

U.S. Fish and Wildlife Service

National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Rights Environmental Impact Analysis

June 2016



EXECUTIVE SUMMARY

This final Rule/Environmental Impact Statement (EIS) presents and analyzes the potential impacts of three alternatives for managing non-Federal oil and gas operations on National Wildlife Refuge System (NWRS) lands, which are surface estate lands held in fee or less-than fee (excluding coordination areas) as well as to operations on any waters within the boundaries of the refuge. These alternatives include: the no-action alternative, and two action alternatives involving revisions to the existing regulatory provisions contained within Title 50 of the Code of Federal Regulations (CFR), Part 29, Subpart C (29C). The EIS provides an assessment of the impacts that could result from the no-action alternative (continuing under the current regulations) or implementation of either of the action alternatives.

Upon conclusion of the EIS and decision-making process, one of the alternatives, or a combination of different parts of the various alternatives, could be adopted through a rulemaking process, which would guide future non-Federal oil and gas development on NWRS lands and waters for the foreseeable future.

This EIS is programmatic in nature, which means that it provides a framework for taking a range of actions, but that actions relating to new non-Federal oil and gas development would require more site-specific analyses before they could be permitted. In implementing these proposed regulatory revisions on specific NWRS lands and waters, additional analyses and environmental compliance, including consultation and an opportunity for public comments, would be completed under a separate National Environmental Policy Act (NEPA) and decision-making process.

BACKGROUND

There are over 5,000 oil and gas wells in a total of 107 refuge units. Based on the presence of split estates, exploration, and production occurring on adjacent or nearby lands, and future increases in energy prices, we believe that non-Federal oil and gas operations on refuges could affect many additional refuges.

In 1960, the U.S. Fish and Wildlife Service (Service) promulgated the current regulations to govern the exercise of non-Federal mineral rights on lands and waters in the NWRS. These regulations have not been updated since it was originally published and are ineffective at protecting refuge resources and at giving operators and Service employees clear guidance on requirements for operating on refuge lands. The existing regulations lack a specific process for operators and Service employees to plan operations that would both minimize impacts to refuge resources and allow operators to conduct efficient operations on refuges. As a result, management of non-Federal oil and gas operations on NWRS lands and water has been inconsistent and resulted in avoidable impacts to refuge resources from non-Federal oil and gas operations.

The Service is proposing to revise, clarify and expand the current regulations to reflect current laws, policies, and practices.

PURPOSE AND NEED FOR ACTION

The purpose of the proposed revisions to the current regulations is to ensure that non-Federal oil and gas operations, conducted on NWRS lands and waters, avoid or minimize adverse effects on fish,

wildlife, and plant resources on refuges to the greatest extent practicable. Additionally, the Service intends to ensure that operations are conducted in a manner that protects employee and public health and safety, as well as wildlife-dependent recreational uses. The final purpose of the revisions is to improve understanding, application, and effectiveness of the regulations for the Service, the regulated community, and the public.

The Service has identified the following key reasons for proposing revisions to the existing 29C regulations:

- The Service has not formally asserted its authority to regulate non-Federal oil and gas rights currently being exercised on refuge lands and waters.
- The existing regulations serve as a general policy statement, but do not provide a comprehensive and functional regulatory framework for the exercise of non-Federal oil and gas rights.
- The current regulations do not provide comprehensive operating standards.
- The Service has limited means under the existing regulations to address violations.
- The existing regulations do not clearly state the scope of Service jurisdiction for directional oil and gas wells drilled beneath refuges from a surface location on lands or waters outside refuge boundaries.
- The existing regulations are not consistent with practices of other Federal agencies and private landowners concerning compensation to the United States for privileged access across federally owned lands beyond the boundary of an operator's non-Federal oil and gas property interest.
- The proposed regulations rectify the existing regulatory inconsistencies with the practices of other Federal agencies (e.g., NPS).
- The existing regulations do not address the Service's ability to require financial assurance from operators to ensure that funds are available to properly restore oil and gas operation sites in the event operators fail to fulfill their reclamation obligations.
- The existing regulations do not provide a means for the Service, as appropriate, to recover the costs for processing applications and monitoring non-Federal oil and gas operations on refuges.

Objectives must be achieved for an action to be considered a success. All alternatives selected for detailed analysis in this EIS must meet all objectives as well as resolve the purpose and need for action. Objectives for adequate regulatory oversight of non-Federal oil and gas operations must be grounded in the enabling legislation, purpose, significance, and mission of refuges affected under the proposed revisions. The Service has identified the following primary objectives to be met by revising the regulations:

- The Service's authority to specifically regulate the exercise of non-Federal oil and gas rights is clarified.
- The regulation provides consistent, functional, and understandable procedures and provisions to the regulated operating community, public, and refuge staff.
- Performance-based standards provide flexibility to resource managers and operators to achieve resource protection across various environments and uses of technology.
- The regulations provide a practical and effective means for dealing with acts of noncompliance or with illegally conducted operations (unauthorized operations) in refuges.
- The regulation addresses Service jurisdiction for directional oil and gas wells drilled beneath refuges from a surface location on lands or waters outside refuge boundaries

- All future non-Federal oil and gas operations conducted on federally owned or administered lands, and any waters within refuges utilize the least damaging methods to prevent or minimize damage to refuge resources and uses.
- All existing non-Federal oil and gas operations conducted on federally owned or administered lands, and any waters within refuges do not create additional unnecessary impacts on refuge resources and uses by maintaining full compliance with Federal and State laws, regulations, and permits.
- The regulation addresses existing operations by balancing the incremental level of protection for refuge resources and uses with the incremental administrative and cost burden imposed on both the regulated community and the Service.
- All non-Federal oil and gas operations conducted on federally owned or administered lands, and any waters within refuges are eventually reclaimed in a manner consistent with the purposes for which the refuge was established.
- The public and refuge staff are protected from health and safety hazards associated with non-Federal oil and gas operations.
- The United States is fairly compensated by operators for use of federally owned land outside the boundary of their non-Federal oil and gas property interest.
- Financial assurance provided by non-Federal oil and gas operators is adequate to ensure the public does not incur reclamation costs in the event of an operator default.
- The regulations provide a means for the Service, as appropriate, to recover the costs for processing applications and monitoring non-Federal oil and gas operations on refuges.

ALTERNATIVES

NEPA requires Federal agencies to explore a range of reasonable alternatives that address the purpose and need for the action. The alternatives under consideration must include the no-action alternative as prescribed by 40 CFR 1502.14. Action alternatives may originate from the proponent agency, local government officials, or members of the public at public meetings or during the early stages of project development. Alternatives may also be developed in response to comments from coordinating or cooperating agencies.

The alternatives analyzed in this document, in accordance with NEPA, are the result of internal and public scoping. These alternatives meet the overall purpose and need for the proposed action. Alternative elements that were considered but were not technically or economically feasible did not meet the purpose and need for the project, or created unnecessary or excessive adverse impacts on resources were dismissed from further analysis.

Three alternatives were developed which meet the stated objectives of this EIS and provide a reasonable range of options to manage exploration, drilling, production and transportation of non-Federal oil and gas within the refuges. These alternatives are described briefly below and presented in greater detail in Chapter 2.

ALTERNATIVE MODIFICATIONS IN THE FINAL EIS

In the FEIS, Alternative B, the Rule (Preferred Alternative) includes one substantial change from the proposed rule. In Alternative B, The Proposed Rule (Preferred Alternative), operators of pre-existing wells could change and the operation would still be considered pre-existing (i.e. not required to obtain a permit). In the final Rule, if an operator of a pre-existing well changes, the new operator must obtain an Operations Permit that ensures those operations meet applicable performance-based standards and general terms and conditions of the rule. This would include posting of financial assurance. This change will lead to more operations on NWRS lands operating under Service

standards sooner, and provide greater protection of refuge resources and uses from ongoing unnecessary impacts of pre-existing operations. We estimate operator turnover could affect up to 5% of the estimated 400 operators annually resulting in permitting actions for up to 20 transferees. These permitting actions would be focused on minimizing or avoiding the ongoing impacts of these pre-existing operations on refuge resources and uses. The Service estimates that operators could incur annual expenses of approximately \$2,400 per well site to obtain an operations permit, meet Service operating standards, and maintain financial assurance, and reimburse the Service for its administrative costs. Descriptions of the new provision and analysis of its costs and benefits for this addition is now included in the appropriate sections of this FEIS.

ALTERNATIVE A: NO-ACTION

The no-action alternative retains the current level of regulation and oversight of oil and gas activities. Outside of Alaska, the Service currently has no clear and defined process for managing these activities, resulting in most management of non-Federal oil and gas operations being conducted on a refuge-specific basis and varying widely. Current policy and training have not established performance-based standards for protection of refuge resources and uses, contributing to the variation in oil and gas practices and the levels of environmental protections across the NWRS.

In Refuge units in Alaska, non-Federal oil and gas operations are governed by title XI of the Alaska National Interest Lands Conservation Act (ANILCA), Section 22(g) of the Alaska Native Claims Settlement Act of 1971 (ANCSA), and the Department's implementing regulations, which require an operator on a refuge unit to obtain a right of way (ROW) permit that ensure operations avoid or minimize impacts to refuge resources and uses.

Non-Federal oil and gas operations outside of Alaska would continue without requiring performance bonds or access fees from operators. Under current conditions, if a transfer of rights and responsibilities for the operations has occurred, there are no general requirements to notify the refuge manager. The use of third-party monitors to ensure operator compliance is not addressed. Procedures for wells that are no longer active but not yet scheduled to be plugged would continue to vary by refuge and could result in well abandonment without plugging and site restoration in some cases.

The Service currently does not regulate oil and gas operations on conservation easements, inholdings, or operations involving directional drilling from a surface location outside a refuge to reach non-Federal oil and gas rights within a refuge.

ALTERNATIVE B: RULE (PREFERRED ALTERNATIVE)

Under Alternative B, the rule would require an operations permit for all new operations and for any modifications to existing operations that would have additional, notable impacts on refuge resources or uses. Existing oil and gas operations with and without a Service-issued permit may continue as long as they comply with Federal, State, and local laws and the terms of their permit if applicable. All operators must obtain an operation permit or update an existing Service-issued permit at the time of reclamation to ensure the surface area is restored to Service standards. If a new operator acquires an pre-existing well, the new operator must obtain an operations permit to continue production activities. Wells drilled from outside refuge boundaries or on private inholdings are exempt from the regulation. Analysis in this EIS supports that this permitting process is the best way to manage oil and gas operations and protect refuge resources on NWRS lands and waters.

Under Alternative B, non-Federal oil and gas operations on refuge units in Alaska would continue to be governed by title XI of the Alaska National Interest Lands Conservation Act (ANILCA), Section 22(g) of the Alaska Native Claims Settlement Act of 1971 (ANCSA), and the Department's implementing regulations, which require an operator on a refuge unit to obtain a right of way (ROW) permit that ensure operations avoid or minimize impacts to refuge resources and uses.

Under Alternative B, the rule would establish performance-based standards for avoiding or minimizing impacts to refuge resources or visitor uses during operations. Operators would be required to conduct operations in the technologically feasible, least damaging manner. Specifically, the rule would include standards for surface use and site management; resource protections; spill prevention, response, and restoration; and waste management. The rule would also include standards for achieving successful surface reclamation once operations end. These specific standards would all be considered and incorporated into project design so that, overall, operations are conducted in a manner most protective of refuge resources and uses while ensuring human health and safety. For operations on refuge units in Alaska, the Service may use these standards as guidance in approving operations under an ANILCA permit as appropriate in order to meet the standards required by ANILCA for approval of such access.

Under Alternative B, the Service also proposes to create an incentive for operators using directional drilling from a surface location outside a refuge to reach their oil and gas rights within a refuge by exempting them from the regulations. Also, it would authorize the Service to charge a fee for commercial vehicles using Service-administered roads and for new access (e.g., roads or gathering lines) across Federal lands where operators have no pre-existing property or other legal right to do so. Fees would be the fair market value of the use of Federal property and would reflect maintenance costs of roads and cost of mitigating any impacts to habitat on the refuge.

The rule would require an operator to file a performance bond, or other acceptable method of financial assurance, as a condition of obtaining an operations permit. This would ensure adequate funds are available to restore the site, remove any equipment or contaminated soil, and revegetate the area in the event an operator defaults on their reclamation obligations. The financial assurance amount would be set equal to the estimated cost of reclamation. The rule would allow the Service to reduce an operator's financial assurance by the amount of in-kind reclamation the operator may provide during the operations. The objective is to ensure that, in the event of an operator default, the public is not burdened with the cost of plugging and reclamation, and that refuge resources and uses are ultimately restored to pre-disturbance levels.

ALTERNATIVE C: MODIFIED RULE

Alternative C would include all the proposed changes in Alternative B, with a few notable exceptions. Service jurisdiction would expand to regulate non-Federal oil and gas operations that occur on private surface within the boundary of a refuge (i.e., inholdings) and to operations on non-Federal surface locations that use directional drilling to access non-Federal oil and gas underneath the surface of a refuge. Additionally, the operations permit requirement would be expanded from Alternative B to include not only new operations, but also existing operations that are and are not under a current Service-issued permit. Therefore, under Alternative C, all pre-existing and new operations within the boundary of the refuge or directional drilling beneath a refuge would be required to obtain an operations permit, meet all relevant operating standards, and post suitable financial assurance, in compliance with the provisions of the rule. Also under Alternative C,

performance-based standards and the permitting process would expand to actively regulate downhole operations such as well cementing, well casing, and well integrity testing, as a matter of course.

The exemption for operators using directional drilling would be removed under Alternative C. The Service could require actions, such as noise abatement or visual screening, which serve to reduce cross-boundary effects on Service resources and uses.

Detailed discussion of the alternatives considered is in Chapter 2: Alternatives.

AFFECTED ENVIRONMENT

The regulations implementing NEPA require agencies to describe the areas to be affected by the alternative actions being considered (40 CFR §1502.15). As this EIS is programmatic in nature, it broadly describes the following aspects of the NWRS lands and waters that may be affected by the alternatives considered:

- **Natural Resources:**
 - Geology and soils (including paleontology)
 - Air quality
 - Water resources (including surface and groundwater, both quality and quantity)
 - Wetlands
 - Floodplains
 - Vegetation (including plant species of special management concern)
 - Wildlife and aquatic species (including animal species of special management concern)
 - Natural soundscapes and acoustic environment
- **Visitor Use and Experience**
 - Human health and safety
 - Visitation patterns
 - Wildlife-dependent recreation opportunities
 - Scenic views and night sky resources
- **Cultural Resources**
 - Archaeological sites
 - Prehistoric/historic structures
 - Cultural landscapes,
 - Ethnographic resources
- **Refuge Management & Operations**
 - Processing permit applications
 - Monitoring operations to ensure that operators are in compliance with all applicable laws, regulations, and Service permits
 - Addressing incidents of noncompliance
 - Maintaining records
 - Providing information to the public and Congress, and addressing legal issues
 - Preparing guidance and policy documents and participating in training or workshops related to oil and gas management.
- **Socioeconomics**
 - Oil and gas operator costs and project financial viability
 - Regional and local economies

The full description of the affected environment is in Chapter 3: Affected Environment.

ENVIRONMENTAL CONSEQUENCES

Impacts of the alternatives on the affected environment were assessed in accordance with CEQ regulations implementing NEPA (40 CFR § 1508) and the Service's *NEPA for National Wildlife Refuge: A Handbook*. The analysis provides the public and decision-makers with an understanding of the implications of regulatory revisions in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

Each alternative was evaluated for overall impacts and compared to the baseline to determine the context, duration, and intensity of resource impacts. The baseline is the condition that has resulted from implementation of the current 29C regulations.

Some general conclusions can be drawn about the adverse and beneficial impacts of implementing the various alternatives on refuge resources and uses, refuge management and operations, and socioeconomics

Overall Impacts of Alternatives on Natural Resources, Visitor Use and Experience, and Cultural Resources.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and result in no change in effects on refuge resources and uses from the existing condition. Occasional seismic surveys would have short-term and generally localized effects on refuge resources and uses, such as disturbance from human and vehicle activity. Also, other longer term impacts, such as habitat fragmentation, could possibly occur depending on species inhabiting the area, habitat, and the number and width of seismic survey lines.

Beneficial effects would continue from refuge managers negotiating with oil operators to place new operations under SUPs or ROW permits. However, unnecessary, adverse effects may continue to occur from operations not under SUPs or ROW permits, or from the inability to secure an operating standard in an SUP or ROW that provides adequate protection for refuge resources and uses. Ongoing impacts on refuge resources and uses from pre-existing operations would be expected during the drilling and production phases. Adverse impacts to:

- Natural resources would include soil compaction, erosion, effects on water quality, noise, impacts from oil and brine spills, spread of invasive species, wildlife displacement, habitat alteration and fragmentation, and potentially wildlife mortality.
- Visitor use and experience would include visual impacts of sites exacerbated by site erosion and/or abandoned equipment; the risk of exposure to chemical or safety hazards at contaminated or unsecured sites; and noise and visual impacts from equipment and crews due to the lack of setbacks from visitor use and culturally sensitive areas, as well as lack of equipment maintenance or muffling devices.
- Cultural resources would include the risk of destruction of cultural resources or the degradation of their integrity, as well as visual impacts of sites that may be exacerbated by site erosion and lack of adequate distance between sites and areas of intensive cultural resource presence.

The lack of consistent requirements or processes to ensure wells are plugged and sites are reclaimed to Service standards would continue to result in long-term, adverse impacts on natural and cultural resources, including ongoing contamination of soil, air, and water from leaking wells, and permanent damage to refuge landscapes and hydrology. Impacts on visitor use and experiences would result from an increased risk of abandoned equipment, debris, and wastes left on the sites.

The lack of requirements under the current regulations for financial assurance, compensation for use of Federal property, and enforcement and penalties would continue to have indirect effects on refuge resources and uses, such as delays in reclamation because of lack of funding or enforcement.

Alternative B: The Rule (Preferred Alternative)

Alternative B, the rule would result primarily in long-term direct and indirect beneficial impacts on refuge resources and uses, compared to the existing condition. Benefits would accrue primarily from reduced risk to resources and uses due to new operations and those pre-existing wells that are transferred to new operators being subject to a consistent permitting process that includes performance standards that ensure new operations are conducted in the most technologically feasible, least damaging manner. Beneficial impacts to:

- Natural resources would include improved erosion/sedimentation control, storm water management, reduced air emissions, reduced fire hazards, reduced disturbance to wildlife, reduced impacts to wetlands and floodplains as well as wildlife habitat in general, improved water quality, and improved spill prevention, control, and countermeasure actions compared to the existing condition.
- Visitor use and experience would include improved site appearance from erosion/sedimentation control, cleanup of spills, removal of wastes and debris, removal of unused equipment, reduced fire hazards, and improved spill prevention, control and countermeasure actions compared to the existing condition.
- Cultural resources would include improved site appearance from erosion/sedimentation control, protection of cultural resources during site development, and adequate distances between sites and culturally sensitive areas.

Alternative B would extend regulation of oil and gas operations to tracts where the Federal interest is less than fee (e.g., wetland or grassland easements) to the extent necessary to protect Federal interest in those lands. As a result of active regulation by the Service, natural resources associated with interests acquired on easements, such as wetlands or native prairie, would have a consistent and higher level of protection compared to Alternative A.

Additionally, the Service would eliminate many of the ongoing, unnecessary impacts to refuge resources and uses resulting from pre-existing operations by assimilating State laws into the rule and other proposed revisions to enforcement and penalties. For instance, the Service would be able to ensure that operators comply with State laws that would require secondary containment facilities, equipment that meets certain air quality standards, spill reporting and remediation, corrective action for noncompliance, and tank removal and site restoration.

As discussed above, the Service also proposes to create an incentive for operators to use directional drilling from a surface location outside a refuge by exempting such operations from the regulations. The exemption is expected to result in fewer wells drilled on refuge lands and waters. Removing the surface activities associated with oil and gas operations from within refuge boundaries serves to

accomplish the objectives of regulation (avoidance or minimization of impacts) while relieving both the Service and operators from the costs of regulation.

Finally, Alternative B would require that all operations are reclaimed to Service standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, reestablishing native vegetation, restoring conditions to pre-disturbance hydrologic functions, and restoring natural systems using native soil material that would reduce impacts to refuge resources and uses within the refuge units. Eventually, the disturbance associated with the 4,000 pre-existing wells, as well as any new and existing operations under a Service-issued permit or ROW would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts to refuge resources and uses.

Other regulatory changes would result in an improved process of handling minor acts of noncompliance, accelerated reclamation of sites compared to the existing condition, and funding sources that could indirectly benefit refuges and visitors using and viewing those resources.

Overall, these regulatory improvements would result in long-term direct and indirect beneficial impacts on refuge resources and uses compared to the existing condition, analyzed under Alternative A. Alternative B would result in primarily beneficial effects due to the regulation of new operations and the regulation of the reclamation phase of pre-existing operations, as well as stricter compliance with other Federal and State laws. Additionally, any adverse effects of regulated operations would be very limited when compared to the entire refuge area, and mitigation measures or stipulations would reduce the loss or degradation of natural resources, visitor use and experience, and cultural resources. Therefore, the impacts of this alternative would generally not be significant, though there may be some minor level of impact to the smallest operators.

When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts to overall cumulative impacts from the change in regulations. Adverse impacts of oil and gas development would be localized, subject to regulatory review, and limited, and would not be significant.

Alternative C: Modified Rule

Alternative C, when compared to the existing condition, would also result in primarily beneficial impacts. Under Alternative C, the rule would be modified to require that both existing and pre-existing operations on refuges obtain an operations permit and operate under the Service's performance based standards. This may result in some direct beneficial impacts to refuge resources and uses because the Service would be able to impose mitigation measures on pre-existing operations for any ongoing, unnecessary adverse impacts to natural resources. However, the Service believes that ensuring pre-existing operations comply with applicable Federal and State laws, as proposed under Alternative B, would provide adequate protection of refuge resources and uses from these ongoing, unnecessary adverse impacts.

As discussed above, under Alternative C, all operations on an inholding or on a non-Federal surface drilling underneath a refuge would also be required to obtain an operations permit and meet all relevant operating and reclamation standards. These modifications to the rule could result in long-term beneficial indirect impacts on refuge resource uses because the Service standards would apply to operations outside the refuge to the extent necessary to protect refuge resources and uses.

However, these benefits to resources and uses could evaporate, and many adverse consequences could occur, if just a small percentage of wells that otherwise would have been located outside a refuge are drilled inside the boundary. Gains in resource protection from these operations under Alternative C would likely be lost due to loss of the incentive to locate operations outside the refuge.

Operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations, such as well cementing, well casing, and well integrity testing, as a matter of course. The Service's goals in regulating downhole aspects of oil and gas well drilling, production, and plugging are to 1) prevent escape of fluids to the surface, and 2) isolate and protect usable quality water zones throughout the life cycle of the well. The Service found that these regulatory goals can adequately be met by current state regulatory programs, and that Service regulation would slightly reduce already very low risks to usable quality water zones. Refuge resources and uses, other than usable quality water zones, would only be impacted by accidents associated with well control, and as discussed above, these events are extremely rare. For these other resources and uses, the Service does not expect any reduction of impacts or risks of impacts to refuge resources and uses related to our regulation of downhole operations. The Service finds that State requirements for well control and the expectation that companies will act in their own best interest provide adequate protections.

Similar to Alternative B, other regulatory changes would result in an improved process of handling minor acts of noncompliance, accelerated reclamation of sites compared to the existing condition, and funding sources that could indirectly benefit resources at the refuges.

The regulatory improvements in Alternative C would result mainly in long-term direct and indirect beneficial impacts on refuge resources and uses primarily from bringing previously exempt operations under regulation. However, Alternative C would largely eliminate the regulatory incentive for operators to locate operations outside refuge units by eliminating the exemption for operations on non-Federal surfaces. So, this alternative would likely result in more wells being drilled on refuge lands and waters, and thus would have more direct impacts on resources and uses within refuge boundaries. The impacts of Alternative C would not be significant because it would result in primarily beneficial effects, and any adverse effects of regulated operations would be limited in extent compared to the entire refuge area with mitigation measures or stipulations reducing the loss or degradation of natural resources, visitor use and experience, and cultural resources.

Overall under Alternative C, beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and and beneficial.

Overall Impacts of Alternatives on Refuge Management and Operations

As discussed in further detail above, refuge management and operations that may be affected by the Service's action to revise the Service's current regulations for management of oil and gas activities on the NWRS include processing permit applications, monitoring operations to ensure that operators are in compliance with all applicable laws, regulations, and Service permits; addressing incidents of noncompliance; maintaining records, providing information to the public and Congress, and addressing legal issues; and preparing guidance and policy documents and participating in training or workshops related to oil and gas management. The following general conclusions can be drawn about possible impacts of implementing the various alternatives on refuge management and operations.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and there would be no change in the administration of currently regulated operations. Alternative A would result in no change to refuge management and operations. The Service estimates it spends approximately \$3.6 million annually, which is less than 1 percent of the NWRS operating budget, managing activities associated with the exercise of non-Federal oil and gas rights. The costs to the Service in terms of staff and resources of ensuring operational compliance with current requirements would continue under Alternative A, and would result in long-term adverse impacts on refuge management and operations, although these impacts would vary depending on local conditions. For example, exposed well casings and abandoned oilfield equipment and flowlines can limit management options for refuge managers due to safety risks. Tall, dense vegetation can hide flowlines and protruding well casings which can damage refuge equipment and vehicles and potentially injure refuge employees. Therefore, on a refuge-specific level, management of oil and gas operations can have a notable impact on refuge management and operations. However, because Alternative A would not change any impacts to refuge management and operations and impacts are generally manageable and minimal in context of Service-wide refuge management and operations, these impacts would not be significant.

Alternative A would contribute only slightly too adverse cumulative impacts occurring to refuge management and operations as a result of cumulative plans and actions.

Alternative B: The Rule (Preferred Alternative)

The administration of Alternative B could require some reallocation of refuge staff and resources, but would also benefit from cost recovery provisions, such that the overall administrative burden of non-Federal oil and gas management would increase somewhat compared to the existing condition. There would be additional responsibilities involved in processing operations permit applications and monitoring operations. The Service estimates that the equivalent of an additional three FTE could be necessary to provide management at the level needed to meet the objectives of Alternative B. This represents approximately a 10 percent increase in program management costs from \$3.6 million under Alternative A to \$4 million under Alternative B. Provisions for cost recovery and compensation for access across federally owned lands would result in the potential for a reduced financial and administrative burden, resulting in long-term beneficial impacts on refuge management and operations.

Within the broader context of all cumulative plans and actions affecting refuge management and operations, implementation of Alternative B would contribute a small but noticeable amount to adverse and beneficial cumulative impacts. Impacts would likely be greater to refuge operations for those units with a high number of current and/or exempt operations and for those units which exhibit a greater potential for future operations due, for instance, to their proximity to Marcellus shale or the Tuscaloosa shale.

Alternative C: Modified Rule

Under Alternative C, all new and existing operations within the scope of the modified rule would be required to obtain an operations permit and meet all relevant operating and reclamation standards. Operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations as a matter of course.

Under Alternative C, the degree of administrative burden would increase. New operations, pre-existing operations in the production phase, and operations utilizing directional drilling to access private minerals outside the refuge administrative boundaries, would require the regulatory oversight of the Service.

Impacts include the additional responsibilities involved in the oversight and management of all operations, and an increase in the existing workload of refuge staff when compared to the existing condition and Alternative B. This would require additional FTE or other administrative or material resources. Additional responsibilities involved in addressing new, existing, and pre-existing operations would require expansion of dedicated refuge and NWRS Energy Team staff. Provisions for cost recovery and compensation for access across federally owned lands could result in the potential for a reduced financial and administrative burden, resulting in long-term beneficial impacts on refuge management and operations. Overall, management and administration costs would increase substantially, perhaps to a \$7 to \$8 million range annually, to gain the intended incremental resource protections of the Modified Rule, resulting in substantial adverse and long-term impacts on refuge operations due to the added cost burdens.

The contribution to cumulative impacts of Alternative C would be notable, but still small given the wider context of cumulative actions affecting refuge management and operations. Adverse impacts of the additional staff and operational need could be significant on a local level, but not on a Service-wide refuge management basis.

Overall Impacts of Alternatives on Socioeconomics

Socioeconomics that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS may include oil and gas operator costs and project financial viability and local and regional economies. The following general conclusions can be drawn about possible impacts of implementing the various alternatives on socioeconomics.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and there would be no change in effects on operator costs and local and regional economies from the existing condition. Most new operations would continue to be conducted under a voluntary SUP or a ROW.

Operations are currently benefiting local and regional economies in adjacent communities, although their production is fairly minimal within the local and state context. Additionally, the production supports ad valorem and severance taxes, benefitting communities, counties, and sometimes states, although this benefit is also small within the local and regional context. Since the Service receives no compensation from operators to cross federally owned lands, the operator benefits by obtaining access at no cost. Because Alternative A would not change current level of impacts, impacts to communities are generally beneficial, and adverse impacts to operators are generally manageable and minimal, the impacts of Alternative A would not be significant.

Both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario. However, the contribution to cumulative impacts of Alternative A would be slight given the considerable oil and gas development occurring in the regions outside refuge

boundaries; additional Federal, State, and local oil and gas permitting and operational requirements; and the many other cumulative impacts affecting operator costs and local and regional economies.

Alternative B: Rule (Preferred Alternative)

Under Alternative B, operators would incur additional costs to comply with the rule. The additional costs stem primarily from provisions that require operators under an operations permit to maintain financial assurance and reimburse the Service for costs associated with processing and administering the operations permit. Operators of pre-existing wells would incur costs at the time of well plugging and reclamation due to the requirement to conduct reclamation to Service standards under an operations permit. Access fees for use of Federal surfaces beyond an operator's oil and gas rights boundary would be a small additional expense for all operations. The administrative and operational costs of the rule on operators are typically small relative to the total project costs and revenues. Additionally, the increased expenses are not expected to affect most company operations as these expenses are (1) a fraction of a percentage of company revenue, and (2) the number of wells a company operates in a refuge is typically a small percentage of its business portfolio. A very small percentage of small operations could be affected, depending on their financial reserves.

Compared to Alternative A, costs for operators could affect individual well economics. Perhaps up to 1,000 marginally producing and idle wells are likely to be plugged and reclaimed sooner under Alternative B as a result of regulatory costs changing individual well economics. Since these wells currently have little or no associated oil and gas production, wells being plugged and reclaimed would have no noticeable impacts on local and regional economies. The same would apply to royalty revenues to leaseholders.

The socioeconomics of Alternative B provides an even greater incentive for operators to choose a surface location outside a refuge to explore for and produce non-Federal oil and gas resources inside a refuge. Since it includes provisions for maintaining financial assurance, access fees, and cost recovery, among others, the operator's costs increase, as does the incentive to avoid those costs.

The rule would allow the Service to recover fees for processing permits and for refuge maintenance and other impacts necessitated by oil and gas operations. Because Alternative B would result in no noticeable impacts on local and regional economies and any adverse effects on individual operators would be limited in extent, the impacts of this alternative would not be significant.

The additional compliance costs associated with Service requirements under Alternative B would have minor cumulative adverse impacts on operators because of the small contribution of these operational costs compared to company revenue and the small percentage of a company's portfolio represented by wells in a refuge unit. Under limited circumstances, very small companies could potentially be affected by the additional compliance costs, although the number of these operations would be a very small percentage of overall operations.

The contribution to cumulative impacts of Alternative B would be slight given the considerable oil and gas development occurring in the regions and the many other cumulative impacts affecting the local and regional economies, and any adverse impacts of the alternative would not be significant.

Alternative C: Modified Alternative

Alternative C would impose substantial costs on a larger number of operators compared to Alternative B. Primarily, the modified rule would impose costs for permitting, cost recovery, maintenance of financial assurance, and compliance with Service operating standards on up to 4,500 existing wells on both Federal and private surface estate. Using cost estimates for the regulatory provisions described in Alternative B, and applying them to 1,000 operations permit applications and 4,500 wells, operators of pre-existing wells could incur costs over \$20 million initially and \$15 million annually thereafter.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge, subjecting operators of these wells to the full regulatory requirements of a new operation inside a refuge. With little incentive for operators to choose surface drilling locations outside a refuge, some of the additional operations permit applications would be changed to surface operations inside a refuge which would likely increase the cost to operators.

Compared to Alternative B, the expansion of Service regulation to downhole activities under the modified rule could generally increase operator costs by 10 to 30 percent in cost categories of permitting, cost recovery fees, maintenance of financial assurance, and meeting Service standards that are above and beyond other Federal and State requirements.

The contribution to cumulative impacts of Alternative C would be slight given the considerable oil and gas development occurring in the regions and the many other cumulative impacts affecting the local and regional economies, and any adverse impacts of the alternative would not be significant.

Conclusion: Alternative B is Preferred Alternative

Three general conclusions can be drawn from the analysis about impacts of the alternatives:

1. The action alternatives do not authorize any activities that create additional adverse impacts on natural resources, visitor use and experience, and cultural resources compared to the no-action alternative.
2. Overall beneficial impacts on natural resources, visitor use and experience, and cultural resources are expected from the action alternatives.
3. The beneficial impacts come in conjunction with some increased financial considerations for both the Service and operators.

Based on our analysis, we have determined that Alternative B is the preferred alternative because it best meets the purposes and needs of revising the existing rule and will provide the maximum protection of refuge resources when balanced with the cost to operators and to the Service for administration. Alternative C would also have beneficial impacts to refuge resources and uses. In some cases, Alternative C would provide more benefits and protection than Alternative B. However, the Service does not believe that the relatively small, incremental environmental benefits of Alternative C are worth the significant additional administrative costs associated with the implementation of Alternative C on the Service and operators.

The full impact analysis is in Chapter 4: Environmental Consequences.

