes to approximately two feet. This will help with the overall camouflage and barricade of the previous trail and assist in restoration of the natural look of the area.

A Tree Planted Right



Tree care tips

- ◆ Water trees well, especially during the first five years after planting. Let water trickle until soil is moist to a depth of 12 inches. Be sure water is penetrating the rootball. Allow to dry between waterings.
- ◆ If tree is staked, check ties regularly to be sure the trunk is not being damaged. Remove ties after one full growing season.
- ◆ If fertilizer is needed, apply in spring, early summer or late fall. Fertilizing in late summer when trees are preparing for dormancy can promote growth that will not harden off before winter. Never fertilize a tree that is stressed.
- ◆ Avoid using de-icing salt near a tree or where it will drain into the root zone in the spring.
- ◆ Replace mulch as needed and keep grass and weeds out of mulched area. Do not plant annuals or bulbs under trees where shallow tree roots can be damaged, and plants will compete for nutrients needed by the tree.
- ◆ Do not compact the soil or spread additional soil over the tree roots.
- ◆ Keep lawn mowers and weed whips away from tree trunks to avoid damaging them.
- ◆ Begin pruning trees to desired form during the second growing season. Prune conifers to maintain only one strong leader. Do not top trees, make flush cuts, or leave stubs.
- ◆ Contact a qualified arborist to prune large trees or provide special services. Hire only a certified arborist who is insured and can provide references.

For more information

More information is available from Division of Forestry and Alaska Cooperative Extension offices statewide. If you have questions, please contact:

Alaska Urban & Community Forestry
 550 West 7th Avenue, Suite 1450
 Anchorage, Alaska 99501-3566

Telephone:
 269-8465 or 269-8466

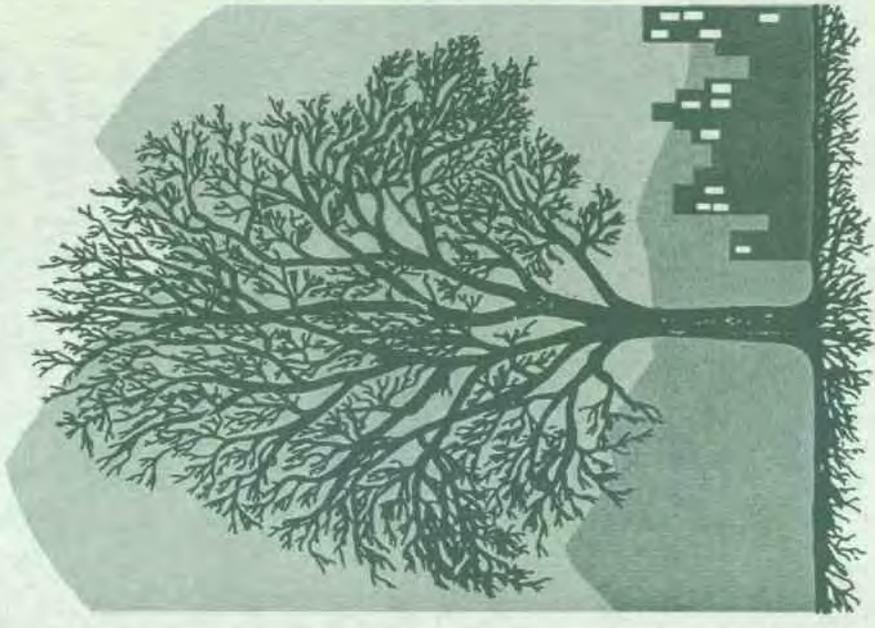
Fax: (907) 269-8902

Website:
www.dnr.state.ak.us/forestry



The State of Alaska is an equal opportunity employer and receives federal financial support for the Urban & Community Forestry Program through the USDA Forest Service.

PLANT A TREE



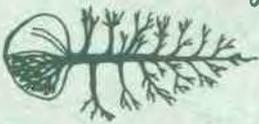
An Alaskan guide to tree selection, planting & care

Plant the right tree

Select trees that provide the benefits you want: flowers, fruit or fall color; winter interest; wildlife habitat; barrier to dust, wind or noise; erosion control; privacy screen; or landscape design.

Select a healthy tree with good form. The tree should:

- ◆ be free of disease, insects and injuries
- ◆ have a single, well-developed leader
- ◆ have branches that are evenly distributed around the trunk and growing from the trunk at between 45- and 90-degree angles
- ◆ be properly pruned. Avoid trees that have been topped or headed-back, the undesirable practice of cutting off the ends of branches and leaving stubs
- ◆ have an adequate root mass for the size of the tree.