TABLE 1. THE EFFECTS OF THE THREE ALTERNATIVES DESCRIBED IN THE FINAL ENVIRONMENTAL IMPACT STATEMENT

	Alternative A	Alternative B (Preferred Alternative)	Alternative C
Natural Resources	<p>No change in impacts.</p> <p>Some ongoing, unnecessary adverse impacts continue from operations not under a voluntary Service-issued SUP or ROW or the inability to secure an operating standard in an SUP or ROW that provides adequate protection for refuge natural resources.</p>	<p>Adverse impacts minimized to the greatest extent practicable for new operations due to permitting requirements and performance-based standards that ensure operations are conducted using technologically feasible, least damaging methods.</p> <p>Some unnecessary, ongoing adverse impacts from pre-existing operations may continue, but stricter compliance with Federal and State laws should minimize or avoid these ongoing impacts.</p> <p>Long-term beneficial impacts due to requirement that all operations will be reclaimed to meet Service standards</p>	<p>Adverse impacts minimized to the greatest extent practicable by permitting requirements and performance-based standards applied to all operations on refuges, inholdings, and non-Federal surface locations adjacent to a refuge with directional drilling extending beneath a refuge. This ensures operations are conducted using technologically feasible, least damaging methods.</p> <p>Long-term beneficial impacts due to requirement that all operations will be reclaimed to meet Service standard</p> <p>Some additional, direct adverse impacts due to removal of incentive to locate operations on non-Federal surfaces.</p>
Visitor Use and Experience	<p>No change in impacts.</p> <p>Some ongoing, unnecessary adverse impacts continue from operations not under a Service-issued SUP or ROW or the inability to secure an operating standard in an SUP or ROW that provides adequate protection for visitor use and experience.</p>	<p>Adverse impacts minimized to the greatest extent practicable for new operations due to permitting requirements and performance-based standards that ensure operations are conducted using technologically feasible, least damaging methods.</p> <p>Some unnecessary, ongoing adverse impacts from pre-existing operations may continue, but stricter compliance with Federal and State laws should minimize or avoid these ongoing impacts.</p> <p>Long-term beneficial impacts due to requirement that all operations will be reclaimed to meet Service standards</p>	<p>Adverse impacts minimized to the greatest extent practicable by permitting requirements and performance-based standards applied to all operations on refuges, inholdings, and non-Federal surface locations adjacent to a refuge with directional drilling extending beneath a refuge. This ensures operations are conducted using technologically feasible, least damaging methods.</p> <p>Long-term beneficial impacts due to requirement that all operations will be reclaimed to meet Service standard</p> <p>Some additional, direct adverse impacts due to removal of incentive to locate</p>

	Alternative A	Alternative B (Preferred Alternative)	Alternative C
			operations on non-Federal surfaces.
Cultural Resources	<p>No change in impacts.</p> <p>Some ongoing, unnecessary adverse impacts continue from operations not under a voluntary Service-issued SUP or ROW or the inability to secure an operating standard in an SUP or ROW that provides adequate protection for cultural resources.</p>	<p>Increased protection on easements due to Federal nexus and applicability of Federal cultural resource protection laws.</p>	<p>Increased protection from operations on private inholdings within a refuge and on non-Federal surface locations due to Federal nexus and applicability of Federal cultural resource protection laws.</p>
Refuge Management and Operations	<p>Administrative costs remain the same. Increased cost of management and operations as Service continues to bear cost of plugging and reclamation from insolvent operators</p>	<p>No material change in administrative costs, but could require reallocation of some refuge staff and resources. Costs of operations may decrease due to access fees and cost reimbursement provisions.</p>	<p>Great increase in administrative costs due to processing of operations permits for all operations (new, existing and pre-existing), regulation of downhole operations, and enforcement of rule.</p> <p>Costs of operations may decrease due to access fees and cost reimbursement provisions.</p>
Socioeconomics (Cost to Operators and Local Economy)	<p>Costs remain the same.</p>	<p>Increased costs to new operators due to compliance with financial assurance, cost recovery, and access fees provisions.</p> <p>Increased costs for existing wells due to reclamation to Service standards. .</p>	<p>Greatly increased costs to all operators due to compliance with modified rule</p>

CONSULTATION AND COORDINATION

The Service engages in internal, external, and public scoping as an essential aspect of the NEPA process. Internal scoping involves discussions among Service personnel regarding the purpose and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics. Public scoping is the early involvement of the interested and affected public in the environmental analysis process. Based on internal and public scoping, the Service developed the objectives of revising the regulations and a list of resources and concerns to evaluate in this final rule revision/EIS.

Internal scoping for the EIS began in January 2013 with the establishment of an interdisciplinary team comprising Service subject matter experts, practitioners, and natural and cultural resource management professionals. The team has continued to meet regularly to provide input to the process, including framing the analysis to focus on main areas of change in the regulations and identifying impact topics for detailed analysis.

Public participation in the scoping process officially began through publication of an advance notice of rulemaking and the notice of intent to develop an environmental impact statement (ANPR/NOI/EIS) in the Federal Register (79 FR 10080) on February 24, 2014. The purpose of issuing the ANPR was to advise the public of the Service's intent to develop a rule to revise the 50 CFR 29.32 regulations, and to seek comments and suggestions related to several topics, including regulation of new and pre-existing operations; directional drilling beneath refuges from surface locations outside refuges; operating standards; operator financial assurance; access fees; and assessments for operator noncompliance with the regulations. The Service also issued an official news release on February 24, 2014, advising the public on publication of the ANPR/NOI/EIS in the Federal Register. The Service received 79,612 responses to the ANPR, containing comments from business interests, professional societies, conservation organizations, unaffiliated individuals, and State agencies. The comments received were primarily supportive of the revisions.

Further details on consultation and coordination for this EIS are described in Chapter 5: Consultation and Coordination.

THE NEXT STEP

Upon publication in the federal register of the Notice of Availability of this final EIS, there will be a 30-day waiting period before the publication of the Service's Record of Decision. Subsequent publication of the final rule in the federal register will be the final agency action.

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ABBREVIATIONS

ACOE	U.S. Army Corps of Engineers
ANPR	Advance Notice of Proposed Rulemaking
API	American Petroleum Institute
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best management practices
BOR	Bureau of Reclamation
BTEX	Benzene, toluene, ethylbenzene, and xylene
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
D.O.	Director's order
dba	A-weighted decibel
DOI	Department of the Interior
DOT	U.S. Department of Transportation
E.O.	Executive order
EIA	U.S. Energy Information Administration
EIS	Environmental impact statement
EPA, USEPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FLM	Federal land manager
FS	Forest Service
GWPC	Ground Water Protection Council
IOGCC	Interstate Oil and Gas Compact Commission
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOI	Notice of intent
NORM	Naturally occurring radioactive material
NPS	National Park Service
NWR	National Wildlife Refuge

NWRS	National Wildlife Refuge System
NWRSAA	National Wildlife Refuge System Administration Act
NWRSIA	National Wildlife Refuge System Improvement Act
ORV	Off-road vehicle
PCB	Polychlorinated biphenyl
PSD	Prevention of significant deterioration
ROW	Right-of-way
Service, USFWS	U.S. Fish and Wildlife Service
SUP	Special use permit
TRRC	Texas Railroad Commission (Railroad Commission of Texas)
USGS	U.S. Geological Survey
VOC	Volatile organic compound
WMD	Wetland Management District
WPAP	Wetlands Policy and Action Plan

CHAPTER 1: PURPOSE AND NEED FOR ACTION

INTRODUCTION

This Purpose and Need for Action chapter describes why the U.S. Fish and Wildlife Service (Service) is proposing revising regulations for governing non-Federal oil and gas activities within the boundaries of National Wildlife Refuge System (NWRS) lands (refuges). The Service evaluated a range of alternatives for the revision and expansion of its rules at 50 CFR Part 29, which apply to non-Federal oil and gas development on NWRS lands. The Service has prepared this environmental impact statement (EIS) pursuant to the National Environmental Policy Act (NEPA) in order to assess potential environmental impacts associated with a range of reasonable alternatives for regulating non-Federal oil and gas development on refuges.

Refuge resources that could be affected include fish and wildlife, geology and soils, air quality, water resources, wetlands, floodplains, vegetation, scenic views and night sky resources, natural soundscapes and the acoustic environment, and cultural resources. Effects on visitor use and experience, refuge management and operations, and socioeconomics have also been analyzed. Changes to the regulations are expected to affect both current and future non-Federal oil and gas operations occurring on Service-administered lands.

This EIS presents and analyzes the potential impacts of three alternatives: a no-action alternative (current management) and two action alternatives for the regulatory oversight of non-Federal oil and gas development. Upon conclusion of the EIS and decision-making process, one of the alternatives, or parts of each, could be adopted through a rulemaking process, which would guide management and oversight of future non-Federal oil and gas development at refuge units for the foreseeable future.

This EIS is programmatic in nature, which means that it provides an analysis of a framework for taking a range of actions, but specific actions relating to new or expanded non-Federal oil and gas development would require more site-specific analyses before they could be permitted. Environmental compliance on the project level, including additional consultation and an opportunity for public comments, will be completed under a separate NEPA and decision-making process.

PURPOSE AND NEED FOR ACTION

The purpose of this action is to develop goals and objectives that the Service intends to fulfill by management activities. The need for this action arises from existing conditions that need to be changed, problems that need to be remedied, decisions that need to be made, and policies or mandates that need to be implemented. *Purpose* is what we want to do; *need* is why we want to do it. The following purpose and need statements were developed by the Service for this EIS with input from the public and other agencies. Additional information that supports the purpose and need is provided throughout the other sections of this chapter.

PURPOSE OF THE REGULATION REVISION

The purpose of the regulation revision is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on

refuge land, water, and resources, as well as refuge wildlife-dependent recreational uses, and are conducted in a manner that protects employee and public health and safety. In addition, the purpose is to improve understanding, application, and effectiveness of the regulations for the Service, the regulated community, and the public. This is accomplished by revising the 50 CFR 29.32 regulations.

NEED FOR ACTION

The Service has identified the following key reasons for proposing revisions to the existing 50 CFR 29.31-32 regulations:

- The Service has not formally and publicly asserted its authority to regulate non-Federal oil and gas rights currently being exercised within the authorized boundaries of refuges.
- The existing regulations serve as a general policy statement, but do not provide a comprehensive and functional regulatory framework for the exercise of non-Federal oil and gas rights.
- The current regulation does not provide comprehensive operating standards.
- The Service has limited means under the existing regulations to address violations.
- The existing regulations do not address Service jurisdiction for directional oil and gas wells drilled beneath refuges from a surface location on lands or waters outside refuge boundaries.
- Inconsistencies and uncertainties in non-Federal oil and gas rights management results in unnecessary adverse impacts on refuge resources and uses.
- The existing regulations are not consistent with practices of other Federal agencies and private landowners concerning compensation to the United States for privileged access across federally owned lands beyond the boundary of an operator's non-Federal oil and gas property interest.
- The existing regulations do not address the Service's ability to require financial assurance from operators to ensure that funds are available to properly restore oil and gas operation sites in the event operators fail to fulfill their reclamation obligations.
- The existing regulations do not provide a means for the Service, as appropriate, to recover the costs for processing applications and monitoring non-Federal oil and gas operations on refuges.

OBJECTIVES IN TAKING ACTION

Objectives must be achieved, to a large degree, for an action to be considered a success. All alternatives selected for detailed analysis in this EIS must meet objectives, to a large degree, as well as resolve purpose and need for action. Objectives for adequate regulatory oversight of non-Federal oil and gas operations must be grounded in the enabling legislation, purpose, significance, and mission of refuges affected under these revisions.

The Service has identified the following primary objectives to meet by revising the 50 CFR §29.32 regulations:

- The Service's authority to specifically regulate the exercise of non-Federal oil and gas rights is clarified.
- The regulation provides consistent, functional, and understandable procedures and provisions to the regulated operating community, public, and refuge staff.

- Performance-based standards provide flexibility to resource managers and operators to achieve resource protection across various environments and uses of technology
- The regulations provide a practical and effective means for dealing with acts of noncompliance or with illegally conducted operations (unauthorized operations) in refuges.
- The regulation addresses Service jurisdiction for directional oil and gas wells drilled beneath refuges from a surface location on lands or waters outside refuge boundaries in a way that utilizes the least-damaging methods to prevent or minimize damage to refuge resources and uses.
- All future non-Federal oil and gas operations conducted on federally owned or administered lands and waters within refuges utilize the least-damaging methods to prevent or minimize damage to refuge resources and uses.
- All existing non-Federal oil and gas operations conducted on federally owned or administered lands, and any waters within refuges do not create additional unnecessary impacts on refuge resources and uses by maintaining full compliance with Federal and State laws, regulations, and permits.
- The regulation addresses existing operations by balancing the incremental level of protection for refuge resources and uses with the incremental administrative and cost burden imposed on both the regulated community and the Service.
- All non-Federal oil and gas operations conducted on federally owned or administered lands, and any waters within refuges are eventually reclaimed in a manner consistent with the purposes for which the refuge was established.
- The public and refuge staff are protected from health and safety hazards associated with non-Federal oil and gas operations.
- The United States is fairly compensated by operators for use of federally owned land outside the boundary of their non-Federal oil and gas property interest.
- Financial assurance provided by non-Federal oil and gas operators is adequate to ensure the public does not incur reclamation costs in the event of an operator default.
- The regulations provide a means for the Service, as appropriate, to recover the costs for processing applications and monitoring non-Federal oil and gas operations on refuges.

UTILITY OF REGULATIONS

Because of the vagueness of the current regulations, they lack utility for oil and gas operations. The regulations have led to inconsistent processes in permit applications, operating standards, approval standards, and general terms and conditions. Administrative inefficiencies can detract from the primary objective of avoiding and minimizing the effects of oil and gas activities on refuge resources. While the Service has had many local successes working with oil and gas operators to achieve appropriate resource protections, there are many more examples of unnecessary impacts on trust resources and refuge management. These same impacts have caused delays and additional costs for operators.

A fundamental aspect of a revised rule would be to improve regulatory consistency and functionality to the benefit of refuge resources, refuge administration, and oil and gas operators.

PURPOSE AND SIGNIFICANCE OF NATIONAL WILDLIFE REFUGES

The NWRS, managed by the Service, is the world's premier system of public lands and waters set aside to conserve America's fish, wildlife, and plants. Since President Theodore Roosevelt designated Florida's Pelican Island as the first wildlife refuge in 1903, the NWRS has grown to more than 150 million acres, 562 national wildlife refuges and other units, plus 38 wetland management districts.

The mission of the Service is:

Working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

To accomplish this mission, the Service established the National Wildlife Refuge System, whose mission is:

To administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966).

The NWRS provides habitat for threatened and endangered species, migratory birds, and some of the Nation's most important fishery resources. Fifty-nine refuges have been established specifically to protect endangered species. The NWRS also includes about 20 percent of the designated Wilderness areas in the U.S.

Refuges offer outstanding wildlife-dependent recreational opportunities, including fishing, hunting, wildlife observation and photography, and environmental education and interpretation. Around 40 million people visit refuges annually.

BACKGROUND

NON-FEDERAL OIL AND GAS DEVELOPMENT ON NATIONAL WILDLIFE REFUGES

Oil and gas exploration and development occur in specific situations on refuges. These activities most often occur where the Service acquired the surface rights to the land and the mineral estate remained in non-Federal ownership. The owners of these "non-Federal" mineral rights (they may be individuals, corporations, State or local governments, or Indian tribes) have the legal right to explore for and extract their oil and gas resources.

Such rights are a form of real property and fall under the protection of the Fifth Amendment to the U.S. Constitution, which states, "No person shall be ...deprived of ... property, without due process of law; nor shall private property be taken for public use, without just compensation." (U.S. Const. amend. V). The Service nonetheless may regulate the exercise of these property rights within the

NWRS pursuant to the authority described in the next section. That is, the regulations apply reasonable time, place, and manner avoidance and mitigation measures to the exercise of mineral rights, but do not deny the operator access.

The types of non-Federal oil and gas development activities conducted on refuge lands generally include geophysical (seismic) exploration; exploratory well drilling; field development; well drilling; oil and gas well production operations, including installation and operation of well flowlines and gathering lines; well plugging and abandonment; and surface restoration. Each of these types of development has occurred or continues to occur. We currently have 103 refuges and 4 wetland management districts (WMDs) with oil and gas production. Appendix C presents a description of each type of operation that typically occurs during exploration and production of oil and gas resources.

SERVICE LAW AND POLICY GOVERNING NON-FEDERAL OIL AND GAS

The authority of the Service to regulate non-Federal oil and gas operations on NWRS lands is broadly derived from the Property Clause of the United States Constitution (Art. VI, Sec. 3), in carrying out the statutory mandates of the Secretary of the Interior, as delegated to the Service, to manage Federal lands and resources under the National Wildlife Refuge System Administration Act (NWRSA), as amended by the National Wildlife Refuge System Improvement Act (NWRRIA), 16 USC 668dd et seq. The NWRRIA directs that, in administering the System, the Secretary of the Interior shall, among other things:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the States in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;
- Recognize wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the NWRS for wildlife-dependent recreational uses; and
- Monitor the status and trends of fish, wildlife, and plants in each refuge.

The NWRRIA also gives the Service, through the Secretary of the Interior, broad authority to promulgate regulations to carry out these responsibilities: “In administering the System, the Secretary is authorized to . . . issue regulations to carry out this Act” (16 U.S.C. § 668dd(b)(5)). This includes the authority to regulate the exercise of non-Federal oil and gas rights within refuge boundaries for the purpose of protecting wildlife and habitat, water quality and quantity, wildlife-dependent recreational opportunities, and the public health and safety of employees and visitors on NWRS lands

The existing Service regulations for management of non-Federal oil and gas activities are contained at 50 CFR, § 29.32. These regulations have not been revised for more than 50 years. The regulation reads in its entirety:

“Persons holding mineral rights in wildlife refuge lands by reservation in the conveyance to the United States and persons holding mineral rights in such lands which rights vested prior to the acquisition of the lands by the United States shall, to the greatest extent practicable, conduct all exploration, development, and production operations in such a manner as to prevent damage, erosion, pollution, or contamination to the lands, waters, facilities and vegetation of the area. So far as is practicable, such operations must also be conducted without interference with the operation of the refuge or disturbance to the wildlife thereon. Physical occupancy of the area must be kept to the minimum space compatible with the conduct of efficient mineral operations. Persons conducting mineral operations on refuge areas must comply with all applicable Federal and State laws and regulations for the protection of wildlife and the administration of the area. Oil field brine, slag, and all other waste and contaminating substances must be kept in the smallest practicable area, must be confined so as to prevent escape as a result of rains and high water or otherwise, and must be removed from the area as quickly as practicable in such a manner as to prevent contamination, pollution, damage, or injury to the lands, waters, facilities, or vegetation of the refuge or to wildlife. Structures and equipment must be removed from the area when the need for them has ended. Upon the cessation of operations the area shall be restored as nearly as possible to its condition prior to the commencement of operations. Nothing in this section shall be applied so as to contravene or nullify rights vested in holders of mineral interests on refuge lands.” (50 CFR § 29.32).

Service policy is outlined in the Service Manual Part 612 FW 2, Oil and Gas. In the case of non-federally owned oil and gas rights, it is the policy of the Service “to protect project [i.e., refuge lands] resources to the maximum extent possible without infringing upon the rights of sub-surface owners.” The Service’s existing regulations and policy lack the clarity and specificity to consistently and effectively manage non-Federal oil and gas operations to protect refuge resources and uses, as well as the health and safety of visitors, Service employees, and the general public as directed under the NWRSA. Therefore, the revisions to the regulations are a valid exercise of Service authority to carry out the mandates delegated to the agency under the NWRSA.

NON-FEDERAL OIL AND GAS RIGHTS IN REFUGES AND PROJECT STUDY AREA

Non-Federal oil and gas mineral rights are known to exist in many refuges. Current development consists of approximately 5,000 oil and gas wells located on 107 refuges, including four WMDs (Figure 1). The 5,002 wells included not only oil, gas, and oil and gas wells but also “other wells” consisting of injection wells for enhanced oil recovery, saltwater disposal wells, or wastewater disposal, coalbed methane wells, observation wells, stratigraphic wells, dry wells, and water wells used for oil and gas operations. Based on the analysis of the 2011 data, the Service determined the need to obtain additional information on approximately 1,100 wells. Preliminary follow up investigations by the Service identified many of these wells were plugged and abandoned with site conditions such that they warrant no further management actions. Until the follow up investigation is completed, we can estimate the number of wells not subject to Service permits at approximately 4,000. Our investigations may also identify a small number of refuges with wells that are “legacy wells” that could be categorized as “other” wells including plugged and abandoned wells that warrant no further management action. One-third of the wells are active, either producing oil or gas, or

injecting gas, oilfield brine, or other fluids underground. Appendix D provides statistics of existing non-Federal oil and gas operations on refuges. Future exploration and development, as well as reclamation activities, are expected in these same areas.

Future development of non-Federal oil and gas rights on refuges that do not currently have oil and gas activities is possible based on: (1) the presence of oil and gas resources in close proximity or within the authorized boundaries of the refuge; (2) the non-Federal oil and gas mineral rights acreage in the refuges is large enough to support development activity; and (3) technological improvements to extract reserves from those currently uneconomically recoverable. The Service estimates another 32 refuges and 4 WMDs could potentially experience oil and gas proposals at some point. In addition to the geologic (e.g., reservoir, source rock, hydrocarbons) and ownership factors, future non-Federal oil and gas development is also largely dependent upon economic elements.

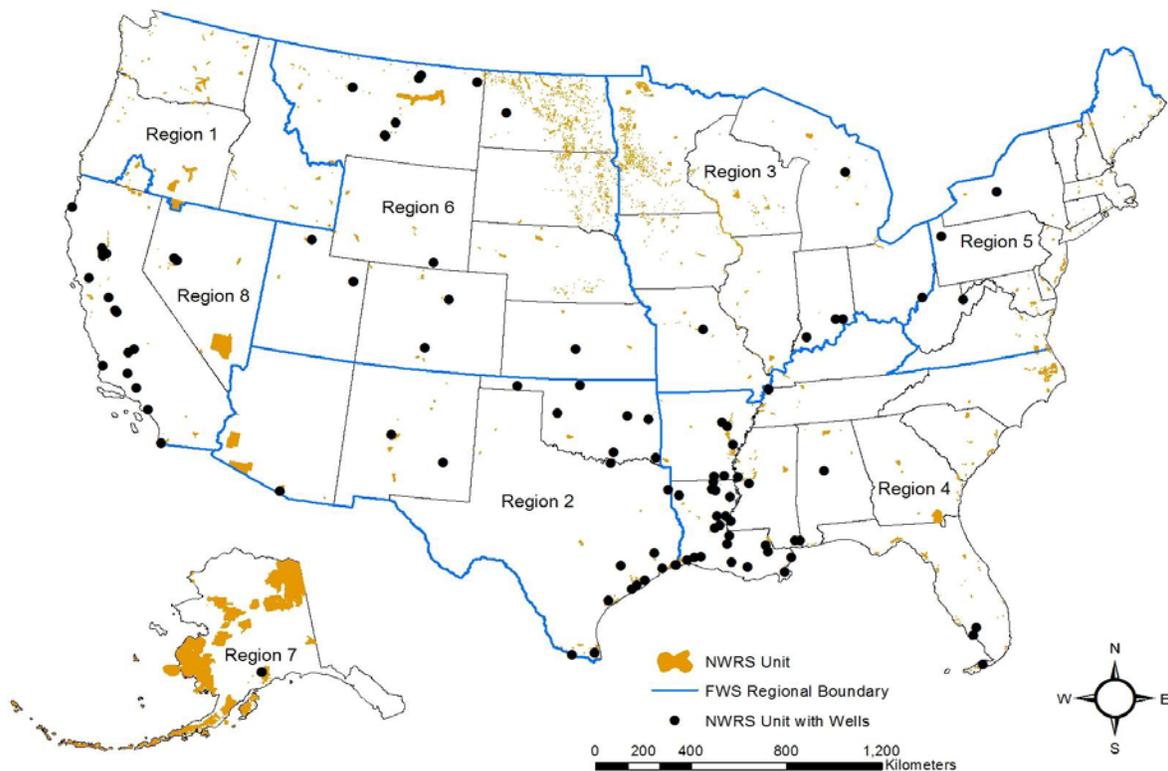


FIGURE 1-1. NWRS UNITS WITH NON-FEDERAL OIL AND GAS WELLS. THE WELLS INCLUDE: OIL, GAS, OIL AND GAS, INJECTION WELLS FOR ENHANCED OIL RECOVERY, SALTWATER DISPOSAL WELLS, OR WASTEWATER DISPOSAL, COALBED METHANE WELLS, OBSERVATION WELLS, STRATIGRAPHIC WELLS, DRY WELLS, AND WATER WELLS USED FOR OIL AND GAS OPERATIONS.

RELEVANT ISSUES PERTAINING TO NON-FEDERAL OIL AND GAS ON NATIONAL WILDLIFE REFUGES

The following discussion provides rationale for the revisions to the Service's regulations, as well as a summary of the analyses presented in this EIS. It includes a description of exempt operational status for wells, the Service's regulatory jurisdiction, new operating technologies allowing directional drilling for longer distances than that which was previously possible, and financial aspects of operations.

SCOPE OF REGULATION AND PERMIT REQUIREMENT

The regulations would apply to all operators conducting non-Federal oil and gas operations within refuges outside of Alaska, on lands held by the United States in fee title, and to property interests in such land in less than fee (excluding coordination areas), such as easements, and the waters occurring on those lands. Non-Federal oil and gas operations on refuge units in Alaska would continue to be governed by title XI of the Alaska National Interest Lands Conservation Act (ANILCA), Section 22(g) of the Alaska Native Claims Settlement Act of 1971 (ANCSA), and the Department's implementing regulations. For areas held in less than fee, the Service would apply regulations only to the extent that the property interest held by the United States may be affected. For example, a proposed drilling operation on a wetland easement held by the Service could significantly alter the wetland and thus the value for which the easement was acquired. Therefore, the regulations would provide a tool to help the Service guide time, place and manner of such operations to avoid or minimize adverse impacts to such easement interests. For instance, the proposed drilling operation could be located in an upland area to prevent impacts to the wetland. The Service is evaluating the benefits of exercising its jurisdiction on drilling and production operations conducted on lands outside refuge boundaries, including private inholdings and neighboring lands that use directional drilling to access oil and gas beneath a refuge.

The heart of the regulations, as well as action alternatives being considered, is a permit system centered on operations designed and conducted to meet applicable operating standards. Before 2000, Service-issued special use permits were rarely required for conducting non-Federal oil and gas operations on refuges. Less than half of the operations initiated in the past 10 to 15 years have been conducted under a special use permit. When permits have been issued, the conditions have varied widely.

There are two primary reasons for the inconsistency across the Service in past management of oil and gas permits. First, the Service had not formally determined its position regarding its authority to require permits for oil and gas activities. Therefore, various interpretations of how much regulatory control the Service has over non-Federal oil & gas rights created variations in Refuge management of such operations. Second, Refuge Managers have lacked sufficient guidance, resources, and training to properly monitor oil and gas operations. Therefore, the regulations would help remedy this inconsistency and provide refuge managers and operators clearer guidance about permit requirements for non-Federal oil and gas operations on Refuges.

In the proposed rule, the Service considered exempting pre-existing operations from the permit requirement. For purposes of this document, *pre-existing operations* means those operations being conducted without an approved permit from the Service prior to implementation of the regulations. In

the final Rule, if an operator of a pre-existing well changes, the new operator must obtain an Operations Permit. In this document, the Service considers the environmental benefits of imposing a permit requirement on pre-existing operations in relation to the administrative costs to the Service and the administrative and operational costs that operators might incur.

DIRECTIONAL DRILLING OPERATIONS FROM LANDS OUTSIDE REFUGES

Advances in oil and gas directional drilling technologies have resulted in the ability of some wells to be drilled into non-Federal mineral estates beneath refuges from surface operation locations outside refuge boundaries. Use of directional drilling in this manner removes surface activities from the refuge thus causing less visual and surface disturbance to the refuge. Directional drilling is not specifically addressed in current regulations. However, since the primary goal of the new regulations is avoidance or minimization of impacts on NWRS resources, directional drilling guidance will be explored. Figure 2 presents a diagram of a directional well drilled beneath a refuge from a surface location outside the refuge boundary.

The Service evaluated maintaining its current status of not exercising jurisdiction on drilling and production operations conducted on lands outside refuge boundaries, including, but not limited to, access routes, well pad location, drilling and production equipment on the surface, and produced product transportation routes and methods. This analysis also considers an alternative to expand Service jurisdiction to both surface and subsurface activities outside of a refuge boundary in instances where the wellbore passes beneath Service fee title land.

In this analysis, the Service considers a recent analysis by the National Park Service (NPS) of wells drilled from surface locations outside a park to points beneath the park. The review identified no known instances of impacts to park resources resulting from the 68 wellbores drilled and operated beneath parks.

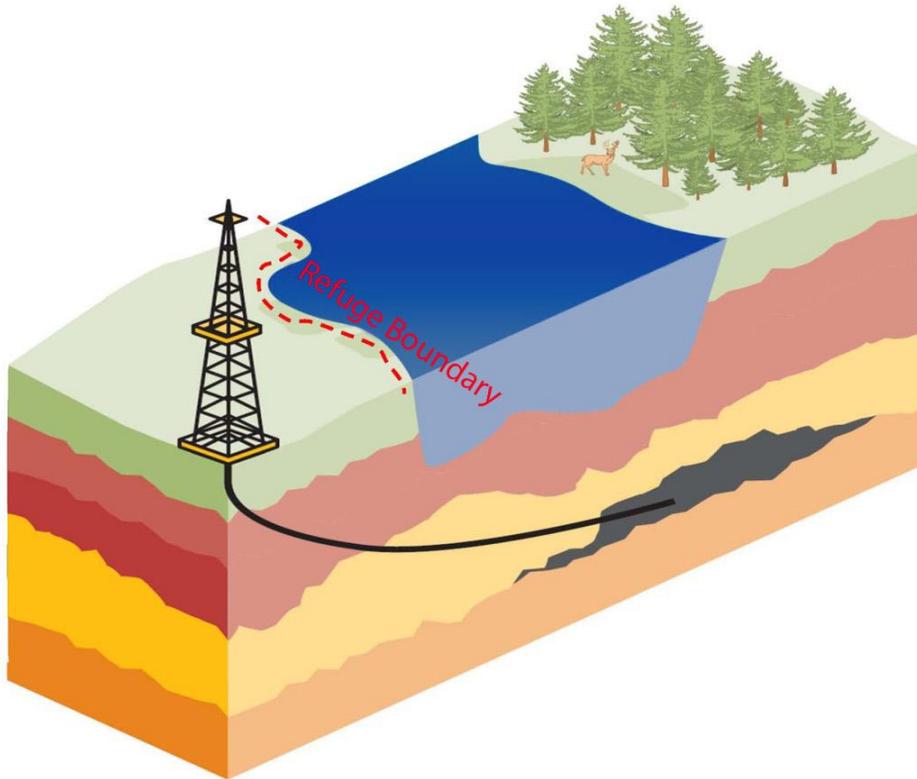


FIGURE 1- 2. SCHEMATIC OF A DIRECTIONALLY DRILLED WELL BENEATH A PARK THAT IS DRILLED FROM A SURFACE LOCATION OUTSIDE THE REFUGE Source: EngineerCE.com 2013

FINANCIAL ASSURANCE FROM OPERATORS

Currently, if a refuge obtains financial assurance for reclamation of oil and gas development, it comes in various forms: bonds administered by the Service, bonds administered by another Federal agency, or State bonds. The variance in practice provides different degrees of financial assurance. For example, the bonds in some States may or may not cover certain damages caused by oil and gas activities if the effects are considered to be “reasonable impacts” to the land. Reasonable impacts are not consistently defined among States because impacts to property are determined by what are usual and customary practices in the area.

State bond amounts do not typically cover the actual costs of well plugging and reclamation. However, States administer well plugging funds with money derived from sources other than forfeited bonds, e.g., permitting fees, taxes on production, or penalties. So, the two primary reasons that state bonding programs do not meet the Service’s needs are that state plugging funds may not be

directly available to wells on refuges that become orphaned, and these funds may not be available to conduct site reclamation to standards higher than what a State may typically require. While States have developed programs for plugging orphaned wells, many State programs remain backlogged, and States are unclear how orphaned wells on federally managed lands rank on their priority lists. (Office of Inspector General, Report No. CR-EV-FWS-002-2014: Oil and Gas Development on U.S. Fish and Wildlife Service Refuges). Even where a State may expeditiously address plugging of an orphaned well on a refuge, funds may not be available to restore sites in a manner that meets Service standards. In the event that a State and the Service were in formal agreement that state plugging funds would be used to plug a well directly upon its becoming orphaned as well as to conduct site reclamation, the Service would consider this to be a condition that would justify reducing the financial assurance required by the Service.

Requiring financial assurance from operators under the regulation would ensure that the operators would be held to a consistent standard on all Refuges to ensure that cost of reclamation to Service standards does not fall to the public. In addition, the financial assurance held by the Service provides an incentive for operators to maintain compliance with the permit and applicable regulations. This, in turn, leads to improved protection of refuge resources.

ACCESS AND COST RECOVERY

Operators often need to cross Federal or private lands where they have no pre-existing rights to do so. Operators must obtain permission from the Service for such access to NWR lands (50 CFR 29.21). In most cases, refuges have not charged fees for access to non-Federal oil and gas rights, leaving the Service, and ultimately the taxpayers, the burden of the costs associated with providing this access. In contrast, NPS, FS, and BLM, as well as private landowners, in most cases, charge fees. Fees would compensate the Service for impacts to surface resources caused by access. Fees could be used to offset maintenance costs, such as purchasing fuel for a road grader, gravel for a road, maintaining refuge equipment used in road maintenance, or allowing for new access (e.g., roads or gatherings lines) across Federal lands. The fees also offset the costs of improving habitat on the refuge, purchasing additional lands to compensate for the loss of use, or reclaiming other oil and gas sites.

The Service would set the fee amount using generally accepted practices. For example, the Service could set fees consistent with current Service regulations regarding fees for access and rights-of-ways (50 CFR 29.21), calculate fees using the BLM's Linear Rights-of-way Fee Schedule, or use an appraisal. The Service needs to be consistent with other agencies and practices to ensure the public is properly compensated for surface uses of those exercising non-Federal oil and gas rights.

The Service is proposing a requirement for operators to reimburse the Service for the costs of processing and administering temporary access permits and operations permits. The amount of reimbursement would be determined by the actual staff time spent directly processing permit applications and subsequently monitoring the operation for compliance. The Service has the authority to collect reasonable fees and recover administrative costs. In Texas and Louisiana, the Service can retain and expend funds at the refuge-specific level from operators who cause refuge damage. Reimbursable agreements and other similar agreements may be used in all states to help retain and expend those fees on a refuge-specific level.

COMPLIANCE PROCEDURES AND PENALTIES FOR DEALING WITH VIOLATIONS AND UNAUTHORIZED OPERATIONS

Noncompliance is not addressed in current regulations, resulting in unnecessary impacts to refuge resources. Acts of noncompliance from recalcitrant operators may require undue refuge administration efforts and increased operational costs. An effective regulatory framework needs to provide the foundation for consistent application of compliance procedures and penalties. These procedures and penalties need to be workable and adaptable to various levels of noncompliance and the resultant impacts that may arise from them.

SCOPING PROCESS AND PUBLIC PARTICIPATION

NEPA requires an “early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).” Refer to Chapter 5 of this document for a more detailed summary of the public comments received during public scoping. The description below provides a summary of this process.

Scoping began in January 2013 with the establishment of an interdisciplinary team composed of Service subject matter experts, practitioners, and natural and cultural resource management professionals to determine the purpose, need and objectives of new management actions for non-Federal oil and gas operations on Refuges. Public participation in the scoping process officially began through publication of an Advance Notice of Proposed Rulemaking and Notice of Intent to Prepare an Environmental Impact Statement (ANPR/NOI/EIS) in the Federal Register (79 FR 10080) on February 24, 2014. The Service also issued an official news release, advising the public of publication of the ANPR in the Federal Register.

The ANPR/NOI/EIS solicited ideas from the public on ways the Service could improve existing management and oversight of non-Federal oil and gas operations. In addition, the Service sought input in identifying the significant issues and NEPA alternatives that should be considered in determining the scope of the EIS for this rulemaking initiative. Specifically, the public was asked to comment on approaches for a permitting system, application of operating standards, requirements for financial assurance and access fees, addressing instances of noncompliance, regulation of existing operations, and impact topics for analysis. A summary of the agency and public scoping activities is available in Chapter 5: Consultation and Coordination.

IMPACT TOPICS

As a result of this scoping effort, issues related to potential impacts on refuge resources and values were identified as requiring further analysis in this Rulemaking. Issues are described in terms of the relationship between actions and environmental resources. They are usually problems caused by one of the alternatives considered, but can also include existing concerns, questions, or other relationships, including those that may be beneficial, which were identified by the Service through internal, public, and agency scoping. Agencies such as EPA, as well as tribes, oil and gas operators, and members of the public have provided their input into these issues through the public scoping process.

Impact topics are derived from the issues, and should be specific, based on the degree to which a resource may be affected. The impact topics developed from the list of issues are discussed in Chapter 3: Affected Environment, and Chapter 4: Environmental Consequences. They examine the extent to which the resources associated with each impact topic would be affected by the actions in a particular alternative.

The following impact topics have been identified for detailed analysis in this Rule/EIS:

- **Geology and Soils** (including paleontology)—Oil and gas activities can result in increased surface runoff and soil erosion and compaction, affecting the permeability of soils (and other soil characteristics). Poorly maintained well pads, roads, and other oil and gas operations are currently causing erosion, sedimentation, compaction, and loss of soil productivity. Sensitive geologic features (such as rock shelters, arches, and chimneys) and paleontological resources can also be affected by oil and gas operations that involve ground-disturbing activities. The implementation of revised regulations could result in beneficial effects to geology, soils, and sensitive geologic features from improved oversight of oil and gas operations that occur near sensitive soils and geologic resources.
- **Air Quality**—Because oil and gas operations can contribute to incremental effects to local and regional air quality, the implementation of revised regulations could result in beneficial effects in regional conformity with the National Ambient Air Quality Standards (NAAQS) and prevention of significant deterioration (PSD) of air quality in refuge units with oil and gas operations.
- **Water Resources** (including surface and groundwater and both water quality and quantity)—Oil and gas operations can affect both surface and groundwater quality by the release of hydrocarbons and other contaminating substances and from soil erosion and sedimentation. These operations may also create an increased demand for water use. The implementation of revised regulations could result in beneficial effects to water resources from improved oversight of operations.
- **Wetlands**—Oil and gas operations may affect wetlands directly through siting of facilities in wetland areas or indirectly through releases of hydrocarbons or other contaminants in wetland areas. The implementation of revised regulations could result in beneficial effects to wetlands from improved oversight of operations that occur within or near these features.
- **Floodplains**—The siting of oil and gas facilities in floodplains can adversely affect floodplain functions and values and have safety implications if facilities are not adequately designed to withstand flooding. The implementation of revised regulations could result in beneficial effects to floodplains from improved oversight of operations that occur near these features.
- **Vegetation** (including plant species of special management concern)—Effects on vegetation can occur from site development and from spills and leaks at oil and gas facilities. The implementation of revised regulations could result in beneficial effects to vegetation (including plant species of special management concern) with improved oversight and enforcement of violations.

- **Wildlife and Aquatic Species** (including animal species of special management concern)—Effects on fish and wildlife can occur from site development and from spills and leaks at oil and gas facilities. The implementation of revised regulations governing non-Federal oil and gas operations could result in beneficial effects to wildlife and aquatic species with improved oversight and enforcement of violations.
- **Visitor Use and Experience** (including human health and safety, visitation patterns, visitor activities, recreation, interpretation)—Revisions to the regulations governing non-Federal oil and gas operations could result in beneficial changes to operations that currently pose a threat to human health and safety from a number of sources, including the use of roads by commercial vehicles (particularly vehicles with less maneuverability and visibility); hazardous equipment at wells and production facilities; flowline or pipeline failure; and release of gases from wells (hydrogen sulfide). The spill or release of hydrocarbons or other contaminants could be inhaled, absorbed, or ingested by humans.
- **Scenic Views and Night Sky Resources**—Visual resources are impacted by oil and gas operations, which create a visual effect on the landscape and affect scenic viewsheds. Impacts on night skies can occur from the effects of artificial lighting near oil and gas operations. Implementation of revised regulations could result in beneficial effects to scenic views and night skies by implementation of mitigation techniques.
- **Natural Soundscapes and Acoustic Environment**—Human-caused sounds from oil and gas operations can adversely affect natural soundscapes in refuges. Effects to natural soundscapes, cultural soundscapes, and the overall acoustic environment from noise generated from oil and gas operations could be influenced by the implementation of revised regulations governing non-Federal oil and gas operations. The revised rule could result in beneficial changes to the frequency and intensity of human-caused sound from activities associated with oil and gas development such as well drilling, compressor stations, well servicing, pump jacks, construction and earth-moving activities, and truck traffic.
- **Cultural Resources** (including archeological sites, prehistoric/historic structures, cultural landscapes, ethnographic resources)—Oil and gas operations can directly impact cultural resources through ground disturbance or leaks and spills. Indirect damage can be caused by increasing or introducing noise, visual intrusions, or possibly noise or odors, into the cultural landscape. The implementation of revised regulations could result in beneficial effects to cultural resources resulting from improved oversight of operations that occur near cultural resources.
- **National Wildlife Refuge Management and Operations**—Refuge staff currently manage non-Federal oil and gas operations to varying degrees. Revised regulations could positively affect refuge operations and management as staff adapt to the new regulations, implement and enforce them, and improve national consistency in their application.
- **Socioeconomics** (including non-Federal oil and gas exploration and development, and regional and local economies)—The implementation of revised regulations governing non-Federal oil and gas operations could facilitate cost recovery and compensation from abandoned operations, and potentially increase the financial burden to operators and decrease

impacts to local economies. Potential impacts of regulations are analyzed in regard to oil and gas well operators, and local and regional economies.

ISSUES AND IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

- **Utilities**—Impacts on utilities, such as electrical transmission lines and pipelines, are not addressed in this programmatic EIS. The Federal Energy Regulatory Commission (FERC) and U.S. Department of Transportation (DOT) have jurisdiction over trans-refuge pipelines. The Service typically includes regulation of gathering lines under its special use or ROW permits. In addition, the rule requires the operator to provide every aspect of design and construction. If pipelines include ancillary facilities inside a refuge, such as compressor stations or pumping stations, air pollution controls would be considered against a technologically feasible, least damaging standard.
- **Unique Ecosystems, Biosphere Reserves, and World Heritage Sites**—Refuges considered in this EIS protect unique ecosystems (including free-flowing rivers) that support habitat for many species of management concern. Impacts on these ecosystems would be discussed and analyzed as part of impacts on species of management concern or their habitats. The alternatives considered represent variations in the revisions to existing regulatory provisions, ensuring adequate protection to resources. As such, the regulatory actions do not have the potential to affect unique ecosystems, biosphere reserves, and world heritage sites, and the issues related to natural resources capture any potential impacts on these resources, which are evaluated in Chapter 4: Environmental Consequences.
- **Environmental Justice**—Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires all Federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Guidelines for implementing this executive order under NEPA are provided by the Council on Environmental Quality (CEQ) (CEQ 1997).

According to EPA, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies. The goal of fair treatment is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts (USEPA 2011).

Evaluating whether a proposed action has the potential to have disproportionately high and adverse impacts on minority and/or low income populations typically involves the following: (1) identifying any potential high and adverse environmental or human health impacts; (2) identifying any minority or low income communities within the potential high and adverse

impact areas; and (3) examining the spatial distribution of any minority or low income communities to determine if they would be disproportionately affected by these impacts.

The Service does not anticipate that any effects from the rule changes would result in disproportionately high or adverse impacts on low-income populations or communities. The Service analyzed the anticipated costs of the regulation on operators compared to data from the U.S. Economic Census and found regulatory costs to represent less than 1 percent of average annual receipts for typical businesses conducting oil and gas operations in the NWRS. Based on that, the Service anticipates that the rule would not be a major factor in an operator's decision to develop wells or continue production for existing wells. With the expectation that implementation of the rule would not noticeably affect the level of activity or the level of oil and gas production, the Service does not anticipate that any effects from the rule changes would result in disproportionately high or adverse impacts on low-income populations or communities. Moreover, additional analysis would be conducted under the revised rule during NEPA analyses of any permit applications associated with oil and gas activities in order to assess any potential impacts. Therefore, environmental justice was eliminated as an impact topic in this EIS.

- **Wilderness**—In accordance with Service policy (610 FW 1-5), the Service conducts wilderness eligibility assessments using the Service's governing criteria of eligibility to determine which areas, if any, meet the criteria for designation as wilderness. Based on the findings of the assessments, the Service makes a determination whether lands contained within Refuge System units warrant further study for possible inclusion in the national wilderness preservation system. The alternatives considered in this EIS represent variations in the revisions to existing regulatory provisions, ensuring adequate protection to resources. As such, these regulatory actions do not have the potential to affect wilderness designations. Issues related to natural resources and visitor use and experience capture any potential impacts on these resources, which are evaluated in Chapter 4: Environmental Consequences.
- **Climate Change**—Global climate change refers to a suite of changes occurring in the earth's atmospheric, hydrologic, biologic, and oceanic systems. These changes, including increased global air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level, provide unequivocal evidence that the global climate system is warming (IPCC 2007).

Although the Intergovernmental Panel on Climate Change affirms that climate change is occurring, the rate and severity of impacts at refuge units are unknown. A disrupted climate could affect natural and cultural resources, and would likely interfere with public use and enjoyment of refuges. Although many places in the world have already observed and recorded changes that can be attributed to climate change, the impacts on individual refuges have not been specifically determined and the actual implications within the lifespan of this EIS are not determined at this time.

The EIS evaluates climate change in two ways. First, the effects of climate change on refuge resources are considered and addressed in Chapter 3: Affected Environment. Climate change can affect refuge resources, especially vegetation, wildlife and wildlife habitat (including special-status species), and water resources, and this effect is discussed in the introduction to Chapter 3. Second, the Service has considered the contribution of the rule changes to

greenhouse gases emissions and potential related impacts on climate change. Currently, non-Federal oil and gas producing (active) wells on refuges comprise 0.16 percent of the total number of producing wells (1,050,637) in the United States in 2011 as reported by the EPA (EPA 2015). The EPA estimates GHG emissions from oil and gas production in the United States at 2.8 million tons of VOCs and 185 million metric tons (MMt) CO₂ Equivalent of methane (EPA 2015). The contribution of GHG emissions from non-Federal oil and gas wells on refuges is unknown. However, the rule changes will generally result in a beneficial net impact on greenhouse gas emissions, though overall incremental contributions reductions to greenhouse gas emissions from operations located on refuge lands are relatively low. For example, operations permits issued under the rule might include provisions to minimize flaring of natural gas or stipulate use of control equipment that does not vent natural gas.

Additionally, permits would ensure operators comply with any Federal, State or local laws related to GHG emissions. For example, permitting requirements implemented under new State greenhouse gas emissions regulations, which are currently being promulgated by several States, will have the effect of mitigating these emissions, thereby lowering overall contributions. These greenhouse gas permitting actions are discussed under cumulative impacts in the analysis. Because the action would have negligible beneficial impacts related to greenhouse gas contributions and associated climate change, GHG emissions related to climate change was dismissed from further detailed evaluation. Evaluation of GHG emissions for future actions under the rule and alternative would be performed at the individual permit level as necessary to comply with NEPA.

- **Adjacent Land Uses and Resources**—Potential impacts on lands adjacent to refuges following implementation of revised regulations governing non-Federal oil and gas operations are addressed under each impact topic in the EIS as part of the discussion of directional drilling. Additionally, refuge resources may be adversely affected by the intensity of development on adjacent lands. The influence of oil and gas development on adjacent lands and, in particular, the use of directional drilling techniques for recovering oil and gas reserves on adjacent lands has the potential to result in adverse impacts on refuge resources. Impacts on refuge resources and adjacent lands stemming from these scenarios are described for each resource topic in this EIS.

FEDERAL LAWS, POLICIES, AND REGULATIONS DIRECTLY RELATED TO NON-FEDERAL OIL AND GAS DEVELOPMENT IN UNITS OF THE NATIONAL WILDLIFE REFUGE SYSTEM

Table 1 summarizes the Service's legal and policy mandates that govern non-Federal oil and gas operations on refuges. The legal and policy mandates include statutes, regulations, executive orders, and Service policies.

TABLE 1-1. U.S. FISH AND WILDLIFE SERVICE LEGAL AND POLICY MANDATES GOVERNING NON-FEDERAL OIL AND GAS OPERATIONS

Authorities	Resources and Values Afforded Protection
Fish and Wildlife Service Laws and Applicable Regulations	
NWRS Administration Act of 1966 (NWRSA) as amended by the NWRS Improvement Act of 1997 (NWRSA)16 U.S.C. 668dd–668ee; 50 CFR Parts 25-29	Provides for the conservation of Federal resources on the NWRS, including air resources, water resources, natural resources, threatened and endangered species, cultural and historic resources, biological diversity, human health and safety, visitor use and experience, and visual resources.
Alaska National Interest Lands Conservation Act (ANILCA), 16 USC 3101 et seq.; 43 CFR Part 36	Provides for protection of over 100 million acres of public lands, fully one-third of which was set aside as wilderness areas. Lands claimed by Alaska Natives under the Alaska Native Claims Settlement Act are officially recognized.
Fish and Wildlife Service Policies, Guidelines, and Procedures	
Minerals and Mining (612 FW 1)	Surface resources against unnecessary or unreasonable damages from prospecting, exploration, development, mining, and processing operations and refuge resource values
Oil and Gas (612 FW 2)	Wildlife populations, habitats, and other resources
Biological Integrity, Diversity and Environmental Health (601 FW 3)	Fish, wildlife, and habitat resources
Refuge Planning Overview (602 FW 1)	Conservation of fish, wildlife, plants, and their habitats
Wilderness Policy (610 FW 1-5)	What needs to be accomplished to meet refuge purposes, then ensure that these activities comply with the Endangered Species Act, and then ensure that these activities comply with the Wilderness Act

OTHER APPLICABLE FEDERAL LAWS, POLICIES, AND REGULATIONS

Table 2 summarizes other Federal laws, regulations, executive orders, policies, guidelines, and procedures apply to the conduct of such operations on refuges.

TABLE 1-2. OTHER FEDERAL LEGAL AND POLICY MANDATES GOVERNING NON-FEDERAL OIL AND GAS OPERATIONS IN NATIONAL WILDLIFE REFUGE SYSTEM UNITS

Authorities	Resources and Values Afforded Protection
Other Applicable Federal Laws and Regulations	
American Indian Religious Freedom Act, as amended, 42 U.S.C. 1996 – 1996a; 43 CFR Part 7	Cultural and historic resources.
Antiquities Act of 1906, 16 U.S.C. 431-433; 43 CFR Part 3	Cultural, historic, archeological, and paleontological resources.
Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa – 470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7	Archeological resources.
Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22	Bald and Golden Eagles
Clean Air Act, as amended, 42 U.S.C. 7401-7671q; 40 CFR Parts 23, 50, 51, 52, 58, 60, 61, 82, and 93; 48 CFR Part 23	Air resources.
Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et seq.; 15 CFR Parts 923, 930, 933	Coastal waters and adjacent shoreline areas.

Authorities	Resources and Values Afforded Protection
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. 9601-9675; 40 CFR Parts 279, 300, 302, 355, and 373	Human health and welfare and the environment.
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450	Plant and animal species or subspecies (and their habitat), which have been listed as threatened or endangered by the Service or the National Marine Fisheries Service.
Federal Insecticide, Fungicide, and Rodenticide Act, as amended (commonly referred to as Federal Environmental Pesticide Control Act of 1972), 7 I U.S.C. 136 et seq.; 40 CFR Parts 152-180, except Part 157	Human health and safety and the environment.
Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701 et seq.; 43 CFR Part 2200 for land exchanges and 43 CFR Parts 1700-9000 for all other BLM activities	Federal lands and resources administered by BLM.
Fish and Wildlife Act of 1956, 16 U.S.C. 742 a-m	Fish, shellfish, and wildlife resources.
Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328	Water resources, wetlands, and waters of the United States.
Historic Sites, Buildings, and Antiquities Act (Historic Sites Act of 1935), 16 U.S.C. 461-467; 18 CFR Part 6; 36 CFR Parts 1, 62, 63, and 65	Historic sites, buildings and objects.
Lacey Act, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904	Fish and wildlife, vegetation.
Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21	Migratory birds.
National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.; 40 CFR Parts 1500-1508	The human environment (e.g., cultural and historic resources, natural resources, biodiversity, human health and safety, socioeconomic environment, visitor use and experience). Human environment is the natural and physical environment and the relationship of the people with that environment (CEQ 2007).
National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810	Cultural and historic properties listed in or determined to be eligible for listing in the National Register of Historic Places (National Register).
Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001-3013; 43 CFR Part 10	Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony.
Noise Control Act of 1972, 42 U.S.C. 4901-4918; 40 CFR Part 211	Human health and welfare.
Oil Pollution Act, 33 U.S.C. 2701-2761; 15 CFR Part 990; 33 CFR Parts 135, 137, and 150; 40 CFR Part 112; 49 CFR Part 106	Water resources, natural resources.
Paleontological Resources Protection Act, 16 U.S.C. 470aaa – 470aaa-11	Paleontological resources.
Pipeline Safety Act of 1992, 49 U.S.C. 60101 et seq.; 49 CFR Subtitle B, Chapter 1, Parts 190-199	Human health and safety, and the environment.
Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq.; 40 CFR Parts 240-280; 49 CFR Parts 171-179	Natural resources, human health and safety.
Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.; 33 CFR Parts 114, 115, 116, 321, 322, and 333	Shorelines and navigable waterways, tidal waters, wetlands.

Purpose and Need for Action

Authorities	Resources and Values Afforded Protection
Safe Drinking Water Act of 1974, 42 U.S.C. 300f et seq.; 40 CFR Parts 141-148	Human health, water resources.
Wilderness Act, 16 U.S.C. 1131 et seq.	All natural resources located in the area designated by Congress as Wilderness or Potential Wilderness.
Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.	Designated rivers and their immediate environments.
Executive Orders	
Executive Order 11593 – Protection and Enhancement of the Cultural Environment, 36 Fed. Reg. 8921 (1971)	Cultural resources.
Executive Order 11988 – Floodplain Management, 42 Fed. Reg. 26951 (1977)	Floodplains; human health, safety, and welfare.
Executive Order 11990 – Protection of Wetlands, 42 Fed. Reg. 26961 (1977)	Wetlands.
Executive Order 12088 – Federal Compliance with Pollution Control Standards, 43 Fed. Reg. 47707 (1978)	Natural resources, human health and safety.
Executive Order 12630 – Governmental Actions and Interference with Constitutionally Protected Property Rights, 53 Fed. Reg. 8859 (1988)	Private property rights, public funds.
Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, amended by Exec. Order No. 12948, 60 Fed. Reg. 6379 (1995)	Human health and safety; minority populations and low-income populations.
Executive Order 12996 – Management and General Public Use of the National Wildlife Refuge System, 61 Fed. Reg. 13647 (1996)	Establishes public use, habitat, partnerships, and public involvement as guiding principles for the management and general public use of the Refuge System
Executive Order 13007 – Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)	Native American sacred sites.
Executive Order 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999)	Vegetation and wildlife.
Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)	Migratory birds.
Executive Order 13212 – Actions to Expedite Energy-Related Projects, 66 Fed. Reg. 28357 (2001)	Production, transmission, and conservation of energy.
Policies, Guidelines, and Procedures	
Department of the Interior, Implementation of the National Environmental Policy Act – 43 CFR Part 46 (2008)	All resources including cultural resources, historic resources, natural resources, human health and safety.
Department of the Interior, Departmental Manual, DM 517 – Pesticides (DOI 1981)	Human health and safety, and the environment.
Department of the Interior, Departmental Manual, DM 519 – Protection of the Cultural Environment (DOI 1994)	Archeological, prehistoric resources, historic resources, Native American human remains, and cultural objects.
Department of the Interior, Onshore Oil and Gas Order Number 2, Section III, Drilling Abandonment Requirements, 53 Fed. Reg. 46,810 - 46,811 (DOI 1988)	Human health and safety.
Secretary of the Interior’s Standards and Guidelines for Archeology and Historic Preservation, 48 Fed. Reg. 44716 (DOI 1983), also published as Appendix C of NPS Director’s Order 28 – Cultural Resource Management	Cultural and historic resources.

Authorities	Resources and Values Afforded Protection
Government-to-Government Relations with Native American Tribal Governments, Presidential Memorandum (Clinton 1994)	Native Americans – Tribal rights and interests.
Department of the Interior Secretarial Order 3226 – Climate Change and the Department of the Interior	Ensures that climate change impacts are taken into account in connection with DOI planning and decision making
Department of the Interior Secretarial Order <u>3289</u> – Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources	Establishes a framework through which DOI bureaus will coordinate climate change science and resource management strategies to address climate change
National Oil and Hazardous Substances Pollution Contingency Plan – 40 CFR Subpart D	Establishes procedures for operational response phases for oil removal for the protection of the environment as well as human health and safety
The President’s Climate Action Plan, Executive Office of the President, June 2013	Directs federal agencies to “protect biodiversity, and conserve natural resources in the face of a changing climate, and manage our public lands and natural systems to store more carbon.”

RELATIONSHIP TO STATE LAWS, REGULATIONS, AND POLICIES

Operators conducting non-Federal oil and gas operations on refuges must comply with Service laws and regulations, as well as all applicable Federal and State laws, regulations, and policies. In general, the Service regulations and policies focus on surface protection of refuges by requiring operators to use oil and gas development methods that will avoid or minimize adverse impacts on refuge resources, values, and human health and safety.

State laws, regulations, and policies typically focus on conservation of the oil and gas resource through the application of well spacing and density rules, and protection of the associated ownership interests. In addition, State oil and gas development rules often address protection of groundwater and surface water through the application of well drilling, cementing, completion and plugging requirements. Some State oil and gas rules, though not all, address the protection of wildlife potentially exposed to open-top oil storage tanks or various types of earthen pits (Ramirez 2009). Although most State oil and gas rules require the reporting of oil and oilfield brine spills on soils cleanup and remediation requirements for soils vary between states.

Because the Service and State oil and gas regulatory agencies have fundamentally different legal and policy mandates and objectives, the Service requirements pertaining to non-Federal oil and gas development in refuges would often be complementary to and beyond State requirements.

CHAPTER 2: MANAGEMENT ALTERNATIVES

INTRODUCTION

This chapter describes the alternatives under consideration for proposed revisions to the existing regulations governing the management of non-Federal oil and gas rights within the NWRS. NEPA requires Federal agencies to explore a range of reasonable alternatives for implementing proposed actions and to analyze what impacts those alternatives could have on the human environment, which NEPA defines as “the natural and physical environment and the relationship of people with that environment.” The existing conditions of the human environment that may be affected by the alternatives are described in Chapter 3: Affected Environment. The analysis of impacts is presented in Chapter 4: Environmental Consequences.

The alternatives under consideration must include a no-action alternative, as prescribed by NEPA regulations at 40 CFR 1502.14. The no-action alternative in this document is the continuation of the current regulations and the practices associated with implementing those regulations. Proposed changes to the regulations are presented as two action alternatives, developed by the Service, taking into consideration comments obtained from the public and other entities during the planning process. These alternatives meet, to varying degrees, the objectives developed for this effort, as well as the purpose and need for action (refer to Chapter 1: Purpose and Need for Action). Upon conclusion of the EIS and decision-making process, one of the alternatives, or a combination of different parts of the various alternatives, will be adopted as the Service non-Federal oil and gas regulations for refuges for the foreseeable future. If an action alternative is selected, the Service will issue a final rule.

This EIS is programmatic in nature, which means that it will analyze the regulations as a framework for taking a range of actions, and it will set forth requirements for the implementation of the actions. Before any specific oil and gas operation is approved under the provisions of a new, finalized rule, the Service will conduct further analysis and consultation in accordance with NEPA, NHPA, ESA, and other Federal laws, as applicable.

The no-action and action alternatives selected for detailed analysis are briefly described below, with emphasis on the major changes that would be made to the regulations. This is followed by a summary table (Table 1) of the substantive changes that would result from specific components of the proposed alternatives under the rule change. The remainder of this chapter describes how the alternatives meet project objectives, addresses NEPA consistency, and presents additional alternatives that were considered but eliminated from detailed analysis. Finally, the agency’s preferred alternative and the environmentally preferable alternative are identified.

ALTERNATIVE MODIFICATION IN THE FINAL EIS

In Alternative B, The Proposed Rule (Preferred Alternative), operators of pre-existing wells could change and the operation would still be considered pre-existing (i.e. not required to obtain a permit). In the final Rule, if an operator of a pre-existing well changes, the new operator must obtain an Operations Permit that ensures those operations meet applicable performance-based standards and general terms and conditions of the rule. This would include posting of financial assurance. This change will lead to more operations on NWRS lands operating under Service standards sooner, and

provide greater protection of refuge resources and uses from ongoing unnecessary impacts of pre-existing operations. We estimate operator turnover could affect up to 5% of the estimated 400 operators annually resulting in permitting actions for up to 20 transferees. These permitting actions would be focused on minimizing or avoiding the ongoing impacts of these pre-existing operations on refuge resources and uses. The Service estimates that operators would incur annual expenses of approximately \$2,400 per well site to obtain an operations permit, meet Service operating standards, and maintain financial assurance, and reimburse the Service for its administrative costs. Analysis of costs and benefits for this addition is now included in the appropriate sections of this chapter and Chapter 4 – Environmental Consequences.

OVERVIEW OF ALTERNATIVES

ALTERNATIVE A: NO-ACTION

The no-action alternative is the continued implementation of the current Service regulations and policies now used to govern the exercise of non-Federal oil and gas rights located within refuges. These consist of the regulation at 50 CFR §29.32, Service policy at 612 FW 2, and the guidance document titled *Management of Oil and Gas Activities on National Wildlife Refuge System Lands*. The discussion below focuses on those areas of management in existing provisions that the Service is proposing to change through this rulemaking.

Purpose and Scope

Under the no-action alternative, the Service would continue to apply its regulations, policy, and guidance to non-Federal oil and gas operations on lands and waters within the NWRS where the Service owns the surface estate in fee title. The Service has not sought permits for non-Federal oil and gas operations on lands and waters where Federal ownership is less than fee.

Accessing Oil and Gas Rights from a Surface Location Outside The Refuge Boundary

The Service currently does not apply regulation to operators who use directional drilling from a surface location outside a refuge to reach their oil and gas rights within a refuge.

Requirement to Obtain a Service Permit to Conduct Operations

The regulations at 50 CFR 29.32 do not address any requirements or processes related to permits. The Service has developed policy and guidance for requiring permits for various situations. Under current policy, the Service first looks to the deed language to determine whether it recognizes the Service's right to require a Special Use Permit (SUP). If recognized, an SUP is required. If a deed does not recognize the Service's permitting authority, the Service next looks to clarify its power as a holder of the surface estate under State law. State statutes or case law may give rights to surface owners beyond the usual common law to protect the surface estate from the impacts of oil and gas operations. Where States require surface use agreements between landowners and operators, the Service may interpret that as having the authority to require an SUP.

Absent a permitting requirement in the deed or under State rules, Service policy recommends voluntary permitting arrangements with an operator who demonstrates a valid oil and gas right to specify the reasonable limits of the intended operations. The operator's incentive for entering into

such an agreement is a degree of protection from later being found to have acted unreasonably and to possibly be subjected to civil or criminal liabilities.

If neither mandatory nor voluntary permitting is possible, Service policy is to give operators written notice of all reasonable alternatives, which would minimize impacts of the activity. This enables the Service to establish, if necessary, that these less-damaging alternatives were disregarded without due consideration of the Service's interests as surface owner, should damage occur.

Finally, when the operation exceeds the boundaries of what is reasonably necessary to recover the minerals, or fails to take reasonable precautions to minimize the surface damage, the Service may take legal action for damages, secure an injunction, and where appropriate, seek criminal penalties. In refuge units in Alaska, per 43 CFR Part 36, operators must obtain a Service permit if crossing Federal lands or waters to access their oil and gas right. The Service uses its ROW regulation as the permit vehicle.

As discussed in Chapter 1, under the current regulations and policy, most non-Federal oil and gas operations initiated in the past 10 to 15 years have been conducted under an SUP issued by the Service. However, the permit requirement itself has not been consistent across the Service, and where permits have been issued, the permit conditions have varied widely. Prior to 2000, permits were rarely required for conducting non-Federal oil and gas operations.

Pre-existing operations are defined in the rule as “operations conducted as of the effective date of the regulations in accordance with local, State, and Federal laws and regulations and without an approved SUP from the Service.” Of the 5,002 non-Federal wells within the NWRs, only 115 are being conducted under an SUP. The Service is currently investigating the status of over 1,000 wells, but estimates that over 4,000 wells would meet the definition of a pre-existing operation.

Under the no-action alternative, these wells would continue to be unregulated by the Service. Managers would address impacts to refuge resources and uses (primarily from spills, accidents, or new, unauthorized use of Federal surface) as needed using general Service regulations, cooperation with other Federal or State permitting agencies, and cooperation with the operators. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would vary widely across the Service, generally resulting in many unnecessary impacts to the environment.

Performance-Based Standards

Currently the Service has no performance-based standards for oil and gas operations. Consequently, oil and gas activities are managed on an individual unit basis, with protective stipulations developed in a site-specific manner. Generally, stipulations are applied to Service permits to include protection of air quality, soils, water, wildlife, wildlife habitat, and other refuge resources.

There are many best management practices (BMPs) (prescriptive measures) that could and have been used to accomplish resource protection standards. The Service has established and published an oil and gas management handbook outlining existing policy and developed a formal training program for refuge managers and other Service personnel in managing oil and gas operations. BMPs are included in the handbook and training course.

Current policy and training, however, have not established a suite of performance-based standards for protection of refuge resources and uses. As a result, the levels of protection required in SUPs can vary across the NWRs.

Permitting Process

The *Management of Oil and Gas Activities on National Wildlife Refuge System Lands* handbook provides guidance for obtaining an SUP. The recommended steps in the process are described as follows:

1. Operator contacts refuge regarding interest in conducting oil and gas operations. Operator provides written documentation demonstrating right to conduct operations.
2. Refuge provides operator copies of regulations, performance standards, plan of operations requirements, and other information, as appropriate.
3. Operator meets with refuge personnel to scope resource issues relevant to the proposed operation to determine resources that could be affected by the operation; identify environmental planning and compliance requirements; and determine affected Federal, State, and local agencies.
4. Operator meets with refuge personnel and affected Federal, State, and local agencies to identify resource issues, permitting requirements, and mitigation strategies for potential impacts.
5. Operator submits written request for temporary access to gather basic information needed to complete the plan of operations.
6. Refuge issues 60-day data collection permit with refuge resource and visitor protection requirements.
7. Operator conducts necessary surveys, including natural and cultural surveys, as applicable, and surveys and stakes the operations area.
8. Operator submits draft plan of operations to refuge.
9. Service performs a completeness and technical review of the plan of operations. Refuge accepts plan of operations as complete or returns the plan to the operator with specific directions on how to revise the plan.
10. Operator revises plan of operations, as necessary.
11. Service prepares NEPA documentation or adopts operator or consultant-prepared NEPA documents, incorporating other environmental compliance requirements (e.g., NHPA, wetlands, floodplains, ESA, and Coastal Zone Management Act) and initiates mandated consultations with other agencies. Refuge completes public review process, finalizes decision documents, and notifies the operator if the plan has been approved, conditionally approved, or rejected.
12. Operator agrees to conditions of approval (if any), submits applicable State and Federal permits, and files suitable performance bond with the Service.
13. Service issues the SUP.

The information contents of a permit application are not defined for non-Federal oil and gas SUPs, but would at least include:

1. Names, addresses, and phone numbers of owner(s) and operator;
2. Proof of mineral rights in the form of a copy of the lease, deed, designation of operator, or assignment of rights;

3. Map(s) showing the location of mineral rights;
4. Maps showing the location of proposed activity and facilities;
5. Estimated timetable for completion and periods of activity;
6. Description of potential hazards to persons and/or the environment;
7. Methods for disposal of all waste, including drilling mud;
8. Provisions for rehabilitation; and
9. Any additional information required by the refuge manager for evaluation of the operation.

The policy does not specify timelines in which the Service will respond to an operator's submission of information.

Performance Bond (Financial Assurance)

The Service does not typically require financial assurance as a condition of an SUP issued for non-Federal oil and gas operations. Operators in Alaska are permitted using ROW under 43 CFR part 36, which does provide a requirement for financial assurance.

Access Fees

Under current regulations and policy, the Service does not assess fees for an operator's use of a Federal surface for access to their oil and gas rights boundary.

Change of Operators

Under current conditions, there are no general requirements of either the former operator or the new operator to notify the refuge manager that a transfer of rights and responsibilities for the operation has occurred. Some SUPs may contain a requirement to provide notification of a change in operator.

Refuge managers are most often made aware of a change in operator when signs at oil and gas production sites are changed and include the new operator's name and contact information.

Cost Recovery

The Service does not seek cost recovery for administration of SUPs for non-Federal oil and gas operations. Operators in Alaska are typically permitted using ROW under 43 CFR Part 36, which does provide for cost recovery.

Third-Party Monitoring

Current regulation does not address the use of third-party monitors to monitor operator compliance with an SUP permit. Service policy guides refuge managers to use third party monitors to help ensure that the Service receives unbiased, reliable, and timely monitoring information demonstrating an operator's compliance with its permit. Thus, the ability to use third-party monitors would continue to rely on the Service's ability to secure an SUP as described earlier.