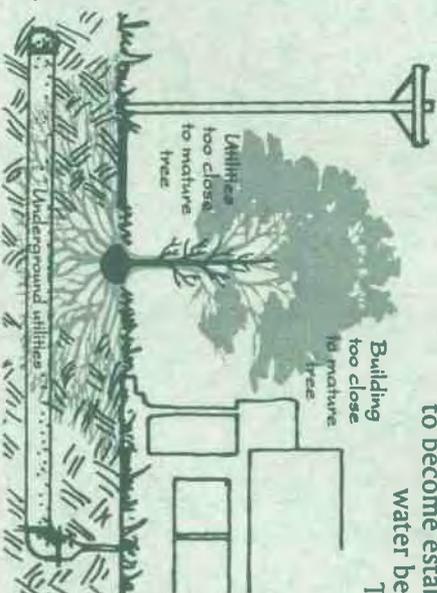
How to plant it right

- ◆ Prepare a planting site that encourages the roots to spread and grow into the surrounding soil.
- ◆ Remove vegetation and rototill or loosen the soil in a saucer-shaped area at least three times the diameter of the root ball and only as deep as the height of the root ball. If planting more than one tree, prepare one large planting bed for all the trees when possible.
- ◆ Slope and roughen the sides of the pit.
- ◆ Leave the tree in its container or burlap until you are ready to plant it. Keep roots moist.
- ◆ Remove all twine and wrap from around the trunk.
- ◆ Cut away and remove the container, wire basket or burlap before planting.
- ◆ Prune roots that are diseased, damaged or circling the container or root ball, with clean cuts.
- ◆ Set the tree in a hole in the prepared site on solid ground so that it does not settle. The trunk flare (just above where the roots begin to branch) must be just above ground level. Planting too deeply may kill the tree.
- ◆ Separate and spread the roots so that they will grow out into the surrounding soil.

in the right place

When selecting a planting site, imagine what your tree will look like and how much space its crown and roots will need when it is mature. Most roots grow in the top 12 to 18 inches of soil and far beyond the drip line. Avoid planting a tree where it will:

- ◆ interfere with overhead or underground utilities
- ◆ be too near a house, fence, driveway or other structure
- ◆ shade areas where you want sunlight
- ◆ block desirable views, walkways or traffic signs
- ◆ be an obstacle to snow removal or storage, or damaged by snow sliding from a roof
- ◆ be damaged by de-icing salt or runoff during break-up.



at the right time

Bare root trees must be planted in the spring before their leaves open.

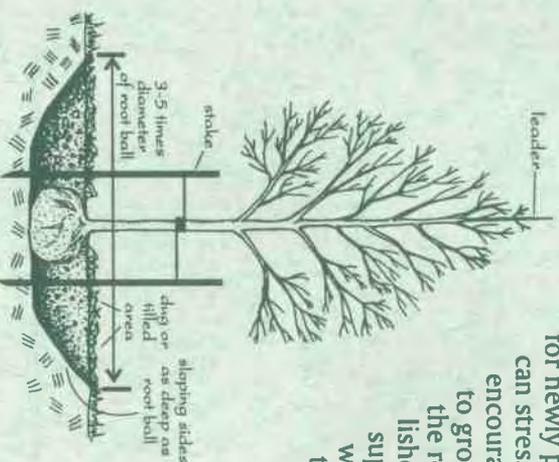
Containerized and balled/burlapped trees may be planted at any time during the growing season.

Plant trees by early September in most of Alaska, and by early October in Southeast. Roots need to become established and take in adequate water before the ground freezes.

This is especially true for evergreens, which continue to lose moisture through their needles during the winter. Complete the season's planting at least 4 weeks before soil temperatures drop below 40°F.

- ◆ It is usually best to use soil from the planting site as backfill. Discard large rocks and loosen compacted soil.
- ◆ If soil is very poor or compacted, thoroughly mix some topsoil with existing soil, creating a transition to surrounding soil. Roots growing in a hole filled with only amended soil may circle the planting hole and become "pot-bound," rather than spreading out.
- ◆ Use water to settle the soil as you backfill. Do not injure roots by packing too firmly or walking on the planting site.
- ◆ Stake only if needed to stabilize the root ball. Do not penetrate the root ball with stakes. Use ties of smooth, wide, flexible material that support the tree but allow it to sway; movement helps the tree develop a strong trunk and root system. Never use wire as ties, even in a rubber hose. Secure ties as low on the trunk as they can be placed to stabilize the root ball, about one-third of the way up.
- ◆ Apply composted mulch two to four inches deep in about a 3-foot circle around the tree. Mulch improves the soil, reduces compaction, holds moisture, moderates soil temperatures and discourages injury from lawn mowers and weed whips. Keep mulch about six inches away from the trunk.

- ◆ Soak the planting area thoroughly.
- ◆ Prune only dead and damaged branches and those rubbing against each other. The pruning cut should leave the branch collar but not a stub. Do not use pruning paint.
- ◆ Fertilizer is not recommended for newly planted trees. It can stress the tree by encouraging the crown to grow quickly before the roots are established and able to supply enough water to support the growth. Test soil the year after planting to determine if any nutrient is needed.



Appendix B

Wildlife Awareness Interaction & Bear Avoidance Plan

*Wildlife Awareness Interaction and
Bear Avoidance Plan*

Shadura #1 Exploration Project

Prepared for



NORDAQ ENERGY, INC.