Well Plugging (Maintenance of Idle or Shut-In Wells)

Current regulations and policy do not address procedures for wells that are no longer active but are not scheduled to be plugged in the near future. Instead, the Service relies on State rules for maintaining wells in shut-in status.

Administration of a Permit

Regulations and policy for SUPs would apply. These generally provide the Service or operator a means to modify permit terms to account for unexpected conditions or operational needs. Regulations and policy for SUPs also provide a means for the Service to ensure the operator's compliance with the terms and conditions of the permit.

If an operator disagrees with a decision made by the Service, the appeals process in 50 CFR § 25.45 would apply. The operator must exhaust these remedies before the Service decision is considered a final agency action that is subject to review under the Administrative Procedure Act.

ALTERNATIVE B: THE RULE (PREFERRED ALTERNATIVE)

Alternative B includes proposed changes to the regulations that: provide a regulatory framework to achieve necessary protections for ecosystems and wildlife, to conserve fish and wildlife resources, and enhance public enjoyment and improve regulatory consistency and functionality to the benefit of both refuge managers and oil and gas operators.

To effect these changes, the Service must comply with applicable rulemaking provisions of the Administrative Procedures Act, 5 USC 551 – 559.

The discussion below focuses on those areas of management that the Service is proposing to change through this rulemaking.

Purpose and Scope

The rule would clarify that the revised regulations are designed to protect Service-owned or administered lands, waters, or wildlife resources of refuges, visitor uses or experiences, and visitor and employee health and safety, as outlined in the mission of the NWRS.

Outside of refuge units in Alaska, the rule would apply to all operators conducting non-Federal oil and gas operations on lands held by the United States in fee title, or any waters within the boundaries of refuges under the jurisdiction of the Service. Non-Federal oil and gas operations on refuge units in Alaska would continue to be governed by title XI of the Alaska National Interest Lands Conservation Act (ANILCA), Section 22(g) of the Alaska Native Claims Settlement Act of 1971 (ANCSA), and the Department's implementing regulations. Additionally, operations conducted on lands where the property interests held by the United States are less than fee, such as easements, also fall within the scope of the rule to the extent necessary to protect those property interests. For example, where the Service has purchased a wetland easement, the regulations would be applied only as necessary to protect the values and functions of wetlands that could be affected by proposed operations on that property. For areas where the United States does not hold a property interest but are within the boundaries of a refuge (i.e., inholdings), the regulations would not apply.

Accessing Oil and Gas Rights from a Surface Location Outside The Refuge Boundary

The Service proposes to provide an incentive for operators to use directional drilling from a surface location outside a refuge to reach their oil and gas rights within a refuge by exempting that portion of operations that occur within refuges (i.e., the subsurface borehole) from these regulations. Should operators decide to use directional drilling to avoid Service regulation, the effect of removing the surface activities associated with oil and gas operations from inside refuges serves to accomplish the objectives of regulation (avoidance or minimization of impacts). The administrative effect of the proposed regulatory exemption would be essentially the same as Alternative A.

Requirement to Obtain a Service Permit to Conduct Operations

The rule would further clarify the Service's authority and the responsibility of operators regarding permitting non-Federal oil and gas operations. Under the rule, the Service would require the following:

New Operation: An operator conducting new operations on refuge lands or waters must obtain an Operations Permit before commencing non-Federal oil and gas operations within a refuge.

Operations Under an Existing Service-issued SUP: Operations under an existing Service permit may continue under the terms of that permit so long as they comply with existing Federal, State, and local laws and regulations, and the General Terms and Conditions outlined in their SUP and the rule. Additionally, these operations would be required to obtain or update the existing permit at the time of well plugging and reclamation to ensure the surface area is restored to Service standards.

Pre-existing Operations: Operations not under a Service permit that are being conducted prior to the finalization of the revised regulations would be considered "pre-existing operations" and could continue as they have been as long as the operator complies with existing Federal, State, and local laws and regulations and the General Terms and Conditions outlined in the rule.

Under the rule, operators of pre-existing operations would be required to provide the Service with documentation that they hold the right to conduct operations, company contact information, a map delineating the existing area of operations (the area of operations defines the area for which an operator would be responsible for reclamation), and copies of the plans and permits required by Federal, State, and local agencies relative to their operations. The Service uses this information for future monitoring of the approved operations to ensure compliance with existing standards (Federal, State, and local).

The Service would manage pre-existing operations during the production phase by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. Many of the unnecessary impacts occurring from existing operations without permits can be addressed more cost effectively through stricter adherence to existing Federal (e.g., Spill Prevention, Control, and Countermeasure plans) and State rules. For example, the state of Louisiana rules require oil leaks be appropriately repaired and spills reported within 24 hours. We have documented operators who fail to comply with these rules. This approach to permitting allows the Service to focus its limited time and resources on those new operations that create the highest level of incremental impacts. Also, requiring all operations to have a permit for plugging and reclamation ensures long-term rehabilitation of habitat damaged by all operations.

Pre-existing operations would also be subject to general terms and conditions of the rule addressing responsibility for subcontractors' compliance, use of water obtained within a refuge, hold-harmless provisions, responsibility for unauthorized damages to refuge resources or facilities, and notifications of spills and accidents. The provisions on prohibitions and penalties, changes of operators, well plugging, and appeals would also apply to pre-existing operations.

Additionally, the regulations would require pre-existing operators to obtain an operations permit if they are proposing to conduct new activities or modify pre-existing operations in a manner that has a would result in additional, notable impacts on refuge resources, visitor uses, refuge administration, or human health and safety. The operator must consult with the Service to determine if a change to a pre-existing operation is a "modification". Examples of a modification could include drilling additional wells from the existing pad, creating additional surface disturbance (expanding the footprint of a well pad, realigning a road), or converting a natural gas well into a wastewater disposal well. This provision is not intended to apply to minor actions, such as repositioning of surface facilities within the footprint of pre-existing operations, minor changes in color schemes, or non-routine maintenance actions.

Once production ends and the operator intends to plug the well, pre-existing operations, like all other operations on refuge lands, would be required to obtain an operations permit for plugging and reclamation. This requirement would ensure that plugging and reclamation are performed to Service standards and that federally owned or administered lands and waters are restored and protected over the long-run from impacts of non-Federal oil and gas operations.

In addition, a change in operator would trigger the loss of pre-existing status for the well so that the new operator would need to obtain an operations permit for their continued production operations.

Operations on Non-Federal Surfaces or Private Inholdings: Operations on non-Federal surfaces outside of refuge boundaries or private inholdings within a refuge are exempt from the proposed regulation. However, if an operator needs to physically cross Service land for access to an inholding, then the operator must comply with the applicable provisions of this subpart, including obtaining an operations permit for new access or amending existing authorization for access.

Performance-Based Standards

The regulations establish performance-based standards for avoiding or minimizing impacts to refuge resources or visitor uses during operations. The rule also includes standards for achieving successful surface reclamation once operations end.

The use of performance-based standards or performance goals provides flexibility to resource managers and operators to achieve standards across various environments using new and evolving technology. In contrast, prescriptive regulations define specific requirements of time, place, and manner without considering how these measures achieve a desired level of resource protection or how they may apply in different environments. The Service examined other Federal and State oil and gas regulations and determined the standards-based approach provided the most efficient means of successfully avoiding or minimizing the effects of oil and gas operations on refuge resources and visitor uses. A one-size-fits-all (i.e., prescriptive) approach would not work due to the widely differing environments and national extent of refuges with oil and gas.

The rule includes standards for surface use and site management, specific resource protections, spill prevention and response, waste management, and reclamation. These specific standards are all considered and incorporated into project design so that, overall, operations are conducted in a manner most protective of refuge resources and uses while ensuring human health and safety. Use of the technologically feasible, least damaging methods takes into consideration all relevant factors, including environmental, economic, and technological factors and the requirements of applicable law.

Permitting Process

The rule establishes the process for obtaining an operations permit, including:

- initial steps in developing a permit application,
- contents of the application,
- the Service's review of the application including timelines,
- the Service's approval standards, and
- actions the Service may take on the application including timelines.

Initial Steps: The rule recommends operators first participate in a pre-application meeting with the refuge manager to allow for an early exchange of information with the intent of understanding initial concerns of both the refuge manager and the operator, as well as avoiding unnecessary delays in the application process. The first requirement in the permitting process is for the applicant to provide documentation demonstrating a valid and current right to operate. The operator would also provide an overview of the proposed operation and its timing. Also, oil operators are encouraged to provide information on mineral ownership, operation schedules, contact information for company officials and their contractors, a map of the proposed area of operations, description of access, and transportation plans. At this time, the refuge would provide guidance on the permitting process and information on available resource data and identify additional data needs.

Reconnaissance Surveys: The rule defines a process for obtaining a temporary access permit to collect basic information needed to prepare an application for the operations permit. A temporary access permit would be issued for reconnaissance surveys for a period not to exceed 60 days, but may be extended for a reasonable additional period when justified by an operator.

Contents of the Application for an Operations Permit: The rule contains several information requirements. The objectives of these information requirements are to clearly and completely define all proposed actions, provide a comprehensive description of the refuge resources and uses that could potentially be affected by the proposed actions, and document the expected effects on the refuge resources and uses by the proposed actions, as well as expected effects from other feasible alternatives. The information collected by the refuge provides a means to evaluate whether the actions would be conducted in a manner that meets the operating standards defined in the rule.

The rule would codify existing practices requiring an operator to submit all necessary information to ensure protection of federally owned or administered lands, waters, or resources of refuges, refuge visitor uses or experiences, or visitor or employee health or safety.

The rule defines information requirements organized by the type of activity for which approval is being sought. It lists information requirements common to all operations, which include:

- documentation of the right to operate,

- company contacts,
- estimated cost that a third party would charge to complete reclamation. The Service uses the estimate in determining performance bond amount,
- source, quantity, access route, and transportation/conveyance method for all water needed,
- maps identifying natural features, existing and proposed structures, pipelines, new surface disturbances, proposed area of operations,
- a description of environmental conditions and mitigation actions, and
- spill control and emergency plans.

The rule includes additional information requirements grouped for geophysical, drilling, and production operations.

Review Process: The rule establishes a two-stage permit application review process, provides realistic timeframes to provide notice to an operator, and consolidates the final decisions the Service can make on an operator's permit application.

The proposed regulation describes the Service's initial review of an operator's permit application. During initial review the Service would determine whether the applicant has supplied all information necessary for the Service to evaluate the operation's potential effects on federally owned or administered lands, or any waters or resources of Service units, visitor uses or experiences, or visitor or employee health and safety. The Service would respond within 30 days and tell the operator whether the information contained in the permit application is complete. Once a permit application is complete, the Service conducts a formal review.

During the formal review process, the Service would coordinate and consult with a variety of State and Federal regulatory agencies to ensure that the operation plan complies with applicable Federal statutes, such as NEPA, ESA, and NHPA.

Approval Standards and Actions: The proposed regulations require that, before approving an operations permit, the Service determine that the operator uses technologically feasible, least damaging methods that provide for protection of the refuge's resources and public health and safety. Two additional prerequisites to approval are (1) an operator's submittal of adequate financial assurance and (2) proof of adequate liability insurance.

The proposed regulations establish a 180-day timeframe for the Service to complete its formal review. The proposed regulations would allow for a longer period of time if the parties agree to it, or if the Service determines that it needs more time to comply with applicable laws, Executive Orders, and regulations. The rule would establish two final actions: (1) approved, with or without conditions, or (2) denial, and the justification for the denial. The Service would notify the operator in writing of the final action.

Performance Bond (Financial Assurance)

The rule would require an operator to file a performance bond as a condition of approval for its operations permit, or other acceptable method of financial assurance, for all types of non-Federal oil and gas operations and all phases of the operation(s). The financial assurance amount would be set equal to the estimated cost of reclamation. The rule allows the Service to reduce an operator's

financial assurance by the amount of in-kind reclamation the operator may provide prior to or during its operations.

The objective of the rule is to ensure that, in the event of an operator default, the public is not burdened with the cost of plugging and reclamation, and that refuge resources and uses are ultimately restored to pre-disturbance levels.

The rule includes a process for adjusting the amount of financial assurance due to changed conditions. For example, if an operator elects to conduct interim reclamation, the bond amount for full reclamation could be reduced based on the amount of the site reclaimed.

The Service would release the bond when the operator has met all applicable reclamation standards. The rule holds that failure to comply with any provision of an operations permit could result in forfeiture of the financial assurance. This provides the Service with an enforcement tool and provides an operator with additional incentive to remain in compliance with its permit.

Access Fees

The rule authorizes the Service to charge a fee for commercial vehicles using Service- administered roads. This fee would be used to offset maintenance costs, such as purchasing fuel for a road grader, gravel for a road, or maintaining refuge equipment used in road maintenance.

The proposed regulation also would allow a fee for new access (e.g., roads or gatherings lines) across Federal lands. This fee would be used to offset the cost of improving habitat on the refuge, obtaining additional lands to offset the loss of use, or reclaiming other oil and gas sites. The Service would set the fee amount using generally accepted practices. For example, the Service could set fees consistent with current regulations regarding fees for access and ROW (50 CFR 29.21), or calculate fees using the BLM's Linear Rights-of-way Fee Schedule. Other methods could be used, such as appraisal or Habitat Equivalency Analysis, which bases compensation on the loss of resource services and the cost to restore those services.

Change of Operators

A Change of Operator occurs anytime an entity exercising non-Federal oil and gas rights transfers those rights to another party who assumes responsibility for operations. The rule outlines the steps for both the transferring party and the new operator. All operators would be required to notify the Service within 30 calendar days of the transfer, the contact information of the party to whom the operation was transferred, the effective date of the transfer, and a description of the rights transferred. The former operator must also provide written acknowledgement from the new operator that the contents of the notification are true and correct.

If the operations are being conducted under a Service-issued permit, in addition to the notification requirements above, the former operator would remain responsible for compliance with its permit until the new operator agrees in writing to adopt the permit with all its terms and conditions. In addition, if financial assurance is a component of the permit, the Service would not release the financial assurance until the new operator replaces it.

In a transfer of an operation under an SUP, the new operator would need to agree in writing to conduct operations in accordance with all terms and conditions of the previous operator's permit, and file any financial assurance required under the permit with the Service.

If the transferred operations are pre-existing wells, the new operator, within 30 calendar days from the date of the transfer, must provide to the Service its right to operate documentation and company contact information. The new operator must apply for an operations permit within 90 days of the transfer.

New operators also have the ability to propose modifications to their operations as outlined in the rule.

Cost Recovery

The Service is proposing a requirement for operators to reimburse the Service for the costs of processing and administering temporary access permits and operations permits. The amount of reimbursement would be determined by the actual staff time spent directly processing permit applications and subsequently monitoring the operation for compliance. The Service has the authority to collect reasonable fees and recover administrative costs. In Texas and Louisiana, the Service can retain and expend funds at the refuge-specific level from operators who cause refuge damage. Reimbursable agreements and other similar agreements may be used in all states to help retain and expend those fees on a refuge-specific level.

Third-Party Monitoring

The rule would allow the Service to require that operators hire third-party monitors when they are necessary to ensure compliance and protect refuge resources and uses. The use of third party monitors helps ensure that the Service receives unbiased, reliable, and timely monitoring information demonstrating an operator's compliance with its permit. The rule would describe the criteria that the Service would consider when deciding to require an operator pay for a third-party monitor. The criteria could include an operator's proposal for self-monitoring. The third-party monitor would report directly to the Service to ensure oversight and accountability and prevent the appearance of a conflict of interest. Use of a third-party monitor is a common industry practice.

Well Plugging (Maintenance of Idle or Shut-In Wells)

The proposed procedures would be consistent with the way many states approach the issue of inactive wells. The Service would recognize that certain economic or logistical reasons exist to justify maintenance of wells in shut-in status for extended periods of time. Rather than a "produce or plug" policy, the proposed regulation would provide assurance that shut-in wells are maintained in an environmentally sound and safe manner.

Operators would be required to plug a well when any of the following occurs:

- (a) The drilling operations have ended and the operator has taken no further action on its well within 60 calendar days;
- (b) A well, which has been completed for production operations, is continuously inactive for a period of 1 year; or
- (c) The period approved in an operations permit to maintain a well in shut-in status has expired.

The operator could apply for either an operations permit or a modification of its approved operations permit to maintain its well in a shut-in status for up to 5 years. The application to extend the plugging requirement would describe why drilling or production operations have ceased and the reasonable future use of the well, demonstrate the well's mechanical integrity, and describe how relative operating standards would be maintained while the well is idle. Additional extensions can be obtained by submitting a new application as long as operating standards can be maintained.

Administration of an Operations Permit

Modification of an Operations Permit: The rule would provide the Service or operator a method to modify an operations permit to address new or unanticipated changes in operational or environmental conditions. Any modification to an approved permit must meet the same criteria that apply to an operations permit as outlined in the Application Review Process.

A modification is an action outside the scope of an existing operation in a manner that has notable impacts on refuge resources, visitor uses, refuge administration, or human health and safety. Examples of a modification could include drilling additional wells from the same pad, creating additional surface disturbance (expanding the footprint of a well pad, realigning a road), or converting a production well into a wastewater disposal well.

Minor actions that are not specifically addressed in the operations permit but are within the scope of the impacts analyzed are not considered modifications subject to additional review and approval. Examples of such minor actions would include repositioning of surface facilities within the permitted area of operations, minor changes in color schemes, or non-routine maintenance actions.

Prohibited Acts and Penalties: The rule lists the prohibited acts that would constitute a violation of these regulations, as well as the penalties associated with violations. Prohibited acts include operating in violation of terms or conditions of an operations permit or a Service-approved SUP, damaging Federal property, conducting operations without Service authorization, failure to comply with suspension or revocation orders, or failure to comply with Federal, State, and local statutes or regulations.

The refuge manager in coordination with Service law enforcement would have the discretion to fine, suspend, or revoke an operation if the operator engages in a prohibited act. Any violation that results in a threat to public safety or risk of damage to refuge resources and values should be addressed by the refuge manager.

Appeals: As in Alternative A, if an operator disagrees with a decision made by the Service, the appeals process in 50 CFR § 25.45 would apply. . The operator must exhaust these remedies before the Service decision is considered a final agency action that is subject to review under the Administrative Procedure Act.

ALTERNATIVE C: MODIFIED RULE

Alternative C would include all the proposed changes in Alternative B, except as follows.

Purpose and Scope

Alternative C would expand Service jurisdiction to regulate non-Federal oil and gas operations that occur on private surface within the boundary of a refuge (i.e., inholdings). Operational standards would be applied only to the extent necessary to avoid or minimize impacts to refuge resources and uses.

This alternative would require operators of new wells or seismic operations on inholdings to submit certain information that would allow the Service to fully analyze potential impacts on federally owned or administered lands or waters, resources, or visitor health and safety. If the Service determines that it does not reasonably expect that operational requirements are needed to protect against expected impacts or risk of damage to federally owned, administered, or controlled lands, or any waters or resources of the unit, or refuge visitor and employee health and safety, then the operator would not be required to obtain an operations permit, provided that the operator would still be subject to the general terms and conditions, prohibitions and penalties, and appeals provisions in the rule. This provision would also apply to existing operations that are located on private surfaces within the boundary of a refuge.

Accessing Oil and Gas Rights from a non-Federal Surface Location

Alternative C would expand Service jurisdiction to encompass surface and subsurface directional drilling operations on and beneath non-Federal surfaces. Directional drilling operations would be subject to the full regulatory requirements of a new operation. The Service would impose operational standards on activities outside of the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Financial assurance would likely not be required as reclamation to Service standards on non-Federal surfaces because it would not be necessary to protect Federal interests. Operators may be responsible for reimbursing the Service for costs associated with administering the operations permit. Access fees would not apply since there would be no use of Federal surface.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative C, all operations, including those on non-Federal surfaces, within a refuge boundary would be required to obtain an operations permit under the proposed regulations. The operations permit requirement would be expanded from Alternative B to include not only new operations, but also existing operations that are under a current Service-issued permit and pre-existing operations not under a Service-issued permit.

Alternative C would require existing operations with or without Service-issued SUPs to submit applications for obtaining an operations permit within 1 year from the effective date of the new rule. The Service would be allowed discretion on processing priorities based on operational and environmental conditions at the existing sites. Operators would be allowed to continue operating as provided in Alternative B until the Service processed their application. All existing operations would have to comply with all regulatory provisions including the relevant operating and reclamation standards, maintenance of financial assurance, reimbursement to the Service for its costs associated with administering the operations permit, and payment to the Service for access to the oil and gas right boundary.

Performance-Based Standards and the Permitting Process

Under Alternative C, performance-based standards and the permitting process would be the same as Alternative B, except the Service would actively regulate downhole operations. The modified rule would establish standards and information requirements regarding downhole operations.

Under Alternative C, additional downhole information requirements for operations permit applications would include:

Drilling Information

- The drilling program, including hole size for each section and the directional program, if applicable;
- The proposed drilling depth and the estimated depths and names of usable water, brine, hydrocarbon, geothermal, or other mineral-bearing zones;
- The casing program, including the size, grade, weight, and setting depth of each string;
- The cementing program, including downhole location of any stage equipment, cement types, volumes, and additives to be used, and a description of pressure tests and cement evaluation logs that will be run to verify cement placement and integrity;
- The minimum specifications for pressure control equipment function and pressure testing frequency and the blowout preventer stack arrangement;
- The proposed logging, coring, and testing programs;
- The proposed completion program, including completion type (open-hole, perforated, slotted liner, etc.) and procedures, including considerations for well control;
- A description of the equipment, materials, and procedures proposed for well plugging, including plug depths, plug types, and minimum mud weight.

Well Stimulation Information

- The top and bottom of intervals at which well stimulation fluids are to be injected;
- Geological names, depths, and properties of formations that serve to confine fracture height growth;
- Steps to be taken before treatment to verify mechanical integrity of all downhole tubulars and tools and cement quality, including pressure tests and cement bond logs (or other logs acceptable to the refuge manager) demonstrating that the occurrences of usable water zones have been isolated to protect them from contamination;
- Proposed stimulation fluid including, but not limited to, the base fluid and each additive by trade name and purpose of such additive;
- Proposed proppant (i.e., solid material, such as sand or ceramic beads, that serves to keep a fracture propped open) system;
- Estimated total volume of fluid to be used;
- Anticipated surface treating pressure range;
- Maximum injection treating pressure;
- Estimated or calculated fracture length and fracture height;
- Any microseismic monitoring planned or proposed in conjunction with well stimulation;
- Source, quantity, access route, and transportation method for all water anticipated for use in stimulating the well;
- Storage, mixing, pumping, and control equipment needed to perform the stimulation;
- Estimated volume of stimulation fluids to be recovered during flow back;

Management Alternatives

- Chemical composition and properties of flowback fluid;
- Methods of handling the recovered fluids, including any onsite treatment for reuse of fluids in other stimulation activities; and
- Proposed disposal method of the recovered fluids, including, but not limited to, injection, hauling by truck, or transporting by pipeline.

Production Operations Information

- The size, grade, weight, and setting depth of all casing and tubing strings; cementing history; type and size of packers and subsurface flow control devices; top and bottom depths of each completed interval; and method of completion;
- Well history, including completions, stimulations, servicing, and workovers;
- Minimum specifications for any downhole pressure-control equipment, function, and pressure-testing frequency.

The above information would be used by the Service to evaluate compliance with the following operating standards and reporting requirements:

1. The operator must design, implement, and maintain integrated casing, cementing, drilling fluid, completion, stimulation, and blowout prevention programs. These programs must be based upon sound engineering principles to prevent escape of fluids to the surface and to isolate and protect usable water zones throughout the life of the well, taking into account all relevant geologic and engineering factors.
2. The operator must maintain the well to prevent escape of fluids to the surface and to isolate and protect usable water zones throughout the life of the well, taking into account all relevant geologic and engineering factors.
3. For stimulation operations including hydraulic fracturing, the operator must not begin injection activities before they demonstrate the mechanical integrity of all surface and downhole tubulars and equipment to differential pressures equal to at least those calculated at the maximum anticipated treating pressure.
4. The operator must continuously monitor and record the treating pressures and all annular pressures before, during, and after the treatment to ensure that treatment materials are directed to the intended zone.
5. If mechanical integrity is lost during the treatment, the operator must immediately cease the operation and notify the refuge manager no later than 24 hours after the incident. Within 15 days after the occurrence, the operator must submit to the refuge manager a report containing all details pertaining to the incident, including corrective actions taken.
6. The operator must plug all wells to prevent a pathway of migration for fluids along any portion of the bore.

Performance Bond (Financial Assurance)

Under Alternative C, the requirements for an operator to maintain acceptable financial assurance would be the same as for Alternative B. Additionally, all pre-existing and new operations within the boundary of the refuge or directional drilling beneath a refuge would be required to post financial assurance as necessary to protect refuge resources and uses.

Table 2-1 presents a side-by-side comparison of the three alternatives.

TABLE 2-1. DESCRIPTION OF ALTERNATIVES COMPONENTS FOR IN-DEPTH ANALYSIS

Regulatory Provision	Alternative A: No Action	Alternative B: The Rule	Alternative C: Modified Rule
Purpose and Scope	Apply to NWRS lands held by the Service in fee title, or any waters on the refuge.	Same as Alternative A plus: <ul style="list-style-type: none"> • NWRS lands held by Service in less than fee (i.e., easements), or any waters on the refuge. 	Same as Alternative B plus: <ul style="list-style-type: none"> • Operations on private inholdings within a refuge • Directional drilling operations from non-Federal surface locations to access oil and gas rights within a refuge.
Accessing Oil and Gas Rights from Non-Federal Surface Locations	Service does not regulate.	Similar to Alternative A, exemption from regulations would provide an incentive for operators to choose surface locations outside the refuge.	Expand Service jurisdiction to regulate surface and subsurface directional drilling operations accessing oil and gas rights from non-Federal surfaces. These operations would be subject to the full regulatory requirements of a new operation to the extent necessary to avoid or minimize impacts on refuge resources and uses.
Requirement to Obtain a Service Permit to Conduct Operations	<ul style="list-style-type: none"> • Most new operations are under a Service-issued voluntary SUP, because of deed language, State law, voluntary agreement, or ANILCA regulations • Most operations prior to 2000 do not have Service-issued permit (pre-existing operations). These operations 	<ul style="list-style-type: none"> • All new operations require operations permit. • Existing operations under an SUP may continue under those terms and conditions and would be adjusted as necessary to meet reclamation standards of the rule. • Pre-existing operations may continue with current 	All new, existing operations with a Service-issued permit, and pre-existing operations within the scope of the modified rule would be required to obtain an operations permit, including operations on private inholdings and directionally drilling from non-Federal surfaces.

Regulatory Provision	Alternative A: No Action	Alternative B: The Rule	Alternative C: Modified Rule
	<p>are unregulated with unnecessary impacts to refuge resources and uses addressed inconsistently through application of other laws and regulations, and cooperation with other permitting agencies and operator.</p>	<p>operations (e.g. production), but would be required to obtain an operations permit for any modification to operations. Eventually, pre-existing operations would have to obtain an operations permit for reclamation to ensure reclamation standards of the rule are met.</p> <ul style="list-style-type: none"> • When a pre-existing operation is transferred, the new operator would be required to obtain an operations permit. 	
<p>Performance-Based Standards</p>	<p>Not defined, but prescriptive measures (i.e., BMPs) developed on a case-by-case basis to achieve protection of refuge resources and use where permits are issued.</p>	<ul style="list-style-type: none"> • The rule establishes a defined suite of performance-based standards for protection of refuge resources and uses, including surface use and site management, specific resource protections, spill prevention and response, waste management, and reclamation. 	<p>Same as Alternative B, except performance-based standards would be established for downhole operations.</p>
<p>Permitting Process</p>	<p>Defined by policy in general terms and applied in various ways across the Service.</p>	<p>Establishes the process for obtaining an operations permit including:</p> <ul style="list-style-type: none"> • initial steps in developing a permit application, • contents of the application, • the Service’s review of the 	<p>Same as Alternative B, but Service would actively regulate downhole operations as a matter of course. Alternative C would establish standards and information requirements related</p>

Regulatory Provision	Alternative A: No Action	Alternative B: The Rule	Alternative C: Modified Rule
		application including timelines, <ul style="list-style-type: none"> ● the Service’s approval standards, and ● the actions the Service may take on the application including timelines. 	to downhole operations.
Performance Bond (Financial Assurance)	Typically not required and applied inconsistently when required.	Performance bond required as condition of permit approval. Bond amount equal to cost of surface reclamation, but may be reduced by amount of upfront reclamation in-kind (mitigation).	Same as Alternative B.
Access Fees	No provisions for collection of access fees.	Establishes provisions for charging a fee for use of Service roads and for new access across Federal lands and waters (e.g., roads or gatherings lines) outside of the oil and gas mineral right.	Same as Alternative B.
Change of Operators	No general notification or performance requirements of either former or new operator.	Specific procedures and requirements defined to ensure all regulatory and permit responsibilities of former operator are imposed on the new operator.	Same as Alternative B.
Cost Recovery	No provisions for cost recovery.	Provisions for cost recovery for Service expenses associated with administration of permits.	Same as Alternative B, noting that permits and associated cost recovery would include operations on private surface estate within a refuge and operations that use directional drilling from surface locations outside a refuge to access oil and

Regulatory Provision	Alternative A: No Action	Alternative B: The Rule	Alternative C: Modified Rule
			gas rights within a refuge.
Third-Party Monitoring	Common requirement for 3D seismic surveys conducted under an SUP.	Provisions that operators hire third-party monitors when they are necessary to ensure compliance with any operations permit.	Same as Alternative B.
Well Plugging (Maintenance of Idle or Shut-In Wells)	Defer to State requirements for well plugging or maintenance of wells in a nonproducing state.	Defines conditions under which non-producing wells must be plugged, and includes procedures for obtaining approval for maintaining wells in an idle or shut-in status.	Same as Alternative B.
Administration of Permit	Provisions of SUPs would apply when issued.	Establishes suite of administrative procedures to address general terms and conditions common to all permits, modifications to permits, prohibited acts and penalties, and appeals.	Same as Alternative B.

HOW ALTERNATIVES MEET OBJECTIVES

As stated in Chapter 1: Purpose and Need for Action, all action alternatives selected for analysis must meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action; therefore, the alternatives were individually assessed in light of how well they would meet the objectives for this rulemaking and EIS (refer to Chapter 1: Purpose and Need for Action). Alternatives that did not meet the objectives were not analyzed further (refer to the Alternatives Eliminated from Further Consideration section in this chapter).

Alternatives B and C, the action alternatives, meet the Service's purpose and need for the action, as well as the Service's objectives to a large degree. Alternative B, the Service's preferred alternative, meets the Service's objectives to a greater degree than Alternative C. Table 2 is a comparison of how each of the alternatives described in this chapter would meet the Service's objectives of the proposed action.

TABLE 2-2. OBJECTIVES MET BY PROJECT ALTERNATIVES.

Objective	Alternatives		
	A: No Action	B: The Rule	C: Modified Rule
1. Clarification of Service authority	NO	YES	YES
Consistent, functional, and understandable procedures and provisions	NO	YES	YES
Performance-based standards provide flexibility to resource managers and operators to achieve resource protection	NO	YES	YES
Practical and effective means for dealing with acts of noncompliance or with illegally conducted operations	NO	YES	YES
Regulation addresses directional oil and gas wells drilled beneath refuges from surface locations outside refuge boundaries in a way that is most protective of refuge resources and uses.	NO	YES	NO
All future operations on Service fee title and less than fee title lands and waters utilize the least damaging methods to prevent or minimize damage to refuge resources and uses.	NO	YES	YES
All existing operations on Service fee title and less than fee title lands and waters do not create unnecessary impacts on refuge resources and uses by maintaining full compliance with Federal and State laws, regulations, and permits.	NO	YES	YES
The regulation addresses existing operations by balancing the incremental level of protection for refuge resources and uses with the incremental administrative and cost burden imposed on both the regulated community and the Service.	NO	YES	NO
All operations are eventually reclaimed in a manner consistent with the purposes for which the refuge was established.	NO	YES	YES
The public and refuge staff are fully protected from health and safety hazards associated with operations.	NO	YES	YES

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

The following alternatives were brought forth by the planning team during the development of the proposed regulations or were suggested by the public in their comments on the Advanced Notice of Proposed Rulemaking (ANPR) or the Notice of Intent (NOI) to prepare this EIS. These alternatives or alternative components were considered but dismissed from further detailed analysis for reasons explained below.

ACQUISITION OF OIL AND GAS RIGHTS IN REFUGE UNITS WHERE MINERAL DEVELOPMENT IS ONGOING OR LIKELY IN THE FUTURE

This alternative, which would have involved the purchase of private mineral rights, was considered in two forms –a more general and uniform acquisition of mineral rights where oil and gas is ongoing or there is a potential for future exploration and development and, alternatively, case-by-case acquisition.

The alternative to eliminate all oil and gas operations, present and future, by uniformly purchasing non-Federal oil and gas rights was considered. This alternative would provide the highest level of protection of refuge resources and uses, but would create significant conflicts with private property rights. The planning team did not attempt to establish a range of costs needed for uniform acquisition of oil and gas rights because of the highly speculative nature of determining value for oil and gas properties, though it would be a high range. Also, the efficient use of public funds becomes a more important factor than the overall cost considering the Service's ability to make case-by-case acquisitions.

The Service currently has the authority to acquire the nonfederal mineral rights on a case-by-case basis if it determines that oil and gas activities on those land cannot be modified in a manner that would minimize or avoid impacts sufficiently, resulting in the Service being unable to meet its mission or the specific purposes for establishing that refuge. Therefore, the criteria for selecting where oil and gas rights would be purchased on a case-by-case basis would depend on the sensitivity of refuge resources to the adverse impacts of oil and gas activities. Nothing in this rulemaking, would prevent the Service from acquiring minerals in such a situation, and so the case-by-case acquisition of oil and gas rights is in effect a component of the all the alternatives. Therefore, it has been eliminated from further consideration as a stand-alone alternative.

Additionally,, in the event that there were unwilling sellers, this alternative would possibly require condemnation of mineral rights and would thus create substantial conflicts with private property rights. Finally, this alternative would also be inconsistent with the objective of providing owners and operators of private oil and gas rights reasonable access for exploration, production, maintenance, and surface reclamation. Therefore, this alternative was eliminated from further analysis.

UNIFORM ACQUISITION OF ALL MINERAL RIGHTS IN REFUGE UNITS (RIGHTS OTHER THAN OIL AND GAS RIGHTS)

For the same financial reasons discussed above, this alternative was dismissed from further analysis.

CONSISTENCY WITH THE PURPOSES OF THE NATIONAL ENVIRONMENTAL POLICY ACT

NEPA requires an analysis of how each alternative meets or achieves the responsibility of the agency to carry out the policies set forth in NEPA. As outlined in section 101(b) of the Act, in order to carry out the policies of NEPA, Federal agencies have the continuing responsibility to improve and coordinate Federal plans, functions, programs, and resources so the Nation may:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
4. preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
5. achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities; and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. (42 USC 4331(b))

CEQ has promulgated regulations for Federal agencies' implementation of NEPA (40 CFR Parts 1500–1508). Section 1502.2 asserts that “environmental impact statements shall state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of the Act and other environmental laws and policies” (40 CFR 1502.2); therefore, other acts and Service policies are referenced as applicable in the following discussion.

ALTERNATIVE A: NO-ACTION

Alternative A fails to meet the above stated responsibilities of the Service as outlined in section 101(b) of NEPA. Oil and gas operations not currently under an SUP would continue to pose current and potential future impacts on public safety and refuge resources (e.g., impacts resulting from accidental spills and releases, or lack of full site reclamation). Lack of consistency for operations under a SUP may continue to result in unnecessary impacts to refuge resources and uses. Lack of Service consistency for those operations under SUPs and lack of oversight in the form of inspections and monitoring for these exempt operations would not ensure healthful, productive, or aesthetically pleasing surroundings. Upon completion of operations, reclamation to Service standards would not be guaranteed. As a result, Alternative A would not attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences or help to achieve a balance between population and resource use, nor would it enhance the quality of renewable resources. As a result, this alternative would not fulfill the responsibilities of each generation as the trustee of the environment for succeeding generations, and in preserving important aspects of our national heritage.

ALTERNATIVE B: THE RULE (PREFERRED ALTERNATIVE)

This alternative would fulfill the Service's continuing responsibilities as outlined in Section 101(b) of NEPA. By requiring all new operations obtain a permit and meet the standard of technologically feasible, least damaging methods, stricter compliance with Federal and state laws for pre-existing operations, and all operations be reclaimed to Service standards, this alternative would help achieve all the necessary protections for ecosystems and wildlife to conserve fish and wildlife resources and enhance public enjoyment, as well as allow access to non-Federal mineral rights (purpose 4), enhance the quality of renewable resources, and help to ensure safe, healthful, productive, and esthetically pleasing surroundings. Additionally, Alternative B would incentivize operators to locate surface operations off refuge lands and waters, resulting in avoiding most direct impacts to refuge resources and uses.

By providing for the fair compensation for new privileged access across Federal lands outside the boundary of an operator's mineral right, as well as including the authority for Service to accept in-kind reclamation in lieu of fees, Alternative B would also help to achieve a balance between population and resource use. Overall, this alternative would go further than Alternative A towards fulfilling the responsibilities of each generation, as a trustee of the environment, for succeeding generations.

ALTERNATIVE C: MODIFIED RULE

Similar to Alternative B, this alternative would fulfill the Service's continuing responsibilities as outlined in Section 101(b) of NEPA. By requiring all operations, including surface and subsurface directional drilling operations outside the boundary of a refuge, to obtain a permit and meet the standard of technologically feasible, least damaging methods, Alternative C would help preserve important historic, cultural, and natural aspects of our national heritage, and would maintain an environment that supports diversity and variety of individual choice by allowing access to non-Federal mineral rights, enhance the quality of renewable resources, and help to ensure safe, healthful, productive, and esthetically pleasing surroundings. However, the lack of incentives to locate operations outside refuge boundaries using directional drilling could result in less protection of important historic, cultural, and natural aspects of our national heritage.

By providing for the fair compensation for privileged access across Federal lands outside the boundary of an operator's mineral right, as well as including the authority for Service to accept in-kind reclamation in lieu of fees, Alternative C would also help to achieve a balance between population and resource use. Like Alternative B, this alternative would go further than Alternative A toward fulfilling the responsibilities of each generation, as a trustee of the environment, for succeeding generations.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The Service typically identifies the environmentally preferable alternative in its NEPA documents for public review and comment. Guidance from CEQ states that the environmentally preferable alternative means it is "the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (CEQ 1981). Alternative C is the environmentally preferable alternative as it will likely have incremental environmental benefits (primarily due to the regulation of pre-existing operations during the production phase) compared to Alternative B.

U.S. FISH AND WILDLIFE SERVICE PREFERRED ALTERNATIVE

To identify the preferred alternative, the planning team evaluated each alternative based on its ability to meet the objectives set forth for this rulemaking (Table 2), considering potential impacts on the environment and on existing and future operations. Alternative B (Rule) is selected as the Service's preferred alternative, because it is the only alternative that meets all of the Service's objectives for the rulemaking.

Management Alternatives

CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the existing conditions of the natural and cultural environments that would be affected by implementing the alternatives considered in this EIS.

Impacts for each of the following topics are analyzed in Chapter 4: Environmental Consequences.

- Geology and soils (including paleontology)
- Air quality
- Water resources (including surface and groundwater, both quality and quantity)
- Wetlands
- Floodplains
- Vegetation (including plant species of special management concern)
- Wildlife and aquatic species (including animal species of special management concern)
- Visitor use and experience (including human health and safety, visitation patterns, visitor activities, recreation, interpretation)
- Scenic views and night sky resources
- Natural soundscapes and acoustic environment
- Cultural resources (including archeological sites, prehistoric/historic structures, cultural landscapes, ethnographic resources)
- Refuge management and operations
- Socioeconomics (including non-Federal oil and gas exploration and development, and regional and local economies)

The availability of data and information on these topics varies across refuges discussed in this EIS. Moreover, the uniqueness of the natural and cultural environments in individual refuges presents an obstacle to the level of detail with which these topics can be addressed programmatically.

EFFECTS OF CLIMATE CHANGE ON NATIONAL WILDLIFE REFUGE SYSTEM UNITS

Climate change refers to a suite of changes occurring in the earth's atmospheric, hydrologic, and oceanic systems. These changes, including increased global air and ocean temperatures, widespread melting of snow and ice, and rising global average sea levels, provide evidence that the climate system is warming (IPCC 2007). While the warming trend, commonly referred to as global warming, is discernible over the past century and a half, recent decades have exhibited an accelerated warming rate with 11 of the last 12 years ranking among the 12 warmest years on record. Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies 2007). Observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions. What is known is that increasing concentrations of greenhouse gasses (GHGs) are likely to accelerate the rate of climate change.

Greenhouse gases that are included in the US Greenhouse Gas Inventory are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Carbon dioxide and methane (CH₄) are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of greenhouse gas emissions (including CO₂; CH₄; nitrous oxide (N₂O); and several trace gasses) on global climate. Through complex interactions on regional and global scales, these greenhouse gas emissions cause a net warming effect of the atmosphere (which makes surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although greenhouse gas levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO₂ concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO₂ concentrations may also lead to preferential fertilization and growth of specific plant species.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels (IPCC 2007). The National Academy of Sciences (2006) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures.

As climate changes, changes in weather conditions will impact the natural environment of refuges by shifting patterns of precipitation, promoting extremes in storm behavior, altering seasonal temperatures, and influencing the triggers for bird migration, wildlife breeding, insect emergence, and plant dormancy.

Some refuges are already seeing changes to vegetation, wildlife habitat, and water resources as a result of climate change, and research predicts that many refuges will see changes to these resources in upcoming decades (Czech et al. 2014). Climate change can also result in sea level rise and increased frequency and intensity of storm events (IPCC 2013). For example, according to a resource vulnerability assessment for the Eastern Shore of Virginia NWR and Fisherman Island NWR, sea level rise due to climate change will impact coastal marshes and other low-lying areas, increase flooding from storm surges, and cause shoreline erosion (Bulluck et al. 2011). Those same changes will affect refuges in the Gulf Coast (Yang et al. 2014). Climate change could raise sea levels in coastal refuges containing oil and gas resources, such as Delta NWR in Louisiana, and increase flooding along rivers such as found at Deep Fork NWR in Oklahoma, which has wells in and around the Deep Fork River floodplain. Habitat potentially lost due to sea level rise includes beaches and wetlands that surround the landward boundaries of the refuges (Glick et al. 2013, Palaneasu-Lovejoy et al. 2013, Williams 2013). Storm events also have the potential to cause substantial land and habitat loss by exacerbating erosion rates and changing hydrologic and sediment dynamics.

Changing patterns in precipitation and temperature have the potential to shift the latitudinal and elevational distribution of some plant communities and threaten the persistence of others. As

temperature and precipitation patterns affect the abundance, type, and distribution of vegetation cover in watersheds, changes in flood magnitude and duration, sediment loads, and water chemistry will likely occur.

Climate change will alter ecosystems in fundamental ways, which will vary depending on locations and resources. It is not, however, possible at this time to predict with any certainty the causal connection of site specific emissions from sources to impacts on the global/regional climate relative to the proposed regulation of non-Federal oil and gas operations on national wildlife refuges. The effect of climate change on many of the resources discussed in the EIS is recognized and the Service will continue to evaluate as new science becomes available and the future of climate change unfolds.

GEOLOGY AND SOILS

National wildlife refuges lie within 13 physiographic provinces. The type and distribution of geologic features vary widely across refuges, and the extent to which unique soil types are present can be vastly different between two refuges located within the same physiographic province. A description of each of the physiographic provinces associated with refuges follows. These descriptions are derived from Bailey (1995) unless otherwise noted.

APPALACHIAN PLATEAUS PROVINCE

The Appalachian Plateaus province encompasses several refuges. It extends from Alabama to beyond the glacial border in Ohio and Pennsylvania and is bounded on all sides by escarpments, giving the plateau an overall synclinal (trough-like) structure. Most rocks found in this province are clastic sedimentary rocks (i.e., made from fragments of older rocks). They include conglomerates, sandstones, and shales, with some interbedded coal. Limestones are uncommon. Strata are mainly Mississippian (359–323 million years old) and Pennsylvanian age (323–299 million years old), although some northern areas are underlain by younger Permian age rocks (299–252 million years old) (FEN 2008).

BASIN AND RANGE PROVINCE

The Basin and Range Province includes almost all of Nevada, Southern California, western Utah, the southern half of Arizona, southwestern New Mexico, and west Texas. Most, if not all, of the streams in the Great Basin Section of this province do not flow to the ocean (USGS 2014).

CENTRAL LOWLANDS PROVINCE

The Central Lowlands province is the largest geomorphic province in the United States, covering the north-central portion from just east of the Great Lakes west to the Great Plains in the Dakotas. The Central Lowlands are part of the stable continental interior, an area where only minor deformation of the sediments and rocks has occurred since Precambrian time. The geologic structures characteristic of this region are broad uplifts and basins filled with gently dipping sedimentary rocks on its flanks.

INTERIOR LOW PLATEAUS PROVINCE

The Interior Low Plateaus province is characterized by geologic structures similar to those of the Central Lowlands. This province is at the southeastern edge of the stable continental interior and lies between the Central Lowlands on the northwest, the Mississippi embayment part of the Coastal Plain province on the southwest, and the Cumberland Escarpment at the edge of the Appalachian Plateaus province to the east.

COASTAL PLAIN PROVINCE

The Coastal Plain province, where a majority of existing oil and gas operations on NWRS lands currently occur, consists of the seaward-sloping, lowland sediments along the Atlantic Ocean and Gulf of Mexico and the submerged section, the continental shelf. Rocks of the Coastal Plain province fall into one of three groups. Around the inner border of the province are marine sedimentary rocks deposited when the Cretaceous sea (145–66 million years old) inundated this part of the continent. In the middle section of the province, younger marine, Tertiary-age (66–29 million years old) rocks overlie the Cretaceous rocks and dip gently towards the sea. Along the coastal areas, sediments of Quaternary age (2.6–0.01 million years old) form a more or less continuous band of varying width from southern Texas to Long Island.

COLORADO PLATEAUS PROVINCE

The Colorado Plateaus province, a province with a high potential for oil and gas operations in the future, is mostly arid or semiarid and is largely devoid of vegetation and thick soils that obscure the geologic record that exists in other areas of the country. In addition to extensive flat-topped plateaus, other major landforms in the province include canyons produced by the Colorado River and its tributaries, colorful exposed sedimentary rocks, plateau edges and basins localized by fault scarps and folds, igneous mountains produced by both intrusive and extrusive geologic processes, and lava fields.

COLUMBIA PLATEAU PROVINCE

The Columbia Plateau province includes the Snake River plain and the Columbia River basin in Idaho, Oregon, and Washington, and consists of basalts, igneous, or volcanic rock. Basalt was formed by the rapid cooling of basaltic lava deposited on the surface by volcanic activity. The lava flows in this province were deposited between 6 and 17 million years ago (USGS 2014).

GREAT PLAINS PROVINCE

The Great Plains province is characterized by extensive low-relief topography with some localized mountains and volcanic deposits near its western edge. Running water has eroded the sediments and formed the colorful badland topography which also contains Tertiary-age sedimentary debris shed from erosion of the Rocky Mountains.

MIDDLE ROCKY MOUNTAINS PROVINCE

The Middle Rocky Mountain Province is made up of the mountains, plateaus, and basins of western Wyoming, northeastern Utah, and a small portion of Montana and northwest Colorado. In this province, overlying Paleozoic (541–252 million years old) and younger Mesozoic (252–66 million years old) sedimentary rocks over 20,000 feet thick are exposed along the flanks of the folded and thrust-faulted mountain ranges of the Uintas, Beartooths, and central Wyoming.

OUACHITA-OZARK INTERIOR HIGHLANDS PROVINCE

The Ouachita-Ozark Interior Highlands consists of rocky outcrops in eastern Oklahoma, the southern half of Missouri, and Arkansas. Carbonate and other sedimentary rocks of Paleozoic origin were originally deposited on the seafloor. This highland province is marked by folds and faults.

PACIFIC BORDER PROVINCES

The Pacific Border provinces extend from the tip of the Aleutian Islands chain southeastward through California, and include four major tectonic components, one of which is the California San Andreas transform fault system. This province is characterized by active geologic processes at the continental and oceanic plate boundaries (mountain-building and volcanism).

SOUTHERN ROCKY MOUNTAINS PROVINCE

This province contains broad anticlinal uplifts (rocks folded during mountain-building episodes) with thrust faults on one or both flanks that formed during the late Mesozoic-early Tertiary Laramide orogeny approximately 70 to 40 million years ago. Baca NWR represents the only true desert in the southern Rocky Mountains and lies along the east edge of the San Luis Valley within the Southern Rocky Mountains physiographic province.

SUPERIOR UPLAND PROVINCE

Repeated glaciation modified the geology of the Superior Upland Province (USGS 2014), which includes portions of northern Minnesota and Wisconsin. This province contains mostly Precambrian metamorphic rocks and overlying Paleozoic rocks (Cambrian). A thin veneer of glacial deposits covers the older Precambrian and Cambrian rocks.

SOILS IN THE NATIONAL WILDLIFE REFUGE SYSTEM

Dominant soil orders occurring in the NWRS vary depending on the location and include Alfisols, Andisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Spodosols, Ultisols, and Vertisols (USDA 2006).

AIR QUALITY

Air quality is important for natural resources. Natural resources can be harmed by the air pollution emitted by power plants, factories, automobiles, and other sources. Pollutants transported with the wind can come from local sources or from sources hundreds of miles away. These include pollutants

emitted directly from sources (primary pollutants) and those that are formed as a result of chemical reactions in the atmosphere (secondary pollutants). Primary pollutants include sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), and volatile organic compounds (VOCs), while secondary pollutants include sulfates, nitrates, and ozone. Sources of air pollution include stationary sources, such as power plants, industrial facilities, and factories; mobile sources, such as cars, buses, planes, trucks, and trains; and natural sources, such as wind-blown dust, wildfires, and volcanoes.

Many resources and values of the NWRS are affected by air pollution. Air pollutants can cause injury to vegetation, change terrestrial and aquatic ecosystems, degrade sensitive Service-protected flora and fauna, and impair visibility. Visibility is affected by the physical interaction of light with particles and gases in the atmosphere; it is also one of the primary air-related attributes that people associate with refuges. Many visitors come to refuges to enjoy the spectacular vistas, which can be obscured by pollutants, especially fine particles in the atmosphere.

Air pollutants can also harm ecological resources, including, water quality, soils, plants, animals, and geological, archeological, and historical resources. Ozone, for example, causes foliar injury and reduced growth in some sensitive plant species. Atmospheric deposition of sulfur and nitrogen compounds can cause significant ecosystem effects such as acidification, eutrophication, and changes in soil and water chemistry.

Acidification of soils, lakes, and streams can result in changes in community structure, biodiversity, reproduction, and decomposition. Documented impacts in some refuges include stressed trees, acidified streams, and a reduction in species of fish and other aquatic life in affected waters. Although nitrogen is an essential plant nutrient, increased levels of atmospheric nitrogen deposition can stress ecosystems. Excess nitrogen acts as fertilizer, favoring some types of plants and leaving others at a competitive disadvantage. This creates an imbalance in natural ecosystems, and long-term effects of these changes may include shifts in types of plant and animal species, increases in insect and disease outbreaks, and disruptions of ecosystem processes such as nutrient cycling, and changes in fire frequency.

Metals, such as mercury, and persistent organic compounds deposited from the atmosphere can bioaccumulate in the food chain, causing behavioral, neurological, and reproductive effects in fish, birds, and wildlife.

CLEAN AIR ACT

Under the Clean Air Act (CAA), the Federal Land Manager (FLM) (i.e., Secretary of the Interior) and the federal official with direct responsibility for management (i.e., Refuge Manager) have an affirmative responsibility to protect the air quality-related values of Federal lands.

Congress gave the greatest degree of air quality protection, Class I, to certain national parks and wilderness areas. These Class I areas are national parks or national wilderness areas that were so designated as of August 7, 1977, and that are greater than 6,000 acres (parks) or 5,000 acres (wilderness). There are 21 units of the NWRS, 48 units of the NPS, and 88 U.S. Forest Service Wilderness Areas designated as Class I areas. Only a small amount of new pollution is allowed in these areas. All other clean air regions, except some tribally designated Class I areas, are designated Class II areas with moderate pollution increases allowed.

There are 21 Class I areas located in 19 NWRS units:

- Alaska Maritime (AK) There are 3 Class I areas located within the Alaska Maritime NWR:
Tuxedni, Simeonof and Bering Sea Wilderness
- Bitter Lake NWR (NM)
- Bosque del Apache NWR (NM)
- Breton NWR (LA)
- Cape Romain NWR (SC)
- Chassahowitzka NWR (FL)
- Edwin B. Forsythe NWR (NJ)
- Lostwood NWR (ND)
- Medicine Lake NWR (MT)
- Mingo NWR (MO)
- Moosehorn NWR (ME)
- Okefenokee NWR (GA)
- Red Rocks Lakes NWR (MT)
- St. Marks NWR (FL)
- Seney NWR (MI)
- Swanquarter NWR (NC)
- UL Bend NWR (MT)
- Wichita Mountains NWR (OK)
- Wolf Island NWR (GA)

The remaining NWRS units are designated class II areas. The major CAA regulatory programs that the Service has active responsibilities for include the National Ambient Air Quality Standards, New Source Review (NSR)/Prevention of Significant Deterioration (PSD) permit program, and Regional Haze.

National Ambient Air Quality Standards: Sections 108 and 109 of the CAA required the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. NAAQS represent the minimum standards for these air pollutants throughout the United States. CAA identifies two types of NAAQS: primary and secondary. Primary standards provide public health protection, including protecting the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. EPA established NAAQS for seven pollutants: fine particles (PM_{2.5}) and inhalable coarse particles (PM₁₀), sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ground level ozone (O₃), and lead (Pb). EPA periodically updates NAAQS.

State, local, and tribal agencies have primary responsibility for ensuring attainment of NAAQS. In addition, the Service ensures that Service and Service-authorized activities are consistent with NAAQS and applicable State, local and tribal air pollution requirements. The current NAAQS are presented in Table 1. The standards are expressed as either micrograms per cubic meter or parts per million, over a specified period of time (averaging period).

TABLE 3-1. NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Standard	Averaging Period	Metric	Threshold for Nonattainment
Carbon monoxide	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	Not to be exceeded
Lead (Pb)	Primary and Secondary	Rolling 3-month Average	0.15 $\mu\text{g}/\text{m}^3$	98th percentile, averaged over 3 years
Nitrogen dioxide	Primary	1-hour	100 ppb	Annual Mean
	Primary and Secondary	Annual	53 ppb	
Ozone (O_3)	Primary and Secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate matter of 2.5 micron particle size ($\text{PM}_{2.5}$)	Primary	Annual	12 $\mu\text{g}/\text{m}^3$	annual mean, averaged over 3 years
	Secondary	Annual	15 $\mu\text{g}/\text{m}^3$	annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 $\mu\text{g}/\text{m}^3$	98th percentile, averaged over 3 years
Particulate matter of 10 micron particle size (PM_{10})	Primary and Secondary	24-hour	150 $\mu\text{g}/\text{m}^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: USEPA 2013a.

Refuges located in nonattainment areas are identified in Appendix E. If the concentration of one or more criteria pollutants in a geographic area is found to exceed the regulated or threshold level for one or more NAAQS, the area may be classified as a nonattainment area. Areas with concentrations of criteria pollutants that are below the levels established by NAAQS are considered either attainment or unclassifiable areas. An implementation plan describing the approach to reduce the air pollutant levels must be prepared for areas designated as nonattainment. These plans ensure emission sources meet emission goals.

WATER RESOURCES

Water resources refer to surface waters such as lakes, rivers, ponds, streams, and springs, as well as underground aquifers and seeps. Almost every refuge has water resources within its designated boundaries. In many cases, the water resources contained within refuge units constitute one of the reasons for which the refuge was established. For example, many refuges were established for the preservation of important aquatic resources, such as the coastal wetlands at Delta and Sabine NWRs in Louisiana and the bottomland hardwood forests at Deep Fork NWR in Oklahoma and Upper

Ouachita NWR in Louisiana. Additionally, some refuges have congressionally designated wild and scenic rivers or other outstanding natural resource waters as designated by each state.

WATER QUALITY

In 2009, EPA conducted a national assessment (USEPA 2009) of waters within Service properties, including refuges, with waters listed as impaired under Section 303(d) of the Clean Water Act (CWA). Impaired waters under the CWA include waterbodies or streams that fail to meet water quality standards. EPA found that 303(d) listed waters occurred within the boundaries of approximately one-third of the refuges (Table 2). The 449 impaired waters totaled 3,982 km and 1,255 km² of length and area, respectively. The top 10 causes of impairment of streams included pathogens, nutrients, oxygen depletion, pesticides, mercury, sediment, metals (other than mercury), habitat alteration, polychlorinated biphenyls (PCBs), and turbidity. The top 10 causes of impairment in lakes and ponds included nutrients, metals (other than mercury), mercury, oxygen depletion, salinity/TDS/chlorides, noxious aquatic plants, PCBs, selenium, pH, and pesticides (USEPA 2009).

TABLE 3-2. SUMMARY OF IMPAIRED WATERS IN NATIONAL WILDLIFE REFUGES AND WATERFOWL PRODUCTION AREAS (FROM USEPA 2009).

	In NWR	In WPA	Total
Number of impaired waters	429	20	449
Impaired length (km)	3,968	14	3,982
Impaired area (km ²)	1,251	4	1,255
Number of NWRS units affected	178	17	195

GROUNDWATER

Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of rock formations. When a unit of rock or sediment can yield a usable quantity of water, it is called an aquifer. Aquifers are also able to transmit groundwater via the relatively porous substrate that characterizes them. When water can flow directly between the surface and the saturated zone of an aquifer, the aquifer is unconfined. The deeper parts of unconfined aquifers are usually more saturated with groundwater since gravity causes water to flow downward. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally. This natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by drilling and operating extraction wells.

Many of the refuge units are in areas where these groundwater aquifers are present. Surficial aquifers are shallow aquifers typically less than 50 feet in thickness and comprised mostly of beds of unconsolidated sand, cavity-riddled limestone and shells, sandstone, sand, and clay sand with minor clay or silt from the Pliocene to Holocene periods. These aquifers principally supply large municipalities for domestic and commercial uses. The thickness of this surficial aquifer system in Florida is as much as 400 feet in some areas and consists mostly of unconsolidated sand, shelly sand, and shell deposits. The most productive parts of the surficial aquifer system are in southwestern Florida, where complex interbedding of fine- and coarse-textured rocks ranging from late Miocene to

Holocene in age and the limestone beds of the Tamiami and Fort Thompson Formations form an important and highly permeable part of the system.

Data and information on groundwater (absence/presence, quality, recharge, depth, and uses) varies widely across NWRS units. Each refuge's unique needs would therefore need to be assessed for location during the planning for site-specific oil and gas projects. Principal aquifers associated with refuge units addressed in this EIS include those of the Colorado Plateaus, the Coastal Lowlands, and the Low Tertiary, Mississippian, Pennsylvanian, and Valley and Ridge geologic provinces. These principal aquifers can be comprised of carbonate rock, igneous and metamorphic rock, sandstone, or unconsolidated sand and gravel. The geographic distribution associated with these rock types is illustrated in Figure 3. Multiple aquifers are present within, and distributed throughout, each of these formations.

Sole source aquifers that are located underneath Refuges with oil and gas wells include the Chicot Aquifer System and the Southern Hills Regional Aquifer System. Refuges underlain by the Chicot Aquifer System include: Bayou Teche, Cameron Prairie, Grand Cote, Lacassine, Lake Ophelia, and Sabine National Wildlife Refuges (NWRs) in southern Louisiana. Refuges underlain by the Southern Hills Regional Aquifer System include: Saint Catherine Creek NWR in southwestern Mississippi, and Big Branch Marsh and Cat Island NWRs in southeastern Louisiana. EPA defines a sole source aquifer as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer." Sole source aquifers are protected under the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S.C. 300 et seq.). Certain proposed projects located in areas underlain by sole source aquifers and receiving federal funds are subject to review to ensure that they do not endanger the water source.

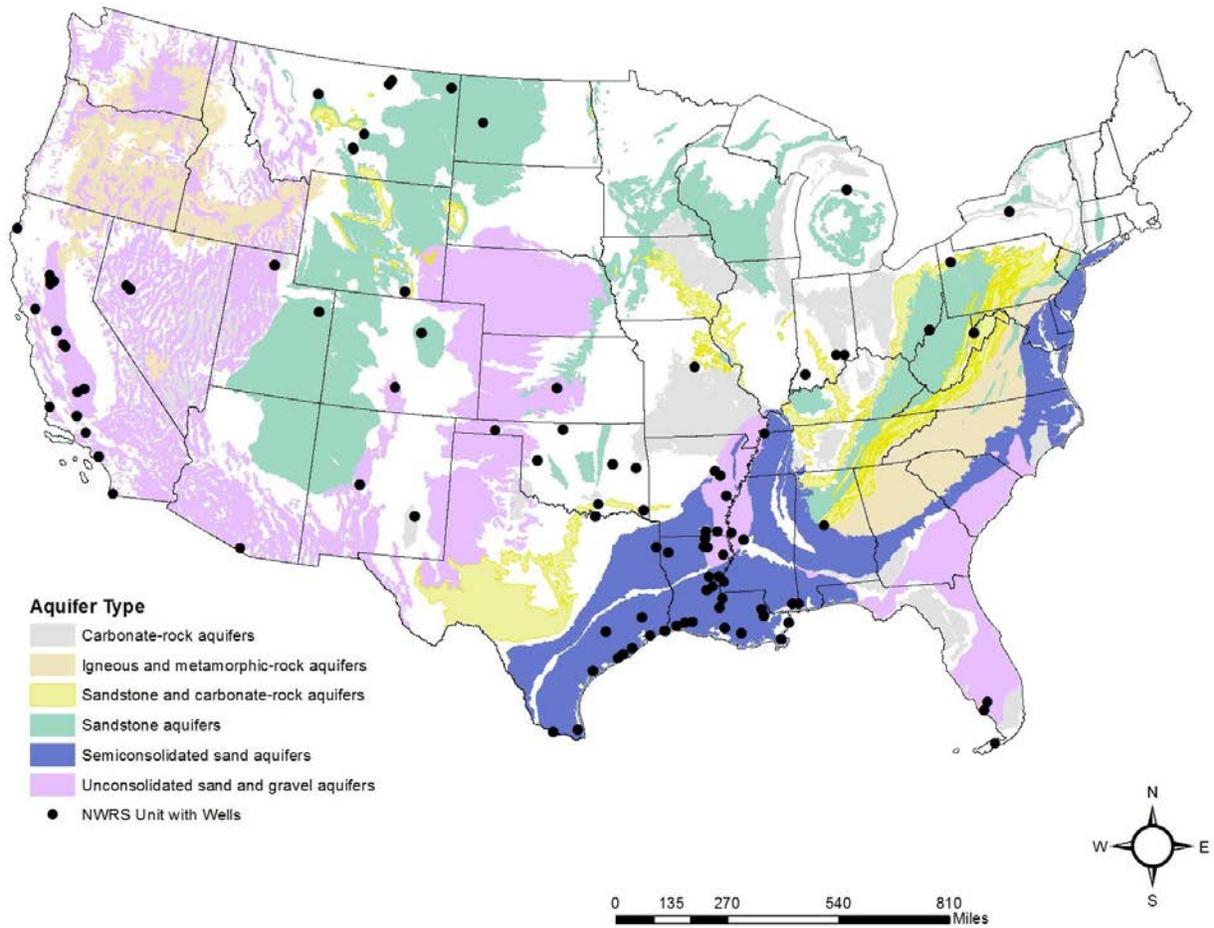


FIGURE 3-1. AQUIFER TYPES ASSOCIATED WITH REFUGE UNITS

WETLANDS

Wetlands include areas inundated or saturated by surface or groundwater for a sufficient length of time during the growing season to develop and support characteristic soils and vegetation. The NWRs classifies wetlands based on the Service's *Classification of Wetlands and Deepwater Habitats of the United States*, also known as the Cowardin classification system (Cowardin et al. 1979). Based on this classification system, a wetland must have one or more of the following attributes:

The habitat at least periodically supports predominately hydrophytic vegetation (wetland vegetation);
The substrate is predominantly undrained hydric soil;

The substrate is nonsoil and saturated with water, or covered by shallow water at some time during the growing season.

The specific wetlands that occur within refuge units are dependent upon the physiographic and climatologic features of the individual refuge and location within the refuge. Descriptions of the major wetland types in refuges are in Appendix F.

Executive Order 11990 was issued by President Carter in 1977 in order "...to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative..." Despite these protection efforts by government and private organizations, significant wetland losses are still occurring.

President Bush further addressed wetland impacts in 1989, which prompted the Service to draft a strategy to consolidate, better coordinate, and improve Service wetlands conservation programs to contribute to the goal of No Net Loss of wetlands. This strategy, called the Wetlands Policy and Action Plan (WPAP), is the basis of our existing wetlands policy (660 FW1). The WPAP identifies strategies the Service will pursue toward the goal of No Net Loss and proposes solutions to many of the current federal wetlands programs that contribute to wetland losses. The WPAP also outlines new opportunities to conserve wetlands.

FLOODPLAINS

Floodplains consist of flat or nearly flat land adjacent to a water body that experiences occasional or periodic flooding. Flood insurance rate maps produced by the Federal Emergency Management Agency delineate areas of potential flooding. The Service protects and preserves the natural resources and functions of floodplains by avoiding environmental effects associated with the occupancy and modification of floodplains, avoiding actions that could adversely affect wetland functions, and restoring floodplain values previously affected by activities in floodplains. The Service, in complying with Executive Order (EO) 11988 and its implementing guidance in the management of floodplains will advise and will advise operators of the Service's responsibility to evaluate the potential effects of any actions they may conduct or authorize in a floodplain.

In compliance with Service policy (613 FW 1) in regards to EO 11988, the Service will:

- Avoid long- and short-term adverse effects caused by the human occupancy and modification of floodplains.
- Avoid direct or indirect support of floodplain development whenever there is a practicable alternative.
- Reduce the risk of flood loss and minimize the impacts of floods on human health, safety, and welfare.
- Restore, preserve, and enhance the natural and beneficial values served by floodplains.
- Inform the public of flood hazards on Service property, including any appropriate floodplain references or restrictions in conveyances of property proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties.
- Incorporate the concepts, strategies, and management tools of the Unified National Program for Floodplains Management into the Service's programs and actions.
- Use an integrated process to involve the public in the planning of all actions and decisions.
- Monitor Federal actions undertaken, funded, or permitted to ensure that they are carried out in accordance with the EO. The Service, in its review of other federal agency proposals, will address the basic requirements of the EO when the protection of floodplains may affect aquatic and terrestrial invertebrates, anadromous fish, migratory birds, threatened and endangered species, candidate species, and other fish, wildlife, and plant species and their habitats that come under the jurisdiction of the Service.
- Ensure all Service personnel, when working with other agencies and the public, advocate compliance with the spirit and intent of the EO.

Some portions of individual refuges addressed in this EIS are likely to be located within 100-year floodplains and are subject to high water table conditions and the drainage and flooding issues that often result from storm events. Generally, lands along the ocean beaches or adjacent to estuaries (at wide points) are located in flood insurance rate areas that correspond to 100-year floodplains that have additional hazards associated with flooding. Data and information on specific flood zones vary widely across refuge units.

VEGETATION

The U.S. Department of Agriculture and other federal agencies identify natural resources of the United States within specific geographically delineated “ecoregions” classified by geographer Robert G. Bailey (1995). Within this classification system, four levels of detail show a hierarchy of ecosystems. The largest ecosystems are domains, four groups of related climates that are differentiated based on precipitation and temperature. Divisions represent the climates within domains and are differentiated based on precipitation levels and patterns as well as temperature. Divisions are subdivided into provinces, which are differentiated based on vegetation or other natural land covers. The finest level of detail is described by sub regions, called sections, which are subdivisions of provinces based on terrain features. Also identified are mountainous areas that exhibit different ecological zones based on elevation.

VEGETATION TYPES IN POTENTIALLY AFFECTED REFUGE UNITS

Each refuge contains a unique assemblage of vegetation types, which can be categorized by the U.S. Department of Agriculture ecoregion within which the refuge unit is contained. The units and ecoregions are presented below, along with a discussion about the vegetation types that are generally associated with these ecoregions.

Arizona-New Mexico Mountains Semi-Desert--Open Woodland--Coniferous Forest--Alpine Meadow Province

Vegetational zones resemble those of the Rocky Mountains but occur at higher elevations. The foothill zone, which reaches as high as 7,000 feet, is characterized by mixed grasses, chaparral brush, oak-juniper woodland, and pinyon-juniper woodland. At about 7,000 feet, open forests of ponderosa pine are found, although pinyon and juniper occupy south-facing slopes. At 8,000 feet, pine forest is replaced on north-facing slopes by Douglas fir. Aspen is common in this zone. At about 9,000 feet, the Douglas-fir zone merges into a zone of Engleman spruce and corkbark fir. Limber pines and bristlecone pines grow in the rockier places.