"KNOWLEDGE AND VISION FOR ALASKA"

**9350 Nordic Drive
Anchorage, Alaska
99507**

Prepared by

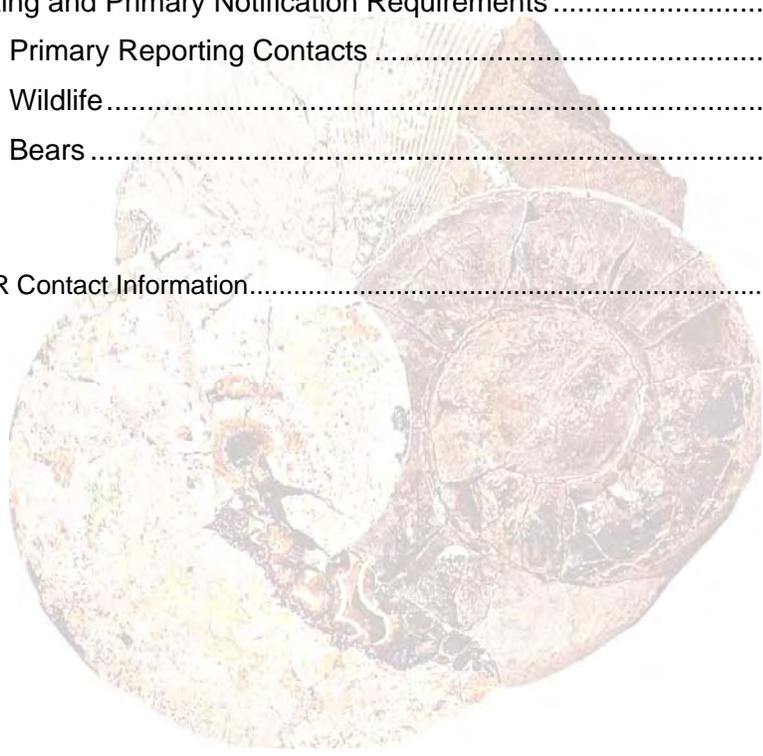


**1600 A Street, Suite 304
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July 2010

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1 Introduction and Project Summary

Nordaq Energy, Inc. (Nordaq) is an Anchorage-based independent oil company with offices in Alaska. Nordaq plans to conduct a fall and winter exploratory drilling program on the east side of Cook Inlet at its proposed Shadura #1 prospect within the Kenai National Wildlife Refuge (Kenai NWR). Nordaq will be the operator of the exploration project and permittee of record.

The drilling project will start in late December 2010 with the construction of a 2.9-mile temporary ice road starting at the north end of the North Kenai Spur Highway at the Captain Cook Recreation Area. The ice road route first heads northeast for about 0.1 miles along an unimproved, 25-foot wide trail, and then east and south for 0.4 miles before crossing and entering the Nikiski Pipeline Company (Tesoro) and Conoco Phillips, Alaska Inc. (CPAI) right-of-way (ROW). The 25-foot wide ice road follows the ROW for 0.4 miles before exiting State Park lands, and heading southeast on State Lands for 0.6 miles before entering the Kenai NWR, where it heads southeast and south for another 1.5 miles to a proposed temporary drill site.

Nordaq will then haul equipment and supplies to the temporary exploration pad from several staging areas operated by Inlet Drilling, Inc. (Inlet) in Nikiski and Kenai, and begin drilling Shadura #1 by early February 2011.

After drilling the well to a target depth of 14,000 feet, encountered natural gas zones will be tested as warranted and additional technical data acquisition programs may also be executed. At the completion of the project all equipment and remaining materials will be demobilized to Kenai or other industrial sites in the Cook Inlet area.

Nordaq will use existing infrastructure and resources found on the east side of Cook Inlet whenever possible during the project. These resources include, staging areas, gravel and paved public roads, gravel pads, camps, airstrips, landfills, water supplies, heavy equipment and personnel.

About 1.5 miles of the proposed ice road and the temporary drill pad are within the Kenai NWR. Therefore, the following Wildlife Awareness Interaction and Bear Avoidance Plan has been developed to help ensure conservation of KNWR wildlife resources and the safety of project personnel. This document, along with environmental, training, provides field crews with an understanding of the importance of wildlife conservation and safety precautions to prevent injury to wildlife or humans.

2 Winter Wildlife

Information presented in this section is from the following sources:

- *Surface Operating Standards and Guidelines for Oil and Gas Exploration (The Gold Book)*. BLM, Fourth Edition, Revised 2007.

- *Final Comprehensive Conservation Plan, Environmental Impact Statement, and Wilderness Review, Kenai National Wildlife Refuge.* USFWS. 1985
- *Final Finding of the Director. Cook Inlet Areawide 1999 Oil and Gas Lease Sale.* ADNR/DOG, January 20, 1999
- *Supplement to Cook Inlet Areawide Oil and Gas Lease Sale Best Interest Finding. Shorebirds.* ADNR/DOG, May 20, 2000

Wildlife is abundant in the Kenai NWR during the summer in the project area. However, many of these animals leave during the early fall, moving to more hospitable environments or hibernating during winter.

Habitat in the project area consists of wetlands and intermediate stage forest. During the planned winter 2009/2010 exploratory drilling project, wildlife likely to be active within the project area may include the following birds and terrestrial mammals.

Birds: common raven (*Corvus corax*), and ptarmigan (*Lagopus spp.*).