The mountain foothills and surrounding plains are characterized by Chihuahuan Desert vegetation, including specialized desert scrub communities found in the salt flat and dune areas.

California Coastal Chaparral Forest and Shrub Province

Monterey cypress, Torrey pine, Monterey pine, and bishop pine are endemic to the ecoregion. Coastal plains and valleys have sagebrush and grassland communities. Riparian forests containing many broadleaf species grow along streams. Live and white oak are found on hills and lower mountains. Chaparral forest consisting of chamise and various manzanitas is found on steep hill and mountain slopes. Exposed coastal areas support desert-like shrub communities dominated by coyote bush, California sagebrush, and bush lupine.

Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province

Valleys support mixed oak-pine forest, above which lies the Appalachian oak forest, dominated by a dozen species each in the white oak and black oak groups. Above this zone lies the northeast hardwood forest, composed of birch, maple, elm, red oak, and basswood, with a mixture of hemlock and white pine. Spruce-fir forest and meadows are found on the highest peaks of the Allegheny and Great Smoky Mountains. Mixed forest of mesophytic type (that is, containing terrestrial plants which are adapted to neither a particularly dry nor particularly wet environment) extends into narrow valleys of the southern Appalachians, where oak predominates.

Coastal Trough Humid Tayga Province

Throughout the Cook Inlet Lowlands, lowland spruce-hardwood forests are abundant. Bottom land spruce-poplar adjoins the larger river drainages, along with thickets of alder and willow. There are wet tundra communities along the Cook Inlet coastline. The Copper River Lowland is characterized by black spruce forest interspersed with large areas of brushy tundra. White spruce forests occur on south-facing gravelly moraines, and cottonwood-tall bush communities are common in large floodplains.

Colorado Plateaus Semi-Desert Province

Arid grasslands occupy the lowest zone with shortgrass sod seldom covering the ground completely. Xeric shrubs grow in open stands along the grasses, and sagebrush is dominant over extensive areas. In this zone, a profusion of annuals and perennial plants bloom during the summer rainy season and several kinds of cactus and yucca are common at low elevations in the south. Cottonwoods commonly occupy riparian areas. Pinyon pine and juniper dominate the woodland zone, while the montane zone is characterized by ponderosa pine in the south and lodgepole pine and aspen in the north.

Eastern Broadleaf Forest (Oceanic) Province

This province is characterized by winter deciduous forest dominated by tall broadleaf trees that provide dense continuous summer canopy and shed their leaves completely in winter. Forest vegetation is divided into three major associations: mixed mesophytic (with American beech, tulip tree, basswood, sugar maple, and eastern hemlock dominant), Appalachian oak (with white oak and northern red oak dominant), and pine–oak.

Eastern Broadleaf Forest (Continental) Province

This province is similar to its oceanic counterpart but is savanna-like in the northern reaches and characterized by the more drought-resistant oak-hickory association, with both species occurring in abundance. Widespread dominants are white oak, red oak, black oak, bitternut hickory, and shagbark hickory. Understory species include flowering dogwood, sassafras, and hophornbeam. Northern reaches of the oak-hickory forest contain increasing numbers of maple, beech, and basswood.

Everglades Province

Tropical moist hardwood forest covers one-fifth of the area. Cypress forest is extensive, with mangrove widespread along the eastern and southern coasts. Much of the area is open marsh covered by phreatophytic grasses, reeds, sedges, and other aquatic herbaceous plants. Mahogany, redbay, and several palmettos are common, as well as strangler fig and abundant epiphytes.

Florida Panther NWR includes a wetland mosaic with cypress strands and domes, pines, wet prairies, marshes, sloughs, and hardwood hammocks.

Great Plains Steppe and Shrub Province

Tall grasses predominate, extending west from the oak savanna of the eastern edge. Bluestem grama prairie covers the finer textured soils that characterize most of the province. Oak savanna occurs along the eastern border and along some of the major river valleys. Sandsage-bluestem prairies are dominant on the coarse textured soils near the provinces western edge.

Great Plains Steppe Province

This province contains a mixture of shortgrass and tallgrass species. Shorter dominants include blue grama, hairy grama, and buffalo grass. Taller grasses include little bluestem and needle-and-thread grass. Woody vegetation is rare, except on the cottonwood floodplains. In mixed grass steppe,

additional species include green needlegrass, sand dropseed, slender wheatgrass, galleta, and purple three-awn.

Great Plains-Palouse Dry Steppe Province

This province consists of formations of short grasses, usually bunched and sparsely distributed in dry steppe or shortgrass prairie with 6 to 7 arid months per year. The Great Plains grasslands east of the Rockies have scattered trees and shrubs, such as sagebrush and rabbitbrush. The typical grass is buffalo grass; sunflower and locoweed are typical plants. Gradations of cover vary from semi-desert to woodland.

Intermountain Semi-Desert and Desert Province

Sagebrush dominates at lower elevations. Other important plants in the sagebrush belt are antelope bitterbrush, shadscale, fourwing saltbush, rubber rabbitbrush, spiny hopsage, horsebrush, and short-statured Gambel oak. A woodland zone dominated by pinyon pine and juniper lies above the sagebrush belt. Above the woodland zone, a montane belt occurs in which ponderosa pine generally occupies the lower and more exposed slopes and Douglas-fir the higher and more sheltered ones. In the rare occurrences of subalpine above the woodland zone, the characteristic trees are fir and Engelmann spruce.

Laurentian Mixed Forest Province

This province is transitional, as it lays between the boreal forest and broadleaf deciduous forest zones. It consists partly of mixed stands of a few coniferous species (mainly pine) and a few deciduous species (mainly yellow birch, sugar maple, and American beech). Mixed stands have several species of conifer, mainly northern white pine in the Great Lakes region, with an admixture of eastern hemlock. Eastern red cedar is found in the southeast. Pine trees are often the pioneer woody species that flourish in burned-over areas or on abandoned arable land.

Outer Coastal Plain Mixed Forest Province

Temperate rainforest consisting of evergreen oaks, laurels, and magnolias is typical in this province. Lower stratum of vegetation includes tree ferns, small palms, shrubs and herbaceous plants. Lianas and epiphytes are abundant. Along the Atlantic coast, the extensive coastal marshes and interior swamps are dominated by gum and cypress.

Prairie Parkland (Temperate) Province

Vegetation is forest-steppe, characterized by intermingled prairie, groves, and strips of deciduous trees. Trees are commonly found near streams and on north-facing slopes. Grasses are the dominant prairie vegetation. Most are moderately tall and usually grow in bunches. The most prevalent type of grassland is bluestem prairie, dominated by such plants as big bluestem, little bluestem, switchgrass, and Indian grass, along with many species of wildflowers and legumes. The upland forest is dominated by oak and hickory. Cottonwood, black willow, and American elm dominate floodplains and moist hillsides in the western part of the province.

Southeastern Mixed Forest Province

Climax vegetation is provided by medium-tall to tall forests of broad-leaf deciduous and needleleaf evergreen trees. At least 50 percent of the stands are made up of loblolly pine, shortleaf pine, and other southern yellow pine species. Common associations include oak, hickory, sweetgum, blackgum, red maple, and winged elm. Main grasses are bluestem, panicums, and longleaf uniola. Dogwood, viburnum, haw, blueberry, American beautyberry, youpon, and numerous woody vines are common.

Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province

Engelmann spruce and subalpine fir dominate the subalpine zone, while ponderosa pine and Douglas-fir occupy the montane zone. Aspen or lodgepole pine replaces original forest trees after fire in the subalpine zone. Grass, often mixed with sagebrush, regularly covers the ground in open ponderosa pine forests and some treeless areas.

National Elk Refuge contains riparian forest of cottonwood, willow, and aspen along the Snake River floodplain.

Southwest Plateau and Plains Dry Steppe and Shrub Province

This province contains arid grasslands in which shrubs and low trees grow singly or in bunches. Other species include blue grama, buffalo grass, mesquite, oak, juniper, and needlegrass. The endangered sabal palm is native to the Rio Grande delta.

Several units of the Lower Rio Grande Valley NWR are located at the southern tip of Texas, which is characterized by broad coastal prairie carpeted with clumps of razor-sharp cord grass and other low-lying grasses and flowers.

INVASIVE VEGETATION

Invasive vegetation refers to nonindigenous species that have colonized a particular habitat due to its suitability for survival of the species. Many invasive species adversely affect the habitats they invade economically, environmentally, or ecologically. Such vegetation is present in every refuge unit and various management efforts are ongoing to deal with the establishment and spread of invasive species.

SPECIES OF SPECIAL MANAGEMENT CONCERN

Under the Endangered Species Act of 1973 (ESA), the Service has the responsibility to address impacts on federally listed threatened and endangered species, and species proposed for listing. The terms “threatened” and “endangered” describe the official Federal status of certain species as defined by ESA.

Under ESA, candidate species receive no statutory protection, but the Service encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under ESA. The term “candidate” is used officially by the Service when

describing those species for which it has sufficient information on biological vulnerability and threats to support issuance of a rule to list, but issuance of a rule to list is precluded due to other higher priority listings.

The term “proposed” describes species for which a rule to list has been published in the Federal Register; however, a finalized rule has not yet been issued.

Refuges provide habitats that support hundreds of species that are threatened, endangered, or of special concern at the national, regional, and State levels. Some of these species and their habitats may occur in areas suitable for oil and gas development.

WILDLIFE AND AQUATIC SPECIES

Each refuge contains a variety of habitats that support various wildlife assemblages, including diverse populations of mammals, amphibians, reptiles, fish, invertebrates, and birds. Because geographic provinces contain similar wildlife species, general wildlife characteristics of individual refuges can be ascertained by their associated region.

Arizona-New Mexico Mountains Semi-Desert-Open Woodland-Coniferous Forest-Alpine Meadow Province

In this region, the most common large mammal is the mule deer. Mammalian predators include mountain lions, coyotes, and bobcats. Small mammals are the deer mouse, long-tailed weasel, porcupine, golden-mantled ground squirrel, Colorado chipmunk, red squirrel, wood rat, pocket gopher, longtailed vole, Abert squirrel, and cottontail. Some of the more common birds are the northern pygmy-owl, olive warbler, red-faced warbler, hepatic tanager, mountain bluebird, pygmy nuthatch, white-breasted nuthatch, Mexican junco, Stellar’s jay, red-shafted flicker, and the Rocky Mountain sapsucker. Goshawks and red-tailed hawks are also present. The only common reptile in this ecoregion is the short-horned lizard.

California Coastal Chaparral Forest and Shrub Province

Brushy rabbit and opossum are common in this ecoregion. Several species of seals and sea lions live along the California coast. Sea otters and blue whale also inhabit the coastal waters. Coastal California is a major migration route for water and land birds. Shore birds, ducks, and geese inhabit coastal estuaries, lagoons, and mudflats. Other birds include the lesser goldfinch and golden-crowned sparrow.

Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province

Black bear and white-tailed deer are very common throughout the Appalachians. At higher elevations in boreal forest, red-breasted nuthatches, black-throated green warblers, golden-crowned warblers, golden-crowned kinglets, and northern juncos forage in red spruce and Fraser fir trees. In hardwood forests, pileated woodpeckers, downy, hairy, and red-bellied woodpeckers, common flickers, and wild turkeys are common. The region hosts 27 species of salamanders.

Coastal Trough Humid Tayga Province

In this region, muskrats and red foxes are common, as well as moose in lowland areas, and Dall sheep in the uplands. Black bear populations are dense throughout the region. Trumpeter swans nest and tundra swans are present during migration. King, sockeye, and silver salmon are common.

Colorado Plateaus Semi-Desert Province

Mule deer, mountain lion, coyote, bobcat, elk, and antelope share this province with smaller species such as the blacktail jackrabbit, Colorado chipmunk, rock squirrel, wood rat, white-footed mouse, cliff chipmunk, cottontail, porcupine, and gray fox. Ringtail and spotted skunk occur rarely in this region. Common birds include the bushtit, pinyon jay, hummingbird, red-tailed hawk, and rock wren.

Eastern Broadleaf Forest (Oceanic) Province

Bird populations are large in this region, with the most abundant breeding birds being the cardinal, tufted titmouse, and woodthrush. Important mammals include the white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. Box turtles, common garter snakes, and timber rattlesnakes are characteristic reptiles.

Eastern Broadleaf Forest (Continental) Province

In this region, gray squirrel, fox squirrel, and eastern chipmunks are found in abundance. Birds include wild turkey, blue jay, tanager, grosbeaks, and ovenbirds. The cerulean warbler is common in the beech-maple forest.

Everglades Province

Mammals in this region include white-tailed deer, Florida panther, black bear, raccoon, bobcat, opossum, skunk, various bats, marsh and swamp rabbits, cotton rat, and fox squirrel. Manatees inhabit estuaries and interlacing channels. Numerous species of birds are present. Characteristic lizards are the Carolina anole and the brown red-tailed skink. American alligator, rough green snake, key rat snake, and southern Florida coral snake also inhabit the province.

Great Plains Steppe and Shrub Province

This region shares some species with the Great Plains Steppe Province (see below). No bird or mammal species is uniquely abundant.

Great Plains Steppe Province

Large mammals include antelope and coyotes. Jackrabbits are numerous on the steppe, and cottontails are present near streams and cover. Burrowing rodents include ground squirrels, prairie dogs, pocket gophers, and many smaller species. Burrowing predators include the badger and the black-footed ferret. Mourning doves are abundant in shelterbelt plantings. Sharp-tailed grouse, greater prairie chicken, and bobwhite are also present.

Great Plains-Palouse Dry Steppe Province

Antelope are the most abundant large mammal; mule deer and white-tailed deer are also common where brush cover is available. White-tailed and black-tailed jackrabbit are found, as well as the desert cottontail. Two bird species, the mountain plover and McCown's longspur, are unique to the shortgrass prairies east of the Rockies.

Intermountain Semi-Desert and Desert Province

Few large mammals live in this region, but mule deer, mountain lion, bobcats, and badgers occasionally occur. Antelope and prairie dog occur in sagebrush habitat. Other common species include ground squirrels, jackrabbits, kangaroo mice, wood rats, and kit fox. Bird species include burrowing owl, sage sparrow, sage thrasher, American kestrel, golden eagle, ferruginous hawk, and sage grouse.

Laurentian Mixed Forest Province

Mammalian species include short-tailed weasel, snowshoe hare, beaver, muskrat, black bear, striped skunk, marmot, chipmunk, and jumping mouse. Ptarmigan are present year-round; summer resident birds include the white-throated sparrow, northern junco, and yellow-bellied sapsucker.

Outer Coastal Plain Mixed Forest Province

Among the numerous bird species are the prothonotary warbler, white-eyed vireo, wood duck, yellow-billed cuckoo, Louisiana waterthrush, and all the species found in the Southeastern Mixed Province.

Prairie Parkland (Temperate) Province

Mink and river otter occupy riverine forest areas. Ground squirrels and prairie dogs are common in prairies. Birds include the belted kingfisher, bank swallow, spotted sandpiper, and green-backed heron. Upland birds include the horned lark, eastern meadowlark, and mourning dove.

Southeastern Mixed Forest Province

White-tailed deer and cottontail rabbits are widespread. Other species include fox squirrel, gray squirrel, raccoon, fox, and, in the western part of the province, the nine-banded armadillo. The eastern wild turkey, bobwhite, and mourning dove are widespread.

Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province

Common large mammals include elk, deer, bighorn sheep, mountain lion, bobcat, beaver, porcupine, and black bear. Grizzly bear and moose inhabit the northern portions of the province. Small mammals include mice, squirrels, martens, chipmunks, mountain cottontails, and bushy-tailed woodrats. Common birds include the mountain bluebird, chestnut-backed chickadee, red-breasted nuthatch, ruby-crowned kinglet, pygmy nuthatch, gray jay, Steller's jay, and Clark's nutcracker.

Southwest Plateau and Plains Dry Steppe and Shrub Province

Mexican ground squirrel and gray fox are characteristic of this province. White-tailed deer are abundant and armadillo are present. Fox squirrel, raccoon, and free-tailed bats also occur. Wild turkey, mourning dove, scaled quail, and bobwhite are common game birds, and several species of hawks and owls are present.

SPECIES OF SPECIAL MANAGEMENT CONCERN

As described in the Vegetation section, the Service has the responsibility to address impacts on federally listed threatened and endangered species, and species proposed for listing under ESA. The terms “threatened” and “endangered” describe the official federal status of certain species as defined by the ESA.

Refuges provide habitat that supports hundreds of species of animals that are threatened, endangered, or of special concern at the national, regional, and State levels. Special-status species types vary widely across refuges. Some of these species and their habitats may occur in areas suitable for oil and gas development. For instance, the federally endangered whooping crane winters at Aransas and Matagorda Island NWRs in coastal Texas.

VISITOR USE AND EXPERIENCE

Refuges attract over 45 million visitors each year (Sexton et al. 2012). Visitation varies across refuges, and the amount of annual visitation a refuge receives is a function of several factors, including its relative proximity to large population centers and popularity as a destination. Many refuges have large numbers of seasonal and annual visitors. For example, Kenai and Laguna Atascosa NWRs received 572,584 and 440,042 visits, respectively, in 2011 (Carver and Caudill 2013). People visit refuges primarily for recreational purposes, such as wildlife observation, fishing, and hunting.

NIGHT SKY RESOURCES

Dark night skies contribute to ecosystem health and important wildlife behaviors. In addition, visitor interest in and public concern for a particular area’s visual resources, an area’s high degree of public visibility, the level and type of use of an area by the public, all play a part in the visual quality of a particular refuge.

Several regulatory provisions serve to protect visual quality in refuges. The Clean Air Act of 1970 (CAA) establishes goals for visibility in national parks, wilderness areas, and international parks. The CAA recognizes the importance of integral vistas, which are those views perceived from within class I areas of a specific landmark or panorama located outside the boundary of the class I area. Additionally, EPA’s Regional Haze Rule of 1999 (USEPA 1999) calls for states to work together to improve visibility in all mandatory class I national parks and wilderness areas. Clear viewsheds and dark night skies are critical to wilderness character.

As a result of their proximity to active oil and gas drilling and production activities, some refuges currently have existing sources of artificial nighttime lighting associated with oil and gas operations.

These sources may include light created by natural gas burn-off operations (flares) and electric lights used during nighttime activities.

Over the past few decades, artificial lighting has spread measurably across the United States. Figure 4 demonstrates the 1996 average luminance from anthropogenic sky glow at night in the United States based on satellite imagery taken by the Air Force Defense Meteorological Satellite Program. Of particular note is an area of oil and gas development around the Bakken production region of North Dakota. Satellite imagery from 1997 (Figure 5) reveals an area of naturally dark skies, while imagery from 2012 (Figure 6) illustrates how oil and gas development has directly impacted night sky resources in the area through the proliferation of artificial lighting related to mineral production activities.

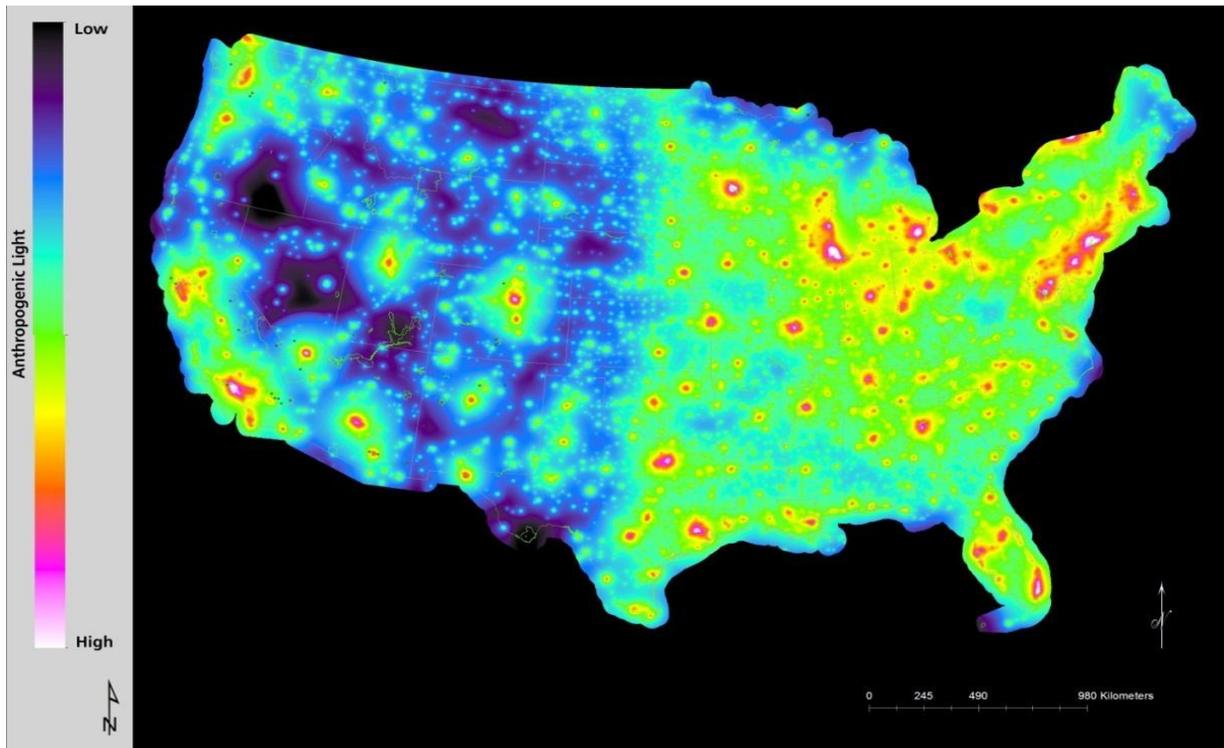


FIGURE 3-2. PREDICTED AVERAGE LUMINANCE FROM ANTHROPOGENIC SKY GLOW IN THE UNITED STATES

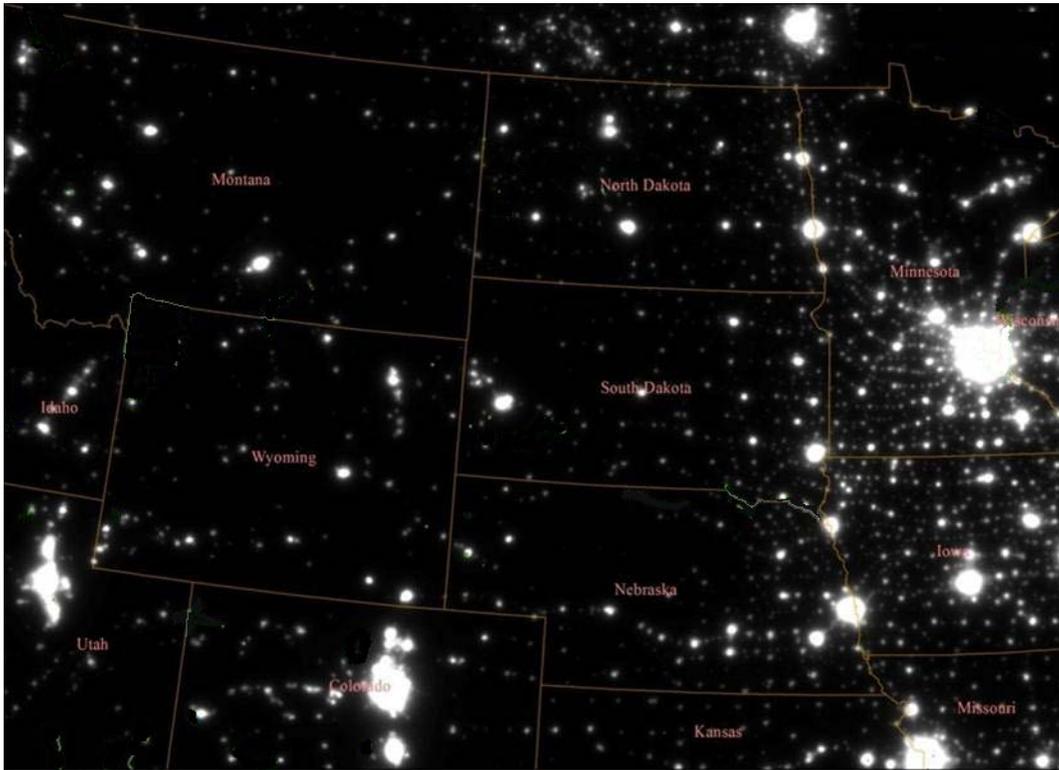


FIGURE 3-3. LIGHT AT NIGHT IN THE ROCKIES AND UPPER GREAT PLAINS IN 1997

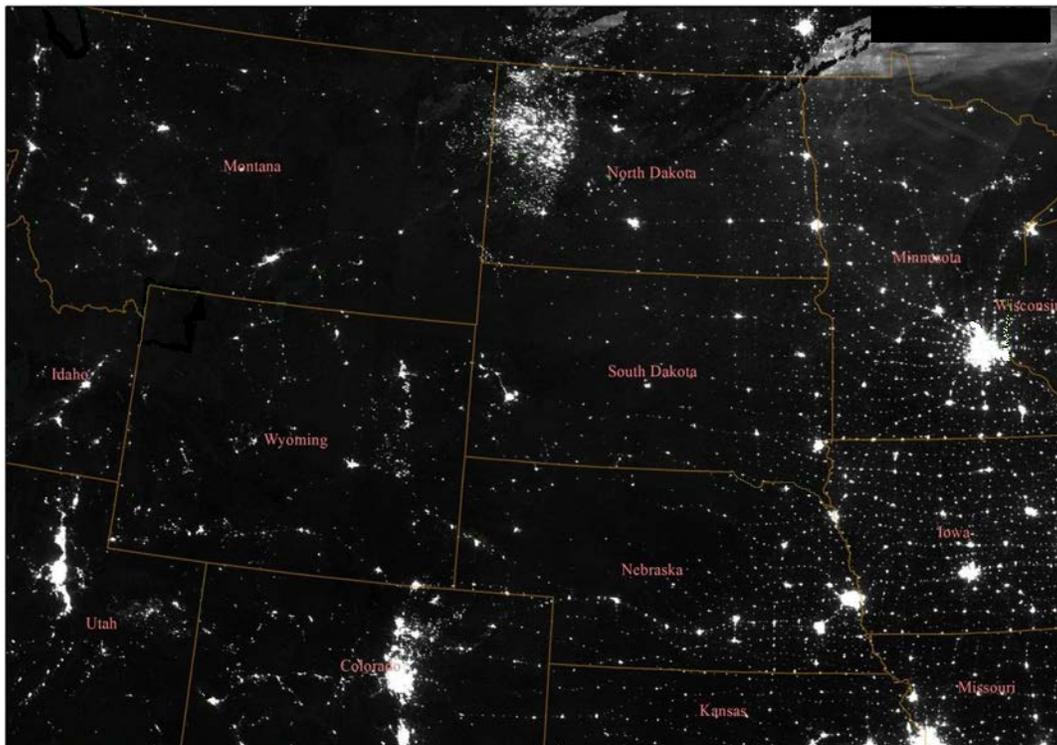


FIGURE 3-4. LIGHT AT NIGHT IN THE ROCKIES AND UPPER GREAT PLAINS IN 2012

NATURAL SOUNDSCAPES AND ACOUSTIC ENVIRONMENT

It is important to distinguish and define certain key terms in regard to natural soundscapes and the acoustic environment.

Acoustic resources—physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence).

Acoustic environment—the combination of all the acoustic resources within a given area—natural sounds as well as human-caused sounds. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls.

Soundscape—the component of the acoustic environment that can be perceived and comprehended by the humans. The character and quality of the soundscape influence human perceptions of an area, providing a sense of place that differentiates it from other regions.

Cultural soundscape—opportunity for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which the refuges were established.

Noise—sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds.

Sound levels in refuges vary greatly, depending on location, topography, vegetation, biological activity, weather conditions, and other factors.

The acoustic environment is a natural resource that is integral to wildlife communication, behavior, and many other ecological processes. Exposure to relatively high noise levels that typically occur close to a sound source can produce potentially harmful physiological responses in humans and other animals, including hearing loss, elevated stress hormone levels, and hypertension. Even low levels of noise can interfere with ecological processes in surprising and complex ways. When ambient sound levels are increased, the listening area for wildlife is reduced. A reduction in wildlife communication distance created by noise might decrease the effectiveness of social behaviors such as predator detection, prey location, mating, and migration. Preserving the acoustic environment and natural sounds of such areas is critical to effective wilderness management and can have important effects on wilderness character. Natural soundscapes and the absence of anthropogenic noise are crucial components of the wilderness qualities of solitude, naturalness, untrammled, and undeveloped character.

Increases in frequency, amplitude, and duration of sound levels can impact human health, visitor experience, wildlife, and ecological systems in a variety of ways. The effects of noise on people can be classified into three general categories: (1) social/psychological effects such as annoyance, nuisance, and dissatisfaction; (2) interference with activities such as speech, sleep, and learning; and (3) physiological effects such as anxiety or hearing loss. The sound levels associated with environmental noise generally produce effects only in the first two categories.

The standard measurement unit of noise is the decibel (dB), which represents the acoustical energy present. Audible sounds range from 0 dB (threshold of human hearing at 1000 Hz) to about 140 dB

(threshold of pain in humans). The normal audible frequency range for humans is approximately 20 hertz (Hz) to 20 kilohertz (kHz). For the purpose of establishing noise regulation and standards, noise levels are measured in A-weighted decibels (dBA), a logarithmic scale which approaches the sensitivity of the human ear across the frequency spectrum. Noise thresholds are provided by various agencies for specific activities such as snowmobiles (NPS) hearing protection on worksites (Occupational Safety and Health Administration) and sound levels in classrooms (EPA). Typical sources of noise within refuges include trucks and automobiles, aircraft, boat motors, motorcycles, all-terrain vehicles, various types of equipment (e.g., tractors, chainsaws, lawn mowers, oil and gas artificial lift equipment, compressors), high-voltage power lines and transformers, and firearms. Sources of noise within refuges are often localized and/or seasonal in duration. High altitude aircraft and roadway noise are pervasive in all seasons and throughout the day.

NOISE FROM OIL AND GAS OPERATIONS

Typical noise sources associated with oil and gas exploration, development, and production include, but are not limited to, compressor stations, pumping units, fuel and water trucks, cranes for hoisting rigs, and concrete pumps used during drilling (La Plata County 2002). Noise levels measured at a distance of 50 feet from the source of oil and gas operations have been reported to be approximately 83 dBA for well drilling and pump jack operations, 71 dBA for produced water injection facilities, and 89 dBA for gas compressor facilities (BLM 2006).

Noise decreases by 6 dB with the doubling of distance from the source under “hard” surface conditions (no intervening ground attenuation) (Caltrans 2013). For example, without considering any attenuation from intervening vegetation or topography, a noise source of 83 dB at a well drilling site (measured within 50 feet of the equipment) would decrease to 35 dB at a distance of 6,400 feet from the site (Table 3).

TABLE 3-3. NOISE DISSIPATION AS A FUNCTION OF INCREASING DISTANCE FROM THE SOURCE

Distance from Source (feet)	Well Drilling (83 dB at 50 feet) Hard Surface Attenuation of 6 dB with Doubling of Distance	Well Drilling (83 dB at 50 feet) Soft Surface Attenuation of 7.5 dB with Doubling of Distance	Gas Compressor Facilities (83 dB at 50 feet) Soft Surface Attenuation of 7.5 dB with Doubling of Distance
50	83	83	89
100	77	75.5	81.5
200	71	68	74
400	59	60.5	66.5
800	53	53	59
1600	47	45.5	51.5
3200	41	38	44
6400	35	30.5	36.5

CULTURAL RESOURCES

The National Historic Preservation Act of 1966 (as amended) (NHPA) is the principal legislative authority for managing cultural resources associated with Service projects. Generally, section 106 of

NHPA requires all Federal agencies to consider the effects of their actions on cultural resources listed on or determined eligible for listing on the National Register of Historic Places (National Register). In addition, federal agencies must minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of NHPA requires Federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the National Register.

Cultural resources, which are defined as the material evidence of past human activities, are found in nearly every refuge. Cultural resources that are or could be present in refuges are described below:

Archeological Resources—Archeological resources are the remains of past human activity and also the records documenting the scientific analysis of these remains, including the record of the effects of human activities on the environment. An archeological resource is capable of revealing scientific or humanistic information through archeological research. Archeological resources can show the spread of ideas over time and the development of settlements from place to place. Many refuges have inventoried some of their lands for archeological resources, but many of these resources (especially subsurface resources) have not yet been identified and may occur in areas where oil and gas development is happening or in areas proposed for oil and gas development.

Cultural Landscapes—Cultural landscapes are settings that humans have created in the natural world. A cultural landscape is a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Historic/Prehistoric Structures—Structures are material assemblies that extend the limits of human capability. Structures can be buildings, bridges, and temple mounds.

Ethnographic Resources—Ethnographic resources are basic expressions of human culture and the basis for continuity of cultural systems. These items include objects and places, such as sites, structures, landscapes, and natural resources, with traditional cultural meaning and value to associated peoples. Research and consultation with associated people identifies and explains the places and things they find culturally meaningful. Ethnographic resources eligible for the National Register are called traditional cultural properties.

The types of cultural resources at each refuge differ and are subject to regional and local influences. As previously mentioned, some refuges may hold yet undiscovered cultural resources, especially archeological resources.

REFUGE MANAGEMENT AND OPERATIONS

Refuge operations refer to the adequacy of staffing levels and the quality and effectiveness of refuge infrastructure in protecting and preserving vital resources and providing for the effective conservation of fish, wildlife, and plants. Refuge operations encompass actions such as resource stewardship, fire management, maintenance, visitor services, administration, research and monitoring, and law enforcement. Refuge facilities include visitor centers, administrative buildings (refuge staff offices and workspace), roads that provide access to and within the refuge (for

administrative, visitor, and emergency use), housing for staff required to work and live in the refuge, management-support facilities (garages, shops, storage buildings and yards used to house and store equipment, tools, and materials), and utilities (phones, sewer, water, and electricity).

Each refuge has amenities and operations commensurate with the size and type of refuge. For example, a refuge the size of the Tensas River NWR has many more roads and maintenance facilities than a smaller refuge unit such as Two Ponds NWR. Related to the EIS, specific features within refuges for which the Service is responsible and which could be affected by the rule revisions include visitor amenities, utilities, refuge roads and turnouts, parking areas, overlooks, and trails, as well as natural resource management and protection.