Terrestrial Mammals:

- Brown (grizzly) bears (*Ursus arctos*) and black bears (*Ursus americanus*) are concentrated along the Swanson River in late summer and fall, but both species are not likely to be active during the winter exploration program. Nonetheless, habitats such as den sites must not be either disturbed or created. Nordaq will work with the USFWS to identify dens in the project area. The ice road will be routed away from bear denning habitats if known or discovered.
- Moose (*Alces alces*). Large ungulates usually have very limited energy reserves during winter and may move quite slowly. They are likely to seek hard surfaces such as prepared roadways for travel. These conditions coupled with the winter darkness increase the likelihood of animal-vehicle collisions. Habitat such as moose browse will not be disturbed or created as part of this project.
- Other mammals include coyote (*Canis latrans incolatus*), red fox (*Vulpes vulpes*), wolf (*Canis lupus*), mink (*Mustela vison*), river otter (*Lutra canadensis*), marten (*Martes americana*), muskrat (*Ondatra zibethicus*), weasel (*Mustela erminea*), and beaver (*Castor canadensis*).

3 Wildlife Interactions

Nordaq and its contractors recognize that the proposed exploration site and surrounding areas are potential areas of wildlife use, and that most birds and mammals are protected by federal or state regulations. Therefore, interfering with wildlife is against Nordaq's company policy. Company personnel and contractors will follow these rules.

- 1. Never feed, approach or harass any wildlife.**
- 2. All vehicle traffic must remain on established roadways.**

3. *All vehicle traffic will follow posted speed limits.*

Human-wildlife interactions will be minimized by:

- Garbage Control
- Worker Training and Work Site Design
- Habitat Protection

Wildlife will most likely be encountered early on in the project during mobilization, and also while traveling between offsite staging areas and the Shadura #1 exploration pad.

4 Bear Avoidance and Interaction Training

Training Topics

Nordaq's mandatory environmental pre-spud training program will include bear awareness, plus watching "Working in Bear Country" DVD (copy on site) and reading/signing off on this Bear Avoidance Plan (copy also kept on site). Awareness also will be reinforced by inclusion as a topic in daily safety meetings.

For training purposes at various employee meetings, the following items will be addressed.

Food Waste Management Plan (Remove Attractants)

- The single biggest influence an individual can make is to handle food waste correctly.
- Segregate food waste from burnable dumpsters and don't put food waste into dumpsters and vehicles that are not secure.
- Only use designated receptacles for food waste inside facilities or those that are secure from wildlife access.
- Eliminate associations of food sources with facilities and vehicles.
- Move dumpsters to a section of the pad with good visibility and away from high traffic areas.
- Backhaul food waste to approved dumpsters.

Safety and Communication

- Contact the onsite HSE advisor for recent sighting information. He will maintain a file of bear observation reports and post notices.
- Report any sightings immediately to the Nordaq onsite representative and/or HSE advisor, preferably before the bear enters the exploration pad, staging area or camp.
- Use the buddy system during outside jobs and designate a bear lookout.

- Make sure personnel are adequately trained to operate radios or other communication equipment.
- Make loud noises before walking into an area with poor visibility.
- Work with other operations being conducted simultaneously on pad to insure each other's actions are compatible with providing protection from and avoidance of bears.
- Provide employee training through various means, including new employee orientation, safety meetings, tailgate discussions.

Being Aware of "At Risk" Locations and Activities

Specific locations and/or activities lead to increased human-bear interaction. These are described below and will be re-inforced by inclusion in Nordaq's training program.

At Risk Locations

- Remote work such as installing poly mats, building ice roads, and spring clean-up activities.

At-Risk Activities

- All night-time activities
- Operating heavy equipment during construction and maintenance of ice roads
- Working as a laborer to support ice road construction and maintenance, and during spring cleanup of ice road and pad footprints
- Spill response personnel "drip chasing" along the ice road and/or pad.

Project Lighting and Waste Management

The biggest impact of human activity on bears is caused by poor waste handling practices. Bears are constantly searching for food and they have learned, in some areas on the both sides of Cook Inlet, to associate humans and oil and gas facilities with a food source. Garbage dumps and dumpsters, in particular, have become major attractants for bears. Proper food waste management is critical to ensuring bears do not become conditioned to associate human activity with a food source.

When bears emerge from dens (April/May) they start foraging for food. Extra care is necessary to keep food waste properly stored and disposed so that bears cannot gain access. If the bears do not find food, they will avoid human activities.

Work locations will be illuminated in the immediate work areas. Personnel will be reminded to be extra cautious when working and to remain within the lighted work areas, avoid drifts around the pad perimeter and always perform 360-degree visual sweep and peer around corners before exiting facilities.

All waste will be secured in bear-proof dumpsters before it is backhauled on a regular basis for disposal offsite.

5 Reporting and Primary Notification Requirements

Primary Reporting Contacts

Primary reporting contact information is listed in Table 1, along with alternate contact information.

Table 1: KNWR Contact Information	
Primary Contact	Alternate Contact
USFW&S	
Claire Caldes USFWS/Kenai NWR Refuge Operations Specialist Ski Hill Road, P. O. Box 2139 MS 519 (907) 262-7021 Soldotna, Alaska 99669-2139 Claire_Caldes@fws.gov	Andy Loranger USFWS/ KNWR Manager Ski Hill Road, P. O. Box 2139 MS 519 (907) 262-7021 Soldotna, Alaska 99669-2139 Andy_Loranger@fws.gov
ADF&G Area Biologist	
Jeff Selinger ADF&G/ DWC-WILDLIFE SOLDOTNA 43961 Kalifornsky Bch Road, Suite B Soldotna, AK 99669-8276 Phone: (907) 260-2905 jeff.selinger@alaska.gov	Larry Lewis ADF&G/ DWC-WILDLIFE SOLDOTNA 43961 Kalifornsky Bch Road, Suite B Soldotna, AK 99669-8276 Phone: (907) 262-2931 larry.lewis@alaska.gov

In the event advice is required in dealing with a wildlife incident, the individuals listed above will be contacted immediately.

Wildlife

Any vehicle-animal collisions or strange animal behavior will be reported to the Nordaq Site HSE Compliance Officer. Kenai NWR will then be contacted concerning any wildlife mortalities. Because carcasses may attract bears or foxes, local officials will be contacted concerning salvage and/or disposal of the carcass.

Bears

Within 24 hours of a bear sighting, the Nordaq HSE advisor will telephone reports made to them to the USFW&S and ADF&G, and also fax or email a completed Bear Observation Form (example next page).

Bear Observation Form

Observer _____ Company _____

Date _____ Time of Observation: Start _____ and End _____

1. **TYPE OF BEAR** Brown (Grizzly) _____ Black _____

2. **OBSERVED FROM:** Ground _____ Truck _____ Building _____ Other (Describe) _____

3. **GENERAL LOCATION:** Capt. Cook Area _____ ROW _____ Shadura #1 Ice Road _____ Shadura #1 Pad _____
Other _____

4. **SPECIFIC LOCATION (Example: 500 feet north of pad on ice road)**

_____ (direction) of (facility/road name)

5. **DUMPSTER PRESENT?** Yes _____ No _____ Unknown _____

6. **WEATHER:** Temp (dF) _____ Wind _____ mph from _____ (direction) Snowing _____ Raining _____
Sunny _____ Overcast _____ Fog _____ Visibility _____

7. **BEAR IDENTIFICATION:**

Earflag? Color _____ Location: right ear _____ (note: "right ear" of the bear) left ear _____

Natural Markings (scars, torn ears, etc.) _____

USE bottom of form in more than one bear sighted.

8. **OTHER BEARS:** _____ none _____ Number of: cubs _____ yearlings _____ others _____

9. **BEAR ACTIVITY: When first seen, the bear was:** resting _____ feeding (garbage) _____ feeding/traveling _____ traveling _____
feeding (natural food) _____ other _____

10. **BEAR'S REACTION TO OBSERVER:** ignore _____ approach _____ Other people in the area ? yes _____ no _____
Bear's reaction to other people: ignore _____ approach _____ avoid _____ unknown _____

11. **DETERRENCE ACTION TAKEN?** No _____ Yes _____ If yes, did you use: horn _____ siren _____ plastic slugs
_____ cracker shell _____ firecracker _____ birdshot _____ other _____ (describe):

Bear's reaction: ignore _____ approach _____ withdraw _____ charge _____

ADDITIONAL COMMENTS? Yes _____ No _____...If yes, attach to report or write on back....

NOTIFICATION

Confirm, Initial w/ Time

Appendix C
USFWS Region 7 Fuel Storage Policy



Engineering

REGIONAL FUEL STORAGE POLICY R7-4

1. ADMINISTRATION

Purpose: This establishes Regional guidance to ensure that the U.S. Fish and Wildlife Service complies with Federal regulations and State laws pertaining to fuel distribution and storage.

Scope: This guidance shall be applied to all fuel storage (including temporary and remote sites) on Service-managed land and to Service-owned and operated fuel storage sites located throughout the Region.

Authority: This policy is in accordance with the Environmental Protection Agency regulations, 40 CFR 112 Oil Pollution Prevention; the Alaska Department of Environmental Conservation (ADEC) regulation, 18 AAC 75 Oil Hazardous Substances Pollution Control Regulations; the 1994 Uniform Fire Code and the National Fire Prevention Association Codes NFPA 30/30A and NFPA 407. Refer to additional references listed on the last page of this document for more information.

Special Conditions: If an AST system or drum storage area is in a remote location, the Project Leader shall use his/her best judgment to determine, within the regulations, what danger is relevant there and the appropriate measures to take to protect personnel and the environment. If a regulation falls within the jurisdiction of local authorities and can be modified or waived, obtain a written authorization.

Contacts for Further Information: The Regional Compliance Coordinator, Division of Engineering, at 907-786-3506 or Fax 907-786-3370.

DEFINITIONS

Aboveground Storage Tank (AST): Neither the Federal Government nor the State of Alaska has a definition of an AST. The EPA has said that it is acceptable to use the "opposite" of the Underground Storage Tank (UST) definition (see below). ADEC's **proposed** definition is "any tank with a storage capacity between 660 and 42,000 gallons (2,500 and 159,600 liters) which stores petroleum products (this does not include home heating oil tanks)." The State definition may change because it leaves out too many categories and too many types of tanks. The Uniform Fire Code defines a tank as a vessel containing more than 60 gallons (228 L). The Fire Code guidelines should be used until a definition is established.