ADMINISTRATION OF NON-FEDERAL OIL AND GAS REGULATIONS

Management of the oil and gas program in refuges is accomplished by refuge staff with technical support from regional oil and gas specialists in the following regions: Alaska, Southwest, Southeast, and Mountain-Prairie, as well as the national Energy Program specialists in Headquarters, and in Fort Collins and Denver, CO. The majority of fieldwork and coordination with individual oil and gas operators is performed by field staff at each refuge. Field staff typically also have other tasks to perform as part of their regular duties.

Table 4 shows the refuge or complex with full-time staff for oil and gas management and their responsibilities.

TABLE3-4. NATIONAL WILDLIFE REFUGES WITH STAFF PROVIDING OVERSIGHT OF OIL AND GAS OPERATIONS.

Refuge	State	Staffing	Responsibilities
Hagerman	TX	Regional oil and gas specialist	Provides technical assistance to refuges in the Southwest Region, conducts oversight of oil and gas activities at Hagerman NWR.
Texas Chenier Plains Refuge Complex	TX	Oil and gas specialist	Conducts oversight of oil and gas activities at Anahuac, McFaddin, Moody, and Texas Point NWRs.
Lower Rio Grande Valley	TX	Biological science technician/oil and gas specialist	Conducts oversight of oil and gas activities at Lower Rio Grande Valley NWR.
Southeast Louisiana Refuge Complex	LA	Regional oil and gas specialist	Provides technical assistance to refuges in the Southeast Region, conducts oversight of oil and gas activities at Atchafalaya, Bayou Sauvage, Big Branch Marsh, Bogue Chitto, Breton, and Delta NWRs.
Southwest Louisiana Refuge Complex	LA	Wildlife biologist/oil and gas specialist	Conducts oversight of oil and gas activities at Cameron Prairie, Lacassine, Sabine, and Shell Keys NWRs.
Kenai	AK	Fish and wildlife biologist/oil and gas specialist	Conducts oversight of oil and gas activities at Kenai NWR.

SOCIOECONOMICS

Non-Federal oil and gas development is currently being conducted in 107 units of the NWRS. A total of approximately 5,000 non-Federal oil and gas wells are located within these units. Appendix X is a report of nonfederal oil and gas operations within the NWRS. Service data indicates that 1,665 of these wells are actively producing oil and gas or injecting fluids, 2,196 are idle, and the status of the remaining 1,141 wells is being investigated. Initial investigations indicate that perhaps over 1,000 wells in our data will prove to be plugged and abandoned with surface conditions requiring no further management actions. Therefore, the Service expects that approximately 4,000 existing wells could be affected by the Rule. Only 115 of these wells are subject to an SUP or ROW leaving the vast majority unregulated by the Service.

Future development of non-Federal oil and gas rights on refuges that do not currently have oil and gas activities is possible based on: (1) the presence of oil and gas resources in close proximity or within the authorized boundaries of the refuge; and (2) the non-Federal oil and gas mineral rights acreage in the refuges is large enough to support development activity. Based on existence of non-federal oil and gas rights and proximity to active or emerging oil and gas plays, the Service estimates another 32 refuges and 5 WMDs could potentially experience oil and gas proposals at some point. In addition to the geologic (e.g., reservoir, source rock, hydrocarbons) and ownership factors, future non-Federal oil and gas development is also largely dependent upon economic elements.

Current Service policy is to secure permits for new non-Federal oil and gas development. Operators develop a plan of operations that outlines the specific location, process, protection measures, and other information that will be employed during geophysical surveys, oil and gas drilling, production, and plugging and reclamation activities. As part of the plan of operations, mitigation measures are developed to minimize or eliminate the impacts on refuge resources and uses for all regulated operations within park boundaries.

Oil and Gas Drilling and Production

A recent survey of drilling and seismic activity in units of the NWRS indicates an annual average of 10 seismic surveys and 25 new wells have been completed over the past 10 years. For comparison, an average of over 40,000 wells has been drilled each year in the United States over the same timeframe. Similarly, the level of geophysical seismic survey activity in NWRS units is certainly a fraction of a percentage of overall industry activity.

The Service does not track actual oil and gas production from non-Federal oil and gas wells within the NWRS. Based on average production rates from oil and gas wells in the United States (data obtained from U.S. Energy Information Administration) multiplied by the number of active oil and gas wells on refuge lands, non-Federal oil production from refuge lands is estimated to be 3,500 barrels of oil per day, and natural gas production is approximately 220,000 thousand cubic feet per day. While this method of estimating production could vary from actual production by several fold, the percentage of production from refuge lands compared to U.S production is only a small fraction of a single percentage point. [Note: U.S. oil and gas production rate in 2013 was 7,450,000 barrels of oil per day and 82,000,000 thousand cubic feet per day. Actively producing wells was approximately 570,000 oil wells and 487,000 gas wells, yielding average production rates of 13 barrels of oil per day per oil well and 170 thousand cubic feet per day per gas well.]

These estimates provide a context for the oil and gas activity in the NWRS relative to oil and gas activity at the Federal level. Generally, the oil and gas operations within NWRS boundaries are located in regions with considerable oil and gas activity. As a result, NWRS production and drilling activity also represents a very small percentage of overall oil and gas activities within each associated state.

Oil and Gas Economic Contributions to Local Economies

Oil and gas exploration and development support jobs and income in nearby communities for drill rig operators, geophysical seismic companies, construction companies, landmen, and oil and gas support companies that hydraulically fracture and complete wells, among others. Oil and gas production supports industry jobs, including inspecting and maintaining equipment and operations, complying with mitigation standards in terms of vegetation, erosion, and other on-going production and operational needs. These residential and nonresidential workers spend their wages in local and regional communities, supporting local businesses, downstream jobs and income. Oil and gas production also provides economic benefits to oil and gas companies, benefiting economies where these companies are headquartered and the nation overall. Many energy-related jobs provide higher wages and earnings than service sector jobs.

During production, the oil and gas value of production is often taxed through severance taxes and ad valorem taxes, although these taxes vary by state. Additionally, local governments often benefit from property and sales and use taxes on oil and gas equipment. These tax receipts typically benefit state and county agencies, providing funding for schools, roads, social services, and other public service and infrastructure. Other potential social and economic linkages with local oil and gas production include contributions to tax revenues and royalty income for private mineral rights owners.

Oil and Gas Compliance Costs for Operators

Industry currently faces an additional cost to operate in units of the NWRS compared to operating on lands outside refuges. These additional costs currently apply to future operations and the 115 currently regulated operations that are approved under SUPs.

Cost categories specific to conducting non-Federal oil and gas operations under a Service-issued permit include:

1. SUP or ROW application preparation (permitting),
2. Compliance with Service operating standards that may exceed other Federal, State, and local requirements, and
3. Compliance with Service reclamation standards that may exceed other Federal, State, and local requirements.

These regulatory costs may exceed those expenditures necessary to comply with other applicable Federal, State, and local laws and regulation.

Further explanation for each cost category is provided below. It must be noted that actual costs incurred by operators are not commonly available to the Service. Further, the costs associated strictly with compliance with Service regulations versus other Federal, State, and local laws and regulations are often combined, making the specific costs associated with compliance with Service regulations difficult to distinguish. The Service makes these estimates based upon the costs of typical services an

operator might need to procure in order to meet the administrative and operational requirements of Service regulations and policy.

Permitting Costs— Permitting costs apply to future operations. The costs described here include only those permitting costs that occur strictly due to the need to comply with the Service regulation and policy. For example, under the Safe Drinking Water Act, operators of underground injection wells must obtain a permit under the Underground Injection Control permit program established by EPA. Although the Service permit would only be approved when injection wells have a valid Underground Injection Control permit, the cost of obtaining the Underground Injection Control permit is not considered a cost of compliance with the Service permit.

Permitting costs consist of compiling and presenting the operational information and obtaining the data and providing the results of reconnaissance surveys. Permitting costs can vary considerably, depending on the complexity of the operation and whether the permit application is prepared in-house or contracted to an environmental consulting firm. Permitting costs include collection of information via reconnaissance surveys, which can account for the majority of the permitting cost. Surveys often include several or all of the following: location surveys, biological surveys including threatened and endangered species, cultural resource surveys, soundscape surveys, soil and water quality measurements, and wetland and floodplain delineations. Depending on the availability of qualified persons to conduct the surveys in the area of operations and the availability of existing resource information, reconnaissance survey costs can range from several thousand dollars to tens of thousands of dollars. For example, a widespread three-dimensional (3D) seismic survey may involve all of the surveys listed above over large geographic areas possibly costing up to \$100,000. The area of operations for drilling operations is much smaller than a seismic survey and so reconnaissance surveys for drilling proposals will typically cost from \$10,000 to \$30,000 with the length of the access road being a primary factor.

When compared to other Federal, State, and local laws and regulations permitting processes, the time to obtain an approved Service permit can possibly extend an operator's overall permitting process by up to 6 months.

Costs to Comply with Service Operating Standards—This applies to new well drilling conducted under a Service-approved permit and includes costs for those operational requirements that exceed other Federal, State, and local requirements. Under the current regulation and policy, the Service seeks application of best management practices from operators. These operating standards may result in additional operational costs for operators, which are further described by the type of operation. Requirements to meet operating standards can vary significantly depending on the proposed operation and its associated topography, access needs, water and wetland features, location of minerals, and other considerations.

For seismic operations, some mitigation examples that an operator might employ to meet permit standards include off-trail travel by foot along receiver lines to avoid impacts to soils and vegetation, use of third-party monitors, and use of less disruptive (but possibly less efficient) shothole drilling equipment. Such mitigation measures can add \$1,000 to \$2,000 per day to a survey operation. As an example, additional costs of \$1,500 per day for a 2-month long survey could add approximately \$100,000 to project costs and might amount to a 5 percent increase to the overall project cost.

For drilling operations, additional permit-required mitigation strategies might include mud handling and container systems; multiple liner systems on the drilling pad; material requirements for road

base; storm water management; testing and evaluation; and noise and light abatement. These added mitigation measures can vary substantially depending on the topography, proximity to water features, site selection relative to downhole target location, and access to the refuge.

The Service estimates that the percentage increase to comply with permit operating standards is typically a small percentage of a project's total cost (e.g., less than 10 percent). Additionally, the higher the overall drilling costs, the lower the percentage of cost increase caused by Service regulation of the operation.

Operating standards for compliance with production requirements include site security and public safety; pressure and flow control equipment; produced water storage and disposal; maintenance of access roads and pads, including vegetation management; among others. These standards for production operations could increase initial site costs up to \$2,000, with an average cost of \$500 per year increased maintenance per operation.

Cost to Comply with Service Well Plugging and Reclamation Standards—The Service does not require operators to plug wells in a manner beyond State requirements. Thus, operators do not incur additional costs specific to the downhole aspects of well plugging in units of the NWRS. When conducted under a permit, the Service seeks a process that ensures wells sites are reclaimed properly. Meeting permit requirements of leaving the site in a clean and safe condition in preparation for surface reclamation often involves placing liners underneath plugging equipment, using steel tanks instead of earthen pits, removing ground structures (e.g., berms), equipment, and debris, restoring natural contour of the land, and reestablishing native vegetative communities. Using NPS experience with these activities as an analogy to the NWRS, these additional plugging and reclamation costs are estimated to be \$25,000 per well site. The reclamation costs can vary by refuge depending on the soils, vegetation, and topography.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter analyzes beneficial and adverse impacts that would result from implementing any of the alternatives considered in this EIS. It is organized by resource topic and provides a standardized comparison among alternatives based on topics discussed in Chapter 1: Purpose and Need for Action, and further described in Chapter 3: Affected Environment. In accordance with CEQ regulations, direct, indirect, and cumulative impacts are described and the significance of the impacts is assessed in terms of context, intensity, and duration (40 CFR 1502.16). The analysis for each impact topic includes the methods used to assess the type of impact.

For a complete discussion of guiding authorities, refer to the sections titled Federal Laws, Policies, and Regulations Directly Related to Non-Federal Oil and Gas Development in Units of the National Wildlife Refuge System, and Other Applicable Federal Laws, Policies, and Regulations in Chapter 1: Purpose and Need for Action. Collectively, these guiding laws and corresponding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this EIS.

GENERAL APPROACH FOR ASSESSING IMPACTS BY RESOURCE

This impact analysis evaluates the difference in impacts between how oil and gas operations are currently managed on Service lands and how those operations would be managed under either of the two alternatives described in Chapter 2: Alternatives. For natural resource topics addressed in this EIS, the impact of the actual physical changes to natural resources resulting from each of the alternative regulatory rule scenarios is analyzed. Other non-resource topics deal more directly with the economic effects of the rule changes. This approach includes the following elements:

- Focusing the analysis on those rule changes that have measurable impacts on the resources or values being evaluated, and not analyzing administrative rule changes for topics with no impacts.
- Using general analysis methods that follow CEQ and DOI guidelines to comply with NEPA regulations.
- Following basic assumptions used in NEPA analysis relating to the area of analysis, timeframe, and types of impacts.
- Evaluating cumulative impacts for each impact topic from each alternative in combination with other actions that can affect the same resource or value.
- Determining significance of the impacts resulting from each alternative and disclosing any significant impacts found.

These elements are described in more detail in the following sections.

FUNDAMENTAL FACTORS IN ANALYSES OF ACTION ALTERNATIVES

Three key facts are fundamental to the impact analysis of Alternative B: Rule (Preferred Alternative) and Alternative C: Modified Rule:

Environmental Consequences

1. The action alternatives do not authorize any activities that create additional adverse impacts on natural and cultural resources or refuge uses compared to Alternative A: No Action.
2. Overall beneficial impacts on natural and cultural resources are expected for the action alternatives.
3. The beneficial impacts come in conjunction with some increased financial considerations for both the Service and operators.

The analyses are largely programmatic in nature. Future permitting actions that occur under any of the alternatives would be subject to further analyses under NEPA based on specific proposals by operators.

RULE CHANGES ADDRESSED IN THE ANALYSIS OF IMPACTS

Although the rule changes are a substantial revision from the existing regulations and associated policy and practices, not all changes are anticipated to have measurable effects on refuge resources and/or oil and gas operators. In accordance with NEPA guidance to focus analysis on the most important issues, the interdisciplinary team identified those rule changes with the potential for measurable impacts on refuge resources and/or oil and gas operations. Those regulatory provisions and rule changes are described below.

Note that each of these proposed changes to the regulations is discussed under each impact topic, but the details of each are not repeated throughout the analysis, to avoid duplicative text and to make the document easier to read. The reader is asked to refer back to this section or to Chapter 2 for details on the regulatory content of the existing and regulations.

REGULATORY PROVISIONS ADDRESSED UNDER EACH TOPIC

Purpose and Scope

Currently, the Service applies its regulations to areas within the NWRS where the surface estate is held in fee title. Alternative B: the Rule would expand the area to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). Alternative C: the Modified Rule would further expand application of regulations to include operations on non-Federal surface locations drilling underneath a refuge or any operation on private land within a refuge (i.e. an inholding). Under this expanded scope, regulations would be applied only to the extent necessary to protect Federal interests.

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Advances in oil and gas directional drilling technologies allow wells to be drilled into non-Federal mineral estates beneath refuges from surface operation locations outside refuge boundaries. The decision for an operator to use this approach is based on both logistical and cost considerations, including the cost and time factors related to compliance with Service regulations.

In developing alternatives on how to handle operations that directionally drill from a non-Federal surface location to a bottomhole beneath a refuge to access their oil and gas rights, the Service considered a recent NPS review of operations directionally drilling into parks. Currently, for these operations, NPS regulates the downhole activities inside a park. However, it can issue a waiver from the regulation if it finds those downhole operations do not pose a significant threat of damage to park

resources. NPS conducted a review of all 68 wells drilled from surface locations outside a park to bottomholes beneath the park and identified no known instances of impacts to park resources emanating from wellbores drilled and operated beneath parks. The review also revealed that NPS found no cause to require actions beyond compliance with State rules and common industry practices to protect subsurface resources (i.e., usable quality water zones). Waivers were granted in all 68 instances.

Perhaps the most notable aspect of the NPS review was finding that a waiver from the regulations provided a demonstrable incentive to locate surface operations outside park units. According to NPS analysis of operations directionally drilling into a park, 37 percent of operations showed surface logistics that favored a vertical well drilled in the park. Another 37 percent of operations showed that surface logistics made a vertical well impractical, but that there were more favorable surface locations inside the park than outside from which to drill a directional well. Thus, of all of the operations that directionally drilled from outside a park unit, only 26 percent showed unfavorable surface logistics for locating operations inside a park unit. Therefore, you can conclude that the other 74 percent were incentivized by the waiver from regulations to locate their operations outside of the park units. The Service expects similar results.

The Service currently does not apply regulations to operators who use directional drilling from a surface location outside a refuge to reach their oil and gas rights within a refuge. Under existing regulations and policy, the Service generally secures SUPs for new drilling operations. Consequently, there exists a current incentive for operators to locate surface operations outside a refuge when feasible in order to avoid Service regulations and their associated administrative and operational costs. Time requirements inherent to the permitting process may also influence an operator's decision.

Alternative B, the rule and preferred alternative, provides an even greater incentive for operators to locate their operations outside refuge units by providing a full exemption from the rule. The rule includes provisions for maintaining financial assurance, access fees, and cost recovery, if operating on a refuge. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Removing the surface activities associated with oil and gas operations from inside refuges serves to accomplish the objectives of regulation (avoidance or minimization of impacts to NWRS resources and uses).

Alternative C would expand the Service jurisdiction under the regulations to encompass surface and subsurface operations outside the boundary of a refuge. These operations would be subject to the full regulatory requirements of a new operation. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. As a result, much of the incentive to locate operations outside the refuge provided by avoiding Service regulations would be lost.

Requirement to Obtain a Service Permit to Conduct Operations

Under current regulations and policy, the Service generally secures either an SUP for new operations, such as seismic surveys or new well drilling. Under Alternatives B and C, a clear requirement for operators to have an approved operations permit prior to conducting new operations would be codified. Thus, for new operations, the requirement to obtain a Service permit varies under each alternative only due to the changes in scope and impacts.

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New Operations and Existing Operations under a Service-issued SUP

An analysis of Service statistics indicates 115 existing production operations (i.e., individual wells) are being conducted under either an SUP; from a total of approximately 4,000 existing wells. Alternative A assumes new operations would be, in most cases, under a Service-issued permit. Because there would not be a formal and consistent permitting process required for operations on a refuge, the protections for refuge resources and uses would continue to be inconsistent and based, in large part, on an operator's willingness to cooperate with a refuge manager in avoiding or minimizing impacts from their operations to refuge resources and uses.

Under Alternative B, existing operations under an SUP may continue producing under the terms of that permit, which invariably include a means to ensure that operational standards of the rule can be achieved. If the existing SUP does not cover reclamation operations to the extent that such operations will meet Service reclamation standards outlined in the rule, operators must amend their permit or apply for a new operations permit.

Under Alternative C, all new and existing operations accessing oil and gas rights beneath a refuge would be required to obtain an operations permit, including those operations that use directional drilling from non-Federal surface locations adjacent to or within a refuge boundary (i.e., inholding).

Pre-existing Operations

Existing operations not under a Service permit conducted prior to the finalization of the revised regulations would be considered "pre-existing operations." Pre-existing operations merit discussion under a separate sub-heading because they represent as many as 4,000 wells. Though the Service is confident in the total number of wells in refuges being approximately 5,000, we are investigating the status of about 1,100 wells. Initial investigations have identified many wells that have been plugged and abandoned with site conditions such that they warrant no further management actions. Until that investigation is completed, we can estimate the number of operations that would need further management actions and be subject to Service regulation to be approximately 4,000.

Pre-existing operations are managed on a case-by-case basis. When substantial and unnecessary impacts to refuge resources and uses occur, such as spills or unauthorized use of Federal surface, we address these through application of other laws and regulations, and cooperation with other permitting agencies and operators. As a result, the levels of protection are inconsistent across the Service, and even across individual refuges since the levels of cooperation among operators can vary.

Additionally, operators with these pre-existing operations would need to obtain an operations permit before modifying a pre-existing operation or beginning any new operation. This requirement would ensure that any new, adverse impacts to refuge resources from new or modified activities would be avoided or minimized to the maximum extent possible.

Eventually, all pre-existing operations would be required to obtain a permit for plugging and reclamation and comply with all Service reclamation standards. Ensuring that all operations are reclaimed to Service standards is the most important aspect of ensuring that refuge resources, such as geology and soils, water, and wetlands will be protected or restored long-term from the impacts of the activities associated with oil and gas.

Under Alternative C, as described in the preceding section, pre-existing operations would be required to obtain an operations permit and comply with all regulatory provisions including the relevant

operating and reclamation standards, maintenance of financial assurance, reimbursement to the Service for its costs associated with administering the operations permit, and payment to the Service for access to the oil and gas right boundary. Compared to Alternative B, the further protections afforded to refuge resources and uses under Alternative C would be minimal for several reasons. First, most of the impacts to refuge resources and uses [or you could substitute specific impact topic] occurred when the operation location was chosen and developed. Most continuing impacts can be avoided or minimized through compliance with applicable State and Federal laws. Finally, because pre-existing operations must be reclaimed to Service standards, most of the impacts to refuge resources and uses from these operations would be mitigated over the long-term.

Time, Place, and Manner

The best tool refuge managers have to avoid or minimize oil and gas impacts is to use time, place, and manner stipulations. These considerations are available for issuing permits for new operations and have already been implemented for those existing operations already under a Service-issued permit. However, the majority of existing operations are not under a Service-issued permit, and the opportunity to mitigate impacts using timing and locational considerations has passed. So, the Service recognizes the need to apply different permit requirements for these classes of operations.

The *place* factor in the “time, place, and manner” equation is often most important in terms of ability to protect an environmental resource. Most of the impacts to refuge resources and uses from operations occur when the operator chooses and develops a site to accommodate their drilling and production operations. The risks created by a poorly selected location cannot easily be overcome with even the best operational methods (Lawson et al. 2011). Conversely, proper site selection can do much to mitigate the effects of accidents or environmentally unsound practices (Sawyer et al. 2006). Timing and spatial restrictions may reduce impacts on a resource (Bradshaw et al. 1997), but typically are poorly understood and apply to very small areas to be effective for wide ranging species in decline (Walker et al. 2007).

Since new operations create the greatest additional impacts, proper site planning, timing restrictions, and BMPs can accomplish a great improvement in resource protection, thus justifying a permit system, as advocated by Alternatives B and C. In Alternative B, the permit process focuses on the full suite of time, place, and manner considerations on those new operations that create the highest level of incremental impacts. By requiring a reclamation standard for all operations, regardless of status, it also ensures long-term rehabilitation of habitat damaged by all operations.

While Alternative C may provide some additional protection to refuge resources and uses, it would not be able to remedy a majority of the impacts to refuge resources and uses caused when the operators chose the time, place, and manner of these pre-existing operations. For example, on existing operations, the operator’s well has already been drilled and the area of operations (access route, well site, production facilities, and routes for gathering lines) was established and impacts to refuge resources, such as geology and soils, wetlands, and wildlife-dependent recreation, occurred prior to the acquisition of a refuge.

Many of the continuing unnecessary impacts occurring from existing operations (e.g., inadequate containment of spills) without permits can more cost effectively be addressed through stricter adherence to existing Federal (e.g., SPCC) and State laws.

Enforcing Existing Regulations Can Reduce Impacts

Currently, Service Law Enforcement does not have the authority to enforce State oil and gas regulations on refuge lands and waters. Many State oil and gas agencies lack adequate staff to inspect operations and enforce regulations (Keel 2007; Purpera 2014). Therefore, it is difficult to ensure that pre-existing operations are in compliance with laws and regulations that may provide varying degrees of protection for refuge resources and uses. For example, most States provide for protection of surface and groundwater via well design requirements and oil pollution control measures, and have requirements for plugging and abandoning wells (State Regulation Summary, FWS Report 2013).

Under Alternative B, our rule, pre-existing operations could continue as long as they comply with applicable existing Federal, State, and local laws, as well as the General Terms and Conditions outlined in the rule. Though not required to obtain a Service operations permit during production, the Service would maintain an active management role by assimilating nonconflicting State laws and regulations into the rule, giving the Service greater authority to ensure these operations are in compliance with applicable laws. For example, in an assessment of State regulations conducted by the Ground Water Protection Council (GWPC) for the U.S. Department of Energy (DOE), the GWPC found that 23 of 27 oil-producing States assessed required oil production site storage tanks to have secondary containment dikes to contain leaks and spills (GWPC 2014). Additionally, the GWPC (2014) reported that 23 of the 27 States require reporting and remediation of spills and 13 of the 27 States specify clean-up standards for spills.

Some States also have siting or setback requirements for pits (production skim pits and reserve pits) with some States prohibiting the use of pits in the 100-year floodplains or in areas with shallow aquifers (GWPC 2014). An operator's compliance with these types of laws and the Service's ability to assist in the enforcement of these laws would provide additional protection to refuge resources and uses.

Assimilating nonconflicting State laws and regulations would provide the respective States with much needed assistance in ensuring compliance with their oil and gas regulations as well as enforcement to ensure corrective action is taken in the event of noncompliance. The need for this type of assistance is borne out by an audit report of inspection and enforcement of oil and gas field operations by the Texas Railroad Commission (TRRC) (Keel 2007). The Texas State Auditor's report found that 25 percent of the TRRC district offices conducted onsite inspections on 70 percent of complaints and spill notifications related to oil and gas exploration and production activities (Keel 2007).

The Louisiana Legislature published a report documenting that the Office of Conservation "did not conduct routine inspections in accordance with timeframes established by the Commissioner of at least 26,828 (53%) of 50,960 oil and gas wells at least once every three years from fiscal years 2008 through 2013" (Purpera 2014). In addition, 12,702 (25%) were not inspected at all during this timeframe." The report also found that the Office of Conservation "did not consistently or timely address violations cited on inspections. Of the 7,665 routine inspections that failed from fiscal years 2008 to 2013, 1,179 (15%) did not receive a compliance order to correct the violation." Although assimilating nonconflicting State laws and regulations into the rule would provide protection to refuge resources and uses, State laws and regulations vary considerably, particularly in addressing impacts to surface owners and wildlife (Engesser 2013).

Complying with existing State oil and gas regulations can reduce oil and gas impacts on refuge resources. For example, Louisiana oil and gas regulations require “reconditioning... on any well ... leaking gas or oil between the oil string and next larger size casing string...” (La. Admin. Code tit. 43, Part XIX, §113). This requirement, when enforced, may stop potential leaks before they contaminate surface and groundwater. Another example from Louisiana oil and gas regulations is the “unpermitted or unauthorized onsite or offsite storage, treatment, disposal or discharge of E and P Waste,” which is prohibited (La. Admin. Code tit. 43, Part XIX, §503). Enforcement of this provision provides an additional layer of protection from leaks or spills of waste materials. Additionally, limiting “access to exploration and production waste transported on land shall be provided by a lockable gate system” (La. Admin. Code tit. 43, Part XIX, §509) would protect most wildlife and visitors from accidental exposure.

Performance-Based Standards

Current policy recognizes that the diverse nature of proposals and the environments in which they are conducted does not allow for the complete standardization of stipulations and conditions to impose on oil and gas operations. Consequently, oil and gas activities are managed on an individual unit basis, with protective stipulations developed in a site-specific manner. Generally, stipulations are applied to Service permits to include protection of air quality, soils, water, wildlife, wildlife habitat, and other refuge resources.

Current policy and training, however, have not established a suite of performance-based standards for protection of refuge resources and uses. As a result, the levels of protection required in SUPs can vary widely across the NWRS. So, under Alternative A, the level of protection for refuge resources and uses would continue to vary.

Under Alternative B, the preferred alternative, the regulations establish performance-based standards for avoiding or minimizing impacts to refuge resources or visitor uses during operations. The rule also includes standards for achieving successful surface reclamation once operations end.

Operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations as a matter of course. The modified rule would establish standards relative to downhole operations including drilling, well stimulation, and well maintenance during production, and well plugging. However, as most of these regulations would overlap with State regulations of downhole operations, this would not offer much additional protection to refuge resources and uses.

Well Plugging (Maintenance of Idle or Shut-In Wells)

Current regulations and policy do not address procedures for wells that are no longer active, but are not scheduled to be plugged in the near future. Instead, the Service relies on State rules for maintaining wells in shut-in status. Therefore, under Alternative A, there is no guarantee that an operator will plug or shut-in their wells in a manner that ensures protection of refuge resources and uses.

Under Alternative B, the proposed procedures would be consistent with the way many States approach the issue of inactive wells, and recognize that certain economic or logistical reasons exist to justify maintenance of wells in shut-in status for extended periods of time. Rather than a “produce or plug” policy, the regulations would provide assurance that shut-in wells are maintained in an

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environmentally sound and safe manner. Operators would be required to plug a well when any of the following occurs:

- (a) The drilling operations have ended and the operator has taken no further action on its well within 60 calendar days;
- (b) A well, which has been completed for production operations, is continuously inactive for a period of 1 year; or
- (c) The period approved in an operations permit to maintain a well in shut-in status has expired.

The operator could apply for either an operations permit or a modification of its approved operations permit to maintain its well in a shut-in status for up to 5 years. The application to extend the plugging requirement would describe why drilling or production operations have ceased and the reasonable future use of the well, demonstration of the well's mechanical integrity, and a description of how relative operating standards would be maintained while the well is idle. Additional extensions can be obtained by submitting a new application so long as operating standards can be maintained.

The process for well plugging under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole plugging operations as a matter of course. As previously discussed, an operator's compliance with State law should be sufficient in protecting refuge resources and uses.

REGULATORY AREAS ANALYZED IN DETAIL ONLY IN REFUGE MANAGEMENT AND OPERATIONS AND SOCIOECONOMICS TOPICS

Several provisions common to all alternatives have notable financial and administrative consequences on the Service and the regulated community that are both adverse and beneficial. These include the permitting process and provisions covering financial assurance, cost recovery, access fees, and third-party monitoring as discussed in this section. A detailed analysis is provided under the Refuge Management and Operations and Socioeconomic impact topic sections.

Though the effects of these provisions could indirectly benefit refuge resources and uses, the connection between the provision and resource protection is less direct. Therefore, it is more suitable for a general discussion of benefits to all natural and cultural resources and refuge uses rather than a repetition in each impact topic area. The general analysis is provided here.

Permitting Process

Currently, the permitting process is described in policy in general terms and applied in various ways across the Service. The *Management of Oil and Gas Activities on National Wildlife Refuge System Lands* handbook provides guidance for obtaining an SUP as well as the minimum information contents that should be included in an SUP application. The policy does not specify timelines in which the Service will respond to an operator's submission of information.

The rule establishes a uniform process for obtaining an operations permit, including:

- initial steps in developing a permit application,
- comprehensive description of contents of the application,
- the Service's review of the application, including timelines,
- the Service's approval standards, and

- the actions the Service may take on the application including timelines.

The permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations as a matter of course.

Performance Bond (Financial Assurance)

The Service does not typically require financial assurance as a condition of an SUP issued for non-Federal oil and gas operations. Operators in Alaska are permitted using ROWs under 43 CFR part 36, which provides a requirement for financial assurance.

Alternative B, the preferred alternative would require financial assurance as a condition of approval of an operations permit. Financial assurance would be set equal to the estimated cost of reclamation. The Service would release the bond when the operator has met all applicable reclamation standards. The rule also holds that failure to comply with any provision of an operations permit could result in forfeiture of a portion of the financial assurance needed to remedy the condition of noncompliance. This provides the Service with an enforcement tool and provides an operator with additional incentive to remain in compliance with its permit.

The performance bond under Alternative C would be the same as Alternative B.

Cost Recovery

The Service does not currently seek cost recovery for administration of SUPs for non-Federal oil and gas operations. Operators in Alaska are typically permitted using ROWs under 43 CFR Part 36, which provides for cost recovery.

Under Alternative B, the preferred alternative, the Service is proposing to reserve the right to require for operators to reimburse the Service for the costs of processing and administering temporary access permits and operations permits where administrative costs of processing applications are significant. The Service would determine the amount of reimbursement by the actual staff time spent directly processing permit applications and subsequently monitoring the operation for compliance.

The process for Cost recovery under Alternative C would be the same as Alternative B.

Access Fees

Under current regulations and policy, the Service does not generally assess fees for an operator's use of a Federal surface for access to their oil and gas rights boundary, except in Alaska. For refuges in Alaska, administration fees are charged for the issuance of SUPs for seismic surveys. For other oil and gas activities in refuges in Alaska, such as road and well pad construction, the Service issues a ROW permit and charges access fees.

The rule, Alternative B, recommends the Service charge a fee for commercial vehicles using Service-administered roads. This fee could be used to reduce maintenance costs, such as purchasing fuel for a road grader, gravel for a road, or maintaining refuge equipment used in road maintenance. The proposed regulation would also set a fee for new access (e.g., roads or gatherings lines) across Federal lands. This fee would reduce the cost of improving habitat on the refuge, purchasing additional lands to offset the loss of use, or reclaiming other oil and gas sites. The Service would set the fee amount using generally accepted practices. For example, the Service could set fees consistent

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with Service current regulations regarding fees for access and rights-of-ways (50 CFR 29.21), or calculate fees using the BLM's Linear Rights-of-way Fee Schedule, or appraisal.

The access fees under Alternative C would be the same as Alternative B.

Third-Party Monitoring

The *Management of Oil and Gas Activities on National Wildlife Refuge System Lands* handbook provides guidance for third party monitoring of seismic surveys and drilling operations; however, the use of monitors at the expense of an operator is not required, but can be negotiated between the refuge manager and the operator. The use of third party monitors is a common industry practice and has become a typical component of seismic surveys conducted in refuges pursuant to a special use permit. Third-party monitoring is effective in ensuring compliance and minimizing impacts (Howard et al. 2014).

The rule, Alternative B, would codify existing practices by allowing the Service to require that operators hire third party monitors when they are necessary to ensure compliance and protect refuge resources and values. The use of third party monitors helps ensure that the Service receives unbiased, reliable, and timely monitoring information demonstrating an operator's compliance with its permit. The rule would describe the criteria that the Service would consider when making the decision to require an operator to pay for a third party monitor. The criteria could include an operator's proposal for self-monitoring. The third party monitor would report directly to the Service to ensure oversight and accountability and prevent the appearance of a conflict of interest.

Third-party monitoring under Alternative C would be the same as Alternative B.

REGULATORY AREAS NOT ANALYZED IN DETAIL UNDER EACH TOPIC

Other regulatory provisions and rule changes addressed in Chapter 2: Alternatives are relatively minor or administrative in nature and would have no appreciable impacts on any of the impact topics included in this EIS. These areas are discussed briefly below, but are not analyzed further in this chapter.