Cabinet: A fully contained, self closing, latched, non-combustible enclosure, used to provide an isolated environment for compatible flammable solids, liquids, or gases. The bottom of the cabinet shall be liquid tight to a height of at least 2 inches.

Container: Any vessel of 60 gallons (228 L) or less capacity used for transporting or storing hazardous or nonhazardous materials.

Containment Pallet: A liquid-tight, visually inspectable sump that will hold not less than 60 gallons (228 L). All exposed surfaces shall be compatible with the material stored. Protect the sump from accumulating rain or snow.

Control Area: A building or portion of a building in which an amount of hazardous material is allowed to be stored. A control area is separated from other areas by one-hour fire rated walls.

Fuel: Petroleum-based substances consisting of complex blends of hydrocarbons. Examples include, gasolines, jet fuels, heating oils, kerosene, propane, diesel fuel, liquefied petroleum gas and "Blazo."

Fuel Storage Site: Any and all places where fuels are stored constitute a fuel storage site. This includes all Service-managed and owned lands, lands leased or used by the Service, and permanent, temporary, and remote fuel storage sites.

Motor Vehicle: A conveyance that uses a flammable or combustible liquid as its source for power (i.e., car, truck, aircraft, snowmobile, construction equipment etc.).

New System: Any system designed or activated for use after the date listed on the cover page of this policy.

Overpacks: Secondary containment for drums or containers.

Portable tank: Any packaging over 60 gallons capacity and designed primarily to be loaded into or temporarily attached to a transport vehicle and equipped with accessories to facilitate handling the tank by mechanical means. It does not include any cylinder having less a 1,000 pound water capacity or cargo tanks, tank cars, or trailers carrying cylinders of over 1,000 pounds capacity.

Protected tank: A system consisting of primary tank provided with protection from physical damage, and fire resistive protection from a high intensity liquid pool fire exposure.

Public Water System: Any source of water, intake work, collection system, treatment works, storage facility, vehicle or vessel used to distribute water that will be used for human consumption. This does not include a system serving only a single family residence.

Public Way: Any street, alley, or parcel of land permanently appropriated to the public for public use and having a clear width of 10 feet (3 m) or more.

Regulated Tank: A tank meeting the definition of an underground storage tank.

Secondary Containment: A means of containing fuel which has spilled or leaked from its original container to prevent it from entering the environment.

Sorbents: Substances or materials which have the ability to absorb liquids from a variety of surfaces, soils and water.

Spill Control: The use of sloped floors, sumps, and collection systems in rooms and buildings, to contain liquids.

Underground Storage Tank (UST): Any tank or combination of tanks (including piping) that are used to contain an accumulation of regulated substances and the volumes of which are 10 percent or more underground. (The ADEC version does not include heating oil tanks or tanks holding 110 gallons or 418 L or less. The Fire Department definition includes all tanks.)

ABOVEGROUND FUEL STORAGE TANK SYSTEM (AST)

Regulatory Requirements:

Fabrication:

- Fabricate the tank with **double walled** construction.
- Locate all fill connections, valves, vents and other penetrations at the top of the tank.
- Provide a minimum five gallon (20 L) spill catchment basin.
- Include normal and emergency vents for the inner and outer tanks.
- Provide an automatic shut-off valve that stops fuel delivery when the container is 90 percent full.
- Provide leak detection monitors for the interstitial space (the area between the double walls of the tank).
- Provide for proper signage, " NO SMOKING" placard, placards showing type of fuel and gallonage, and a placards showing the tank owner with a phone number all on bothe sides of the tank.
- Provide at least two 20#BC or one 40#BC fire extinguisher within close proximity to the tank.
- No deadman switches or other means of securing the fuel nozzle open are allowed.

Installation:

- Install all dispensing tanks with anti-siphon (anti-flow) devices on any piping that extends below the top of the tank.
- Provide dispensing tanks with an emergency fuel shutoff system located no less than 25 feet (7.5 meters) and no more than 75 feet (22.5 m) from tank
- Provide some type of vehicle impact protection either with bollards or by the tank construction method (vaulted)
- Provide some type of stable foundation that prevents tank movement and allows drainage away from the tank.
- **Provide at least one 50 sheet spill absorbent kit**
- **Always replace any SINGLE WALL tanks with an approved DOUBLE WALL tank.**

Location Requirements:

If an AST system **is not** used to dispense fuel into motorized vehicles (e.g., heating oil tanks and storage tanks) and the area is protected by a public or private fire department, use the distances shown. When the area has no fire department, double the distances in the middle column. (i.e., 5 feet becomes 10 feet, etc.):

Size of Tank gallons (liters)	Minimum distance to Property Line which can be built upon. feet (meters)	Minimum distance from building on property nearest public way. feet (meters)
275 (1,045) or less	5 (1.5)	5
276 (1,049) - 750 (2,850)	10 (3)	5
751(2,854)-12,000 (45,600)	15 (4.5)	5
12,001(45,600)-30,000 (114,000)	20 (6)	5

DISPENSING TANKS

TYPE OF TANK	Minimum distance to property line feet	Minimum distance to a building or public way feet	Minimum distance to an ignition source feet	Impact Protection required *	Vandalism protection required **	Nozzle requirement ***
Dispensing, protected avgas on an airport	15	5	20	yes	n/a	yes
Dispensing, protected avgas not on an airport	10	10	20	yes	yes	yes
Dispensing, not protected (SW or DW), avgas on an airport	75	50	20	yes	yes	yes
Dispensing, protected gasoline to a car/truck/boat	15	5	20	yes	yes	n/a
Dispensing, not protected, gasoline to a car/truck/boat	75	50	20	yes	yes	n/a
Mobile	15	15	20	n/a	n/a	yes

* Use bollards or have a concrete encased tank

** Enclosed in a 10 foot (3 m) high security fence with 5 feet (1.5 m) of separation from the tank. Fencing is required if the tank is located inside a security fence on the property.

*** Hose and nozzle extended shall not reach within 5 feet of a building

If an AST is larger than 500 gallons (1900 L), it must be located at least 100 feet (30 m) from a public water system. This requirement does not apply to propane, AST's used for pump maintenance, power generation systems or heating systems associated with potable water sources.

New System Requirements:

Specifications are available from Engineering. **They shall be used to purchase new AST systems or to make modifications to existing systems.** Before the new AST system is purchased or modified, the Project Leader shall send Engineering a site plan and written final tank requirements. The site plan shall show the location of the tank with reference to nearby buildings/structures, property lines, public ways, bodies of water, or wells. After the AST system is installed, the Project Leader shall inform the Regional Compliance Coordinator, who shall inspect, evaluate, and verify that it meets specified requirements.

Additional requirements:

- **Fuel shall not be dispensed using a gravity feed system. All existing tanks using gravity feed piping to dispense fuel into motorized vehicles, aircraft or motorboats shall be converted to a pump system.**

- Tanks that will always be filled by hand pump or a battery/solar pump require a catch basin only as spill prevention.

SINGLE WALL TANKS AND CONTAINER STORAGE

Secondary Containment: Secondary containment shall be provided, when single wall tanks and containers are stored. Containers can use containment pallets or cabinets as secondary containment for indoor storage and covered spill pallets or storage sheds with lips for outdoor storage. Single wall tanks or large numbers of containers shall be stored in diked containment areas, on containment pallets or in control areas.

Area: The fuel storage site must be large enough to allow personnel to move around stored tanks, drums, and containers so they can be regularly inspected.

Disposal: Properly dispose of empty containers as soon as practical. Options for proper disposal of 55 gallon (210 L) drums include: 1) return the drum to the vendor; or 2) remove the ends, crush the drum, and take it to an approved landfill. To properly dispose of a tank: 1) aerate it and remove all fuel and fuel sludge; last drops of unused fuel and sludge can be picked up with absorbent pads, pads can be put in plastic bags and taken to a landfill 2) remove the ends and crush it. If the Project Leader obtains permission to sell used tanks or containers, properly aerate them and remove all fuel residue. Label them in large, clear, legible, permanent markings that say they shall not be used for **food storage** or as a **habitat** for humans or animals.

Inventory: The Project Leader shall maintain an accurate semi-annual record of all fuel tanks, containers, storage areas stored at all sites. The inventory shall include the location, amount in gallons, number of containers, type of container (i.e. drum, can) and date of delivery .

Supplies: Spill containment/cleanup supplies (sorbents and overpacks) shall be available at all times for use at fuel storage sites, remote caches, and temporary caches. Provide sorbent material in sufficient quantity to recover at least 10 percent of the volume of the largest container. Our experience with spills indicates that 10 percent spill prevention capability is conservative at best, but a prudent number. Used sorbents or damaged containers shall be stored in approved DOT transportation-ready containers or permanent containers until they are disposed of.

Additional Requirements: Procurement documents for fuel must specify the use of NEW, d containers. Each container shall bear a label indicating fuel ownership, fuel type, purchase date ; date of placement at the remote location. When containers are stored on shelves, the shelves shall adequate and substantial construction and meet the requirements of the local seismic zone. Shelf shall also have a lip or a guard.

CONTAINER NDOOR STORAGE REQUIREMENTS

Type of Liquid	Exempt amount (gallon(liters))*
Flammable	
Class I-A (Ethyl Ether)	
Class I-B (Gasoline)	30 (114)
Class I-C (Turpentine)	60 (228)
Combination of Above	90 (342)
	120 (456)
Combustible	
Class II (Heating oil, Diesel)	
Class III-A (Formaldehyde)	120 (456)
Class III-B (Ethylene Glycol)	330 (1250)
	13,200 (50,000)

*Quantities can be increased by 100 percent if they are stored in an approved storage cabinet. Limit three cabinets per control area.

*Quantities can be increased by 100 percent if they are stored in a sprinkled building

*Quantities can be increased by 200 percent if they are stored in a sprinkled building and in approved cabinets.

*Four control areas per building are allowed.