Change of Operators

A change of operator occurs anytime an entity exercising non-Federal oil and gas rights transfers those rights to another party who would assume responsibility for operations. Under current conditions, there are no general requirements of either the former operator or the new operator to notify the refuge manager that a transfer of rights and responsibilities for the operation has occurred. Other than SUPs that contain a requirement to provide notification of a change in operator, refuge managers are most often made aware of a change in operator when signs at operations sites change names.

The rule, Alternative B, outlines the steps for both the transferring party and the new operator. All operators would be required to notify the Service within 30 calendar days of the transfer, the contact information of the party to whom the operation was transferred, the effective date of the transfer, and a description of the rights transferred. The former operator must also provide written acknowledgement from the new operator that the contents of the notification are true and correct. If the operations are being conducted under a Service-issued permit, in addition to the notification

requirements above, the former operator would remain responsible for compliance with its SUP or operations permit until the new operator completes the application process for a new operations permit with all its terms and conditions. Also, if financial assurance is a component of the permit, the Service would not release the financial assurance until the new operator replaces it.

In a transfer of an operation under an SUP, the new operator would need to agree in writing to conduct operations in accordance with all terms and conditions of the previous operator's permit, and file any financial assurance required under the permit with the Service.

If the transferred operations are pre-existing wells, the new operator, within 30 calendar days from the date of the transfer, must provide to the Service its right to operate documentation and company contact information. The new operator must apply for an operations permit within 90 days of the transfer.

New operators also have the ability to propose modifications to their operations as outlined in the rule.

The process for a change of operators under Alternative C would be the same as Alternative B.

Administration of a Permit

Under current regulation and policy, the Service's administration of SUPs, found at 50 CFR Parts 25-29, would apply. These permit vehicles provide processes for modifying permit terms to account for unexpected or changed conditions, addressing conditions of noncompliance, and appealing decisions made by the Service.

Under Alternative B, the rule, the Service would administer a permit as follows:

- ***Modification of an Operations Permit.*** The rule would provide the Service or operator a method to modify an operations permit to address new or unanticipated changes in operational or environmental conditions. Any modification to an approved permit must meet the same criteria that apply to an operations permit as outlined in the application review process. A modification is an action not considered or included in the original permit and that would cause additional, notable impacts on refuge resources. Examples of a modification could include drilling additional wells from the same pad, creating additional surface disturbance (expanding the footprint of a well pad, realigning a road), or converting a natural gas well into a wastewater disposal well. Operators must consult with a Refuge Manager to determine whether proposed change in activities would be considered a modification. Minor actions that are not specifically addressed in the operations permit but are within the scope of the impacts analyzed are not considered modifications subject to additional review and approval. Examples of such minor actions would include repositioning of surface facilities within the permitted area of operations, minor changes in color schemes, or nonroutine maintenance actions.
- ***Prohibited Acts and Penalties.*** The rule lists the prohibited acts that would constitute a violation of these regulations, as well as the penalties associated with violations. Prohibited acts include: operating in violation of terms or conditions of an operations permit or a Service-issued permit under § 29.43, damaging Federal property, conducting operations without Service authorization, failure to comply with suspension or revocation orders, or failure to comply with Federal, State and local statutes or regulations.

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The refuge manager, in coordination with Service law enforcement, would have the discretion to fine, suspend, or revoke an operation if the operator engages in a prohibited act. Any violation that results in a threat to public safety or risk of damage to refuge resources and values will be addressed by the Refuge Manager.

- **Appeals.** As in Alternative A, if an operator disagrees with a decision made by the Service, the appeals process in 50 CFR § 25.45 would apply. The operator must exhaust these remedies before the Service decision is considered a final agency action that is subject to review under the Administrative Procedure Act.

The administration of a permit under Alternative C would be the same as Alternative B.

GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ and DOI recommendations to comply with NEPA regulations. The analysis incorporates the best available scientific literature applicable to the region and setting, species and areas being evaluated, and actions being evaluated in the alternatives.

Primary steps for assessing impacts include identifying potential impacts on refuge resources and values from oil and gas exploration, drilling, production, and reclamation under Alternative A, and then assessing the change (if any) to those impacts under the action alternatives. The degree of potential impacts on resources from oil and gas development depends on the type and location of operations and mitigation measures used to reduce impacts. As a result, a qualitative analysis of the potential impacts of oil and gas operations on the resources was conducted based on actual experience of the Service in managing non-Federal oil and gas operations, best professional judgment, and information available in the literature.

Impacts on resources and values from oil and gas development can occur during geophysical exploration, drilling and production, and reclamation phases of development. Current operations consist of pre-existing oil and gas production sites with and without SUPs. There are currently 5,002 oil and gas wells in 107 refuge units. Actions at some of these refuges also include ongoing or planned geophysical surveys and well plugging/reclamation.

Typical impacts on resources and values that could occur from current and future operations during the various phases of oil and gas development (geophysical exploration, drilling and production, and plugging/reclamation) are described in the analysis.

Basic Assumptions Used in this Analysis

The following guiding assumptions were made to provide context for this analysis:

Analysis Period—This EIS assumes that the regulations would be in effect for at least the next 20 to 30 years.

Analysis Area—The geographic study area for all topics addressed in this EIS comprises the refuge units that currently have oil and gas operations (107 refuge units) and those units that are considered more likely to be affected by future oil and gas operations, based on their proximity to existing oil and gas development outside the refuge units, and their immediately adjacent neighboring properties,

except for the socioeconomics topic, which covers a broader area of analysis to address impacts on the local and regional economies. Table 1-1 in Chapter 1 lists the refuge units.

Duration and Type of Impacts—For the purpose of the analysis provided in this EIS, the following assumptions are used for all impact topics:

Duration describes the length of time an effect will occur, either short term or long term.

Short-term: Impacts are those that occur up to one year.

Long-term: Impacts are those occurring over several seasons through the next 20 to 30 years.

Type describes the classification of the impact as beneficial or adverse, direct or indirect.

Beneficial: A positive change in the condition of the resource or a change that moves the resource toward a desired condition.

Adverse: A change in the condition of the resource that detracts from its condition or that moves the resource away from a desired condition.

Direct: An effect that is caused by an action and occurs in the same time and place.

Indirect: An effect that is caused by an action but occurs later in time or is farther removed in distance, but is still reasonably foreseeable.

Context describes the action relative to the area or location in which the impact will occur. The effects may be site-specific, local, regional, or even broader in scale. We are analyzing the impacts in several contexts when the impact varies geographically, over time, or in some other way.

SIGNIFICANCE OF THE IMPACTS

According to the NEPA regulations adopted by the President’s CEQ (40 CFR 1500–1508), the term “significantly” is based on the twin criteria of context and intensity (40 CFR 1508.27).

Context—This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity—This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
- The degree to which the proposed action affects public health or safety.

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- Unique characteristics of the geographic area such as proximity to historic or cultural resources, refuge lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973.
- Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Significance is addressed in the conclusion section at the end of the chapter.

CUMULATIVE IMPACTS ANALYSIS METHOD

CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process for Federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including Alternative A.

Cumulative impacts were determined by considering the combined effects of the impacts of the alternative being considered with the impacts of other past, present, and reasonably foreseeable future actions and assessing the contribution that the alternative makes to the overall cumulative impact on a resource or value. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans that would affect the units in question and, if applicable, the surrounding region. In accordance with CEQ guidance, past actions were included “to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for the actions and its alternatives may have a continuing, additive, and significant relationship to those effects” (CEQ 2005). Cumulative actions that could affect the various impact topics addressed in this chapter are presented below, both at a programmatic level and a more site-specific level for those refuge units with exempt operations.

The planning team identified programmatic level actions for all refuges and adjacent lands in the overall area of analysis from general literature and knowledge of the refuges and the regions in which they are located. These include the following:

TABLE 4-1. PROGRAMMATIC-LEVEL ACTIONS IN REFUGE UNITS.

Past, Present, and Reasonably Foreseeable Activity in Area of Analysis	Descriptions of Cumulative Actions
Prescribed fires and fire management actions	Controlled burns and mechanical fuel reduction to reduce fuel loads; plus other fire management actions such as fire line construction for suppression
Service facility and road construction	Construction of buildings, visitor use and administrative facilities, and road construction and repair
Vegetation management	Treatment of areas with herbicides or mechanical methods to reduce exotic plants; other vegetation management includes removal and control of vegetation for utility lines
Trails development and maintenance	Clearing, grading, and surfacing of trails
Off-road vehicle (ORV) use	Use of ORVs (all-terrain vehicles, 4-wheel drives) off road and in areas around the refuges
Abandoned mine lands reclamation	Reclamation of abandoned mine land sites, including contouring, revegetation, cleanup of contaminated materials; installation of safety features and wildlife protection at shafts
Mining and logging activities	Vegetation removal; creation of deep openings or stripped lands; spoil piles, acid mine drainage at certain locations; clearing and harvesting of trees in forests around refuges; change in natural vegetation; road construction; some replanting and surface reclamation
Recreational use	Wide range of recreational activities including camping, hiking, hunting, boating, etc., that are sources of trampling, noise, wildlife effects
Ranching, agricultural land uses	Grazing and planting of crops – change in natural vegetation and land use
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Clearing for development and permanent footprint of development; sources of noise, lighting, pollution during construction and use; industrial uses can include air or water emissions
Future oil and gas development on adjacent lands	Oil and gas wells and associated roads and pipelines, transportation and collection/storage facilities on adjacent lands (see trends information, in text below)
Oil and gas well plugging and reclamation activities inside and outside refuges	Site reclamation, including restoration of natural contours, topsoil and vegetation cover, and removal of sources of contamination and contaminated soils
Recovery actions against operators that damage refuge resources	Cleanup of areas and recovery of natural resources that have been damaged from oil and gas spills that affected refuge lands and resources

The cumulative actions above would be expected in or near the refuge units included in this EIS and are addressed generally in a programmatic manner.

Trends in oil and gas development can also affect cumulative impacts. Energy development on lands adjacent to Service lands is expected to continue into the foreseeable future. The exploration and production of shale oil and gas, in particular, is anticipated to increase dramatically over the next 30 years. The U.S. Energy Information Administration's *Annual Energy Outlook 2015 Early Release* projects U.S. natural gas production to increase from 23.0 trillion cubic feet in 2011 to 33.1 trillion cubic feet in 2040, a 44 percent increase. Almost all of this increase in domestic natural gas

production is due to projected growth in shale gas production, which is expected to grow from 7.8 trillion cubic feet in 2011 to 16.7 trillion cubic feet in 2040 (EIA 2013).

Currently active and prospective shale plays that underlie or are located in close proximity to refuge units include the Utica and Marcellus (which underlie the Iroquois and Montezuma NWRs in New York, Erie NWR in Pennsylvania, Ohio River Islands and Canaan Valley NWRs in West Virginia), and Tuscaloosa (which underlies Bayou Cocodrie, Bogue Chitto, Cat Island, Catahoula, Grand Cote, and Lake Ophelia NWRs in Louisiana and St. Catherine Creek NWR in Mississippi). Refuge units with shale oil or gas underlying or located nearby include the following refuge units: Red River NWR in Louisiana, Caddo Lake NWR in Texas, Tishomingo NWR in Oklahoma, Holla Bend NWR in Arkansas. Other refuges lie within shale formations include Patoka River NWR in Indiana, Lake Thibadeux and Creedman Coulee NWRs in Montana, Ouray NWR in Utah, and numerous refuges and easements in North Dakota.

Figure 4-1 illustrates the geographic distribution of these shale plays in the United States. Because there are shale gas resources on adjacent lands, this increase in exploration and production activities represents a cumulative action and impact.

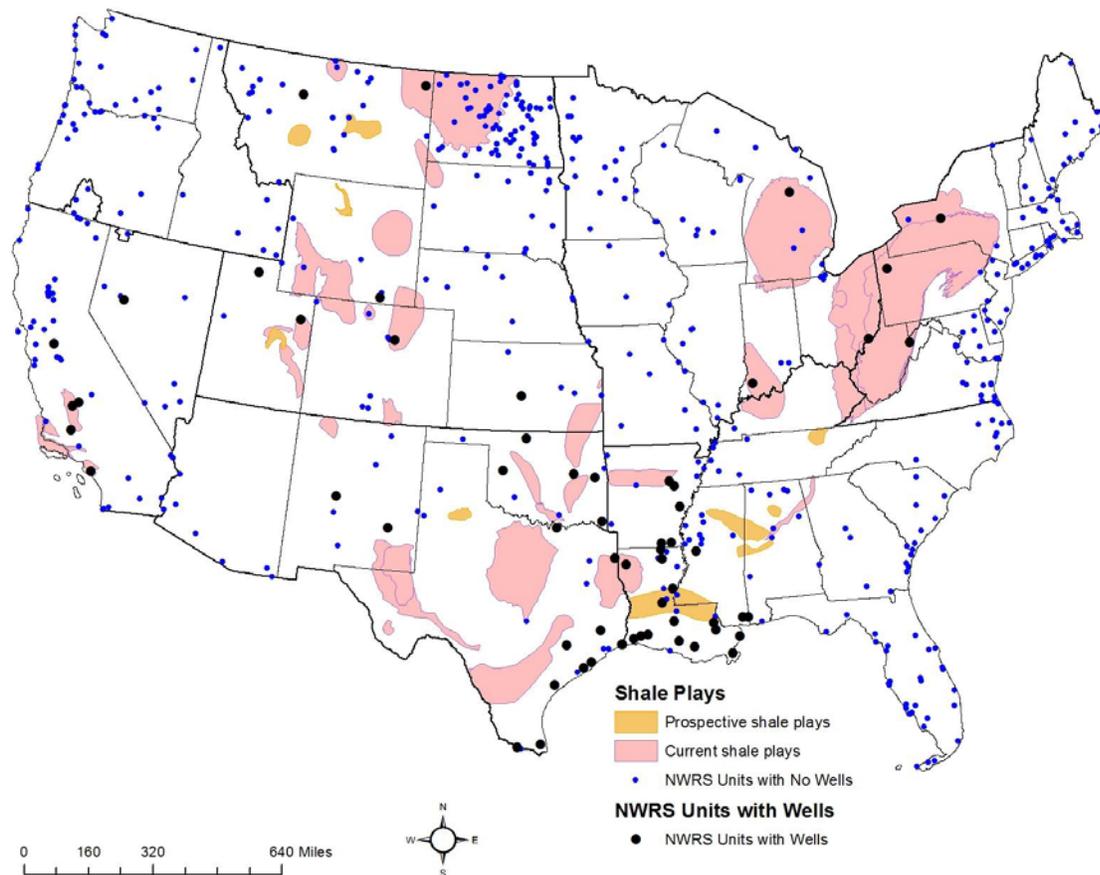


FIGURE 4-1. GEOGRAPHIC DISTRIBUTION OF SHALE PLAYS IN THE UNITED STATES

GEOLOGY AND SOILS

METHODOLOGY

Potential impacts on geology and soils are assessed based on the actions being proposed and characteristics of the geology and soils in the refuge units, as well as the disturbance to unique geologic features that may be affected. Paleontological features are also included in this section by their association to sensitive geologic formations. Resource-specific context for assessing impacts of the alternatives to geology and soils resources includes the following:

- the susceptibility of certain soil types to disturbance (particularly high erosion or shrink/swell potential, compaction characteristics)
- the uniqueness of the geologic features found in the refuges
- the susceptibility of certain geology and soils to vibration, contamination, or other effects of oil and gas activities

Typical Impacts of Oil and Gas Operations on Geology and Soils

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on geology and soils can result from vegetation clearing, which increases the potential for soil erosion by exposing the soil surface to water and wind. Surface disturbance from survey crews traversing the area during geophysical exploration could also cause soil compaction, reducing the soil's water-holding and infiltration capacities. Compacted soils increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009). Ground vibrations from seismic survey technologies used during exploration to obtain images of target formations could adversely impact sensitive geologic features by creating soil movement or settling or ground vibrations. The majority of impacts associated with these surveys would be limited in extent and severity because of the temporary nature of the disturbance and localized area disturbed by shotholes, foot traffic, and all-terrain vehicles.

Impacts of Well Drilling and Production

The primary impact on soils from existing oil and gas wells is a direct loss of soil productivity in the footprint of the site and access roads. During site preparation, impacts on geology and soils occur as a result of removing acreage from natural conditions and transferring that area to an industrial use to accommodate the drilling rig and associated equipment. Site preparation may include extensive vegetation clearing, grading, cutting, filling, and leveling of the site using heavy construction equipment. Soil material suitable for plant growth is often removed and stockpiled for use in reclamation. Slopes are particularly susceptible to erosion caused from road and well pad construction.

During drilling and production, the construction, maintenance, and use of access roads, well pads, flowlines, and pipelines could increase soil erosion and affect soil productivity from vehicle compaction and vegetation clearing (Duiker 2004; Pennsylvania State University 2009). Surface disturbances during drilling and production activities could cause soil compaction, thereby reducing the soil's water-holding and infiltration capacities. This would in turn reduce the root penetration capabilities of vegetation and hinder plant growth and further soil formation (Crush and Thom 2011).

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These compacted soils would also increase runoff of surface waters and accelerate soil erosion (DeJong-Hughes et al. 2001, McBroom et al. 2012).

In addition to construction-related impacts associated with development of access roads and well pads, there is a risk of impact on soils from releases of hazardous or contaminating substances during drilling or production operations, including well workovers and servicing. These releases could occur from leaking equipment. In most cases, however, primary and secondary containment on a well pad, if implemented, should prevent the release of drilling muds, diesel fuel, oil and gas, and other substances beyond the well pad. The risk of releases reaching more area of the well pad or offsite locations is greater for pre-existing wells that would not be required to have some of the more protective measures that would be required for new operations under the regulations. The unintentional or accidental release of hazardous or contaminated materials also includes the risk of the release of drilling mud. Although drilling mud may pose a risk for impacts on geology and soils if there are spills, its contained presence alone does not represent an impact. Drilling mud, which may contain water and chemical additives such as alkalis, bactericides, soluble chromates, and corrosion inhibitors used to optimize well drilling (Fink 2003), and cuttings from the well account for the largest volume of waste generated at the well site.

Contamination from the release of produced waters containing salts, naturally-occurring radioactive materials (NORM) such as radium-226, trace elements, oil and other hydrocarbons, and other well drilling fluids could also impact soils and other geology and soils in the refuge units. For example, such instances of leaks from oilfield brine flowlines and subsequent contamination resulting from mechanical problems and improper operating practices have been documented at the Anderson Waterfowl Production Area in Montana, and Hagerman and Aransas NWRs in Texas (M Maddux and Mike Borgreen pers. comm.). Oilfield brines released onto soils can increase the bioavailability of some heavy metals as well as destroy the soil structure resulting in the significant reduction of infiltration rates (Vavrek et al. 2004). These brine impacted soils are usually devoid of vegetation and are susceptible to erosion. Impacts to the soils from oilfield brine spills remain for years (Vavrek et al. 2004).

At some oilfield sites, the geologic zones being produced along with the processes for handling produced waters can result in NORM being concentrated in wastes such as mineral scales inside pipes and vessels, in sludges or sediments in the bottom of tanks, or in pit sediments. Proper handling and disposal of NORM-contaminated wastes is needed to prevent exposure to humans and the environment.

Salty water often represents the largest volume of waste generated at oil and gas sites. Disposal by injection into deep formations is currently the most common method of disposal. Injecting large volumes of water into deep sedimentary formations raises the pore pressure of large areas and has been associated with induced earthquakes (Ellsworth et al. 2015). Of the 40,000 waste fluid disposal wells, only a small fraction have induced earthquakes large enough to be of concern to the public. However, The USGS is working closely with the Environmental Protection Agency, state and local regulators, and state geological surveys to better understand these earthquakes and mitigate hazards.

The types of impacts related to soil erosion and runoff for directionally drilled wells outside the refuge boundaries are expected to be similar to those described for operations inside the refuge units; however, direct impacts to geology and soils in refuge units would not occur. The risk of indirect impacts and their intensity would vary with the location of the well with respect to the refuge boundary and direction of surface runoff. The risk of impacts on refuge resources would be greater

for directionally drilled operations sited closer to refuge boundaries with surface gradients toward the refuge, where water and sediment can be transported downslope into refuge units through adjacent streams, gullies, or overland flow. Severity of impacts would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; sensitivity of resources; and mitigation measures being employed.

Impacts of Plugging and Reclamation

When drilling and production operations end, well plugging and surface reclamation result in overall beneficial impacts on geology and soils. Although plugging actions could result in surface disturbance from earth-moving equipment, these disturbances are temporary and occur in previously disturbed areas. There are also beneficial effects on geology and soils once cleanup is successfully completed and the site is reclaimed to natural conditions and processes. Reclamation involves returning the topography of a site to approximate the original contours, replacing any stockpiled soils, and re-establishing natural vegetation. Revegetating disturbed areas provides erosion control in areas of previous impacts from oil and gas operations. Sources of potential leakage such as wellhead equipment and flowlines are also removed during plugging and reclamation. Beneficial impacts of plugging and reclamation are realized in both the short and long term.

IMPACTS OF ALTERNATIVES ON GEOLOGY & SOILS

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on geology and soil.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of geology and soils on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, geology and soils resources associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for geology and soils would vary from slight to moderate depending on proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to soils and other geologic resources within refuge units. However, depending on the proximity of these operations to the refuge, some indirect impacts to geology and soils on a refuge could occur because the Service would not be imposing preventive measures, such as spill containment standards. Intensity of impacts on refuge resources would

Environmental Consequences

depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and any mitigation measures the operator puts in place. For instance, water and sediment could be transported downslope into refuge units through streams, gullies, or overland flow.

As previously discussed, Alternative B provides an even greater incentive for operators to locate their operations outside refuges. Therefore, it is likely that direct impacts to geology and soils on NWRS resources and uses from new production and drilling operations would be avoided to a greater extent than in Alternative A. The typical impacts to geology and soils described earlier in this section would occur on adjacent lands where the operator locates operations. Indirect impacts on geology and soils from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Alternative C would provide some additional protection from the indirect impacts of these operations to refuge geology and soils by requiring mitigation measures that would reduce water and sediment transport downslope into refuge units through streams, gullies, or overland flow. However, Alternative C largely removes the incentive to locate operations outside of a refuge, so there would likely be an increase in the number of drilling and production operations located on refuges, as well as the direct impacts to geology and soils associated with these operations. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge soils and geology resources.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued permit, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection for geology and soils. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long-term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; and, where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to geology and soils.

Under Alternative A, there would be unnecessary impacts on geology and soils from the estimated 4,000 pre-existing oil and gas production operations not under a Service-issued permit, including those described above under Typical Impacts of Oil and Gas Operations on Geology and Soils. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on soils from oil and gas operations stem from the fact that soils are taken out of beneficial use where they have been disturbed. Within the footprint of the disturbance, potential impacts include the loss of soils from grading or construction of facilities, soil compaction, soil

erosion and sedimentation associated with disturbed areas, and possible soil contamination from leaks and spills, leading to adverse impacts on soil chemistry and productivity. As previously discussed regarding time/place/manner considerations, most of the impacts to geology and soils occurred when the operator chose and developed the site to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect geology and soils and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect geology and soils. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on geology and soils could include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, and removal of debris, waste, and equipment no longer needed in operations.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to geology and soil, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of geology and soils from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to geologic and soil resources would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soils from tank battery sites to protect soils and water, and clean-up standards for soils contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to ongoing impacts on geology and soils would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet Service's reclamation standards, which would also greatly reduce any long-term impacts on refuge geology and soils as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to geology and soils compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to Alternative B, Alternative C may provide additional protections to a greater number of wells for geology and soils from impacts associated with pre-existing operations. Since the greatest impacts to geology and soils have already occurred, the Service would be focusing on maintenance issues, such as erosion control, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge geology and soils. In most cases, since the

activity is occurring directly on private surface estate, the Service would not identify operational measures to protect geology and soils on adjacent Federal surface estate. Thus, for these operations, the impacts on geology and soils would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on geology and soils. These could include erosion control measures and spill prevention and control equipment and practices; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to geology and soils. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to geology and soils. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting geology and soils. So, as previously discussed, new operations create the greatest additional impacts on geology and soils, so establishing performance-based standards that would include proper site planning, timing restrictions, and the best management practices would avoid or minimize many of the typical impacts to geology and soil resources from oil and gas development. Also, the rule includes additional standards that would protect geology and soils, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations and to avoid areas identified as containing sensitive geology and soil resources. For operations refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge geology and soils in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include protections for geology and soils on these easements (e.g., hydric soils on wetland easements, or soils supporting native steppe on grassland easements).

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells; removing all above-ground structures, equipment, roads, well pads, and contaminating substances; re-establishing native vegetation; restoring conditions to predisturbance hydrologic functions; and restoring natural systems using native soil material that would reduce impacts to geologic and soil resources within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on geology and soils compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to Alternative B (where pre-existing operations come under permits where there is a change in operator), Alternative C may provide for implementation of higher standards for protection of geology and soils to a greater number of wells. Since the greatest impacts to geology and soils have already occurred, the Service would be focusing on maintenance issues, such as erosion control, in those cases where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge geology and soils. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to waters within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Geology and soils would only be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to geology and soils related to our downhole regulation under Alternative C.

Cumulative Impacts

Actions inside and outside refuges and local trends in oil and gas development can cumulatively affect geology and soils. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on geology and soils in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on geology and soils are listed in Table 4-2.

TABLE 4-2. CUMULATIVE IMPACTS ON GEOLOGY AND SOILS (PROGRAMMATIC LEVEL FOR REFUGES)

<p>Past, Present, and Reasonably Foreseeable Activity</p>	<p>Impacts on Geology and Soils</p>
<p>Prescribed fires and fire management actions</p>	<p>Short- and long-term adverse effects on soils from loss of productivity following removal of vegetation that may be preventing erosion and sedimentation; short- and long-term impacts from fire line construction that requires digging and displacement of soils and loss of organic matter from burning of surface litter and topsoil.</p>

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Geology and Soils
	Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire; improved productivity and erosion control from vegetative cover that is established after these treatments.
Service facility and road construction	Short- and long-term adverse effects on soils from direct loss of soils when they are removed for development and compaction during road grading and construction using heavy equipment.
Vegetation management	Long-term beneficial effects of erosion control from improved vegetative cover, which holds soils in place.
Trails development and maintenance	Short- and long-term adverse effects on soils from compaction during clearing, grading and surfacing of trails, and removal of vegetation in trail footprint, exposing soils to wind and water erosion.
ORV use	Short- and long-term adverse effects on soils from compaction, erosion, and sedimentation following vehicle-related disturbances to the soil surface; possible damage to unique geological features from collision, ground vibration, or vandalism.
Abandoned mine lands reclamation	Short-term adverse effects on soils from compaction during reclamation-related disturbances. Long-term beneficial effects of improved surface (revegetation) and reduced erosion following re-establishment of vegetation cover and natural contours.
Mining and logging activities	Long-term adverse effects on soils from erosion stemming from past surface disturbances and vegetation removal and long-term effects of acid mine drainage on soils (change in chemistry, productivity).
Recreational use	Short- and long-term adverse effects on soils from visitor activities including trampling and associated compaction; possible vandalism to unique geological features.
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, create ruts that increase potential for erosion.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects on soils from direct loss of soils in development footprint and compaction, erosion and sedimentation following construction-related disturbances.
Future oil and gas	Direct effects on soils on adjacent property and indirect adverse impacts on refuge soils

Past, Present, and Reasonably Foreseeable Activity	Impacts on Geology and Soils
development on adjacent lands	from “spill-over effects” of sedimentation and contamination from surface runoff; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside uses	Short-term adverse effects on soils from reclamation related disturbances due to use of equipment onsite and grading. Long-term beneficial effects of restoration of natural contours, topsoil and vegetation cover that protects soils from erosion; removal of sources of contamination and contaminated soils.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-2).

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under Service-issued permit, which would continue to have long-term direct adverse impacts on geology and soils, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on geology and soils. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on geology and soils as a result of oil and gas operations that would continue to affect geology and soils where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

AIR QUALITY

METHODOLOGY

The degree of potential impacts on air quality from oil and gas development depends on the type and location of operations and mitigation measures used to reduce impacts.

Environmental Consequences

The exploration and production of oil and gas has the potential to impact air quality from a variety of sources, which are considered in this analysis:

- suspended particulate matter (dust) generated from construction of access roads, well pads, production facilities, flowlines, gathering lines and pipelines, and site reclamation activities; combustion of diesel-powered equipment; the oil and gas itself; routine emission of noxious vapors from storage tanks; vehicle exhaust; and traffic on paved and unpaved roads;
- accidental spills of volatile petroleum products, resulting in emissions of hydrocarbons or volatile organic compounds, and other pollutants such as hydrogen sulfide (H₂S);
- emissions of carbon monoxide (CO), and oxides of nitrogen (NO_x) from vehicle and stationary gasoline and diesel engines (including electric generators from construction machinery and vehicles transporting equipment); and
- flaring of gas during well testing and production operations.

This analysis is programmatic in nature. Future permitting actions will involve additional NEPA compliance. The Service is party to a "Memorandum of Understanding (MOU) regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process" which the EPA, U.S. Department of Agriculture, and the U.S. Department of Interior entered into on June 11, 2011. Based on this MOU, future projects implemented under the Service's regulations may be subject to additional air quality analysis and project level mitigation.

CRITERIA POLLUTANT INFORMATION

Ozone

Ground level or "bad" ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO_x and VOCs. Breathing ozone can trigger a variety of health problems, particularly for children, the elderly, and people of all ages who have lung diseases such as asthma. Ground level ozone can also have harmful effects on sensitive vegetation and ecosystems.

Particulate Matter

"Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. EPA groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.

- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants

Health

The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems because they can get deep into your lungs, and some may even get into your bloodstream.

Exposure to such particles can affect both your lungs and your heart. Small particles of concern include "inhalable coarse particles" (such as those found near roadways and dusty industries), which are larger than 2.5 micrometers and smaller than 10 micrometers in diameter; and "fine particles" (such as those found in smoke and haze), which are 2.5 micrometers in diameter and smaller.

The Clean Air Act requires EPA to set air quality standards to protect both public health and the public welfare (e.g. visibility, crops and vegetation). Particle pollution affects both.

Particle pollution - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- premature death in people with heart or lung disease,
- nonfatal heart attacks,
- irregular heartbeat,
- aggravated asthma,
- decreased lung function, and
- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing.

People with heart or lung diseases, children, and older adults are the most likely to be affected by particle pollution exposure. However, even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particle pollution. For more information about asthma, visit www.epa.gov/asthma.

Environmental Effects

Visibility impairment - Fine particles (PM_{2.5}) are the main cause of [reduced visibility \(haze\)](#) in parts of the United States, including many of our treasured national parks and wilderness areas. For more information about visibility, visit www.epa.gov/visibility.

Environmental damage - Particles can be carried over long distances by wind and then settle on ground or water. The effects of this settling include making lakes and streams acidic; changing the nutrient balance in coastal waters and large river basins; depleting the nutrients in soil; damaging sensitive forests and farm crops; and affecting the diversity of ecosystems. More information about the [effects of particle pollution and acid rain](#).

Aesthetic damage - Particle pollution can stain and damage stone and other materials, including culturally important objects such as statues and monuments. More information about the [effects of particle pollution and acid rain](#).

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas emitted from combustion processes. Nationally and, particularly in urban areas, the majority of CO emissions to ambient air come from mobile sources. CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.

EPA first set air quality standards for CO in 1971. For protection of both public health and welfare, EPA set an 8-hour primary standard at 9 parts per million (ppm) and a 1-hour primary standard at 35 ppm.

In a review of the standards completed in 1985, EPA revoked the secondary standards (for public welfare) due to a lack of evidence of adverse effects on public welfare at or near ambient concentrations.

The last review of the CO national ambient air quality standards (NAAQS) was completed in 1994 and EPA chose not to revise the standards at that time.

Health

CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.

Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress. For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.

Nitrogen Oxides

Nitrogen dioxide (NO₂) is one of a group of highly reactive gases known as "oxides of nitrogen," or "nitrogen oxides (NO_x)." Other nitrogen oxides include nitrous acid and nitric acid. EPA's NAAQS uses NO₂ as the indicator for the larger group of nitrogen oxides. NO₂ forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO₂ is linked with a number of adverse effects on the respiratory system.

EPA first set standards for NO₂ in 1971, setting both a primary standard (to protect health) and a secondary standard (to protect the public welfare) at 0.053 parts per million (53 ppb), averaged annually. EPA has reviewed the standards twice since that time, but chose not to revise the annual standards at the conclusion of each review. In January 2010, EPA established an additional primary standard at 100 ppb, averaged over 1 hour. Together the primary standards protect public health, including the health of sensitive populations: people with asthma, children, and the elderly. No area of the country has been found to be out of compliance with the current NO₂ standards.

The Clean Air Act requires EPA to set national ambient air quality standards for "criteria pollutants." Currently, nitrogen oxides and five other major pollutants are listed as criteria pollutants. The others are ozone, lead, carbon monoxide, sulfur oxides, and particulate matter. The law also requires EPA to

periodically review the standards and revise them if appropriate to ensure that they provide the requisite amount of health and environmental protection and to update those standards as necessary.

All areas presently meet the current (1971) NO₂ NAAQS, with annual NO₂ concentrations measured at area-wide monitors well below the level of the standard (53 ppb). Annual average ambient NO₂ concentrations, as measured at area-wide monitors, have decreased by more than 40 percent since 1980. Currently, the annual average NO₂ concentrations range from approximately 10-20 ppb.

EPA expects NO₂ concentrations will continue to decrease in the future as a result of a number of mobile source regulations that are taking effect. Tier 2 standards for light-duty vehicles began phasing in during 2004, and new NO_x standards for heavy-duty engines are phasing in between 2007 and 2010 model years. Current air quality monitoring data reflects only a few years of vehicles entering the fleet that meet these strict NO_x standards.

Health

Current scientific evidence links short-term NO₂ exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma.

Also, studies show a connection between breathing elevated short-term NO₂ concentrations, and increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma.

NO₂ concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. In fact, in-vehicle concentrations can be 2-3 times higher than measured at nearby area-wide monitors. Near-roadway (within about 50 meters) concentrations of NO₂ have been measured to be approximately 30 to 100 percent higher than concentrations away from roadways.

Individuals who spend time on or near major roadways can experience short-term NO₂ exposures considerably higher than measured by the current network. Approximately 16 percent of U.S housing units are located within 300 ft. of a major highway, railroad, or airport (approximately 48 million people). This population likely includes a higher proportion of nonwhite and economically-disadvantaged people.

NO₂ exposure concentrations near roadways are of particular concern for susceptible