OUTDOOR STORAGE REQUIREMENTS

Class of Liquid	Container Storage gallon(liter)	Portable Tank Storage gallon(liter)	Minimum distance between piles feet(meters)	Minimum distance to property line feet(meters)	Minimum distance to public v feet(meters)
	Quantity/pile	Quantity/pile			
I-A	1,100(4,100)	2,200(8,200)	5(1.5)	50(15)	10(3)
I-B	2,200(8,200)	4,400(16,400)	5	50	10

I-C	4,400(16,400)	8,800(32,800)	5	50	10
II	8,800(32,800)	17,600(65,600)	5	25(7.5)	5
III	22,000(83,600)	44,000(164,000)	5	10	5

UNDERGROUND FUEL STORAGE TANK SYSTEM (UST)

Regulatory Requirements:

1. UST systems that meet the definition of an underground system shall be registered with ADEC. If the Project Leader changes the contents of the UST, closes it in place, or removes it; notify Engineering in writing a minimum of 30 days prior to taking the action.
- 2. Federal and State regulations require that a UST system shall have monthly monitoring and leak detection installed by December 1993 and corrosion protection installed by December 1993.**
3. UST's shall be replaced with AST systems as funding becomes available.

Location Requirements:

1. A UST system shall not be within 100 feet (30 m) of any public water source (a public well or reservoir).
2. A UST system shall not be closer than 5 feet (1.5 m) from a building foundation.

New System Requirements:

- 1. The installation of new UST systems are prohibited unless there are exceptional circumstances that make AST installation impractical. If new heating oil tanks must be installed underground for some reason, they shall comply with Federal and State regulations for regulated tanks. All work done on underground fuel storage tank systems must be performed by State certified workers or supervised by State certified tank workers.**
2. The Division of Engineering has UST specifications available. All new UST's shall comply with these specifications. Before the new UST system is purchased, the Project Leader shall send a site plan and the final tank requirements to Engineering. The site plan shall show the location of the tank with reference to nearby buildings/structures, property lines, public ways, bodies of water, wells, etc. After the UST is installed, the Project Leader shall immediately inform the Regional Compliance Coordinator, who will inspect, evaluate, and verify that it meets specified requirements.

SPILL RESPONSE AND REPORTING REQUIREMENTS

Procedures: The Service shall comply with all State and Federal laws pertaining to fuel spill response and clean up. Spill response procedures follow:

Step 1: Project Leader shall ensure that all spills and discharges have been reported. Alaska law requires that fuel spills be reported to the local ADEC during normal work hours and by calling 1-907-478-4974 after hours.

- a. Immediately report any spill on water and any spill greater than 55 gallons (210 L) that extend

outside of an impermeable secondary containment area.

b. Within 48 hours report spills that exceed 10 gallons (38 L), but are less than 55 gallons (210 L) that extend outside of an impermeable secondary containment area and spills that exceed 55 gallons (210 L), into an impermeable liner. Notify the following contacts also:

1. Regional Spill Response Coordinator 786-3391

2. Regional Compliance Coordinator 786-3506

Step 2: Document the notification process in the "Oil and Hazardous Substance Pollution Incident Report" form or in some type of spill response journal. The spill response journal shall include an entry that records as many of the Pollution Incident Report form categories as are available.

CONTAINMENT DIKE CONSTRUCTION AND MAINTENANCE

Construction:

- Walls and floor of the diked area shall be physically resistant to the contents of the container for at least 72 hours. **This is usually accomplished by lining the dike with an impervious liner material.**
- Berms of the dike must be constructed of earth, masonry, concrete, fire rated wood or sandbags. Minimum liner requirements are 20 mil HDPE with 2% black carbon fiber.
- There must be a minimum 5 feet (1.5 m) between the edge of the tank and the toe of each berm (interior edge).
- Volume of the diked area shall be sized to accommodate 110% of the total contents of all containers in the diked area and shall include sufficient freeboard for snow, ice, or precipitation. Account for precipitation in the region as well as the location of the diked area when sizing freeboard.
- Grade floor area three percent toward one corner so water will collect for removal, or construct a sump.
- Several companies make portable, one-piece, ready-to-use dikes.
- **Contact Engineering before any containment dike is constructed or purchased.**

Maintenance:

- A dike shall be kept free of precipitation to the greatest practical extent. A cover is highly recommended. Pump collected water after rainfall and make emptying the dikes part of regular maintenance.
- If an oil sheen is noticed, immediately begin spill response, prevention and cleanup procedures.

REFERENCES

1. Environmental Protection Agency regulations 40 CFR 112
 2. U.S. Fish and Wildlife Service Environmental Compliance Auditing Handbook
 3. U.S. Fish and Wildlife Service Environmental Compliance Auditing Handbook (Alaska Supplement)
 4. Alaska Department of Environmental Conservation 18 AAC 78 UST Regulations
 5. Alaska Department of Environmental Conservation 18 AAC 75 Oil and Hazardous Substances Pollution Control
 6. Department of Interior, Departmental Manual, 351 DM 1, Aviation Fuel Handling Handbook
 7. Uniform Fire Code and the National Fire Prevention Association Codes NFPA 30/30A and 407
 8. State of Alaska Fire and Life Safety Regulations
 9. U.S. Fish and Wildlife Service, Region 7 - Alaska, Oil and Hazardous Substances Spill Contingency Plan.
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U.S. Fish and Wildlife Service, Region 7
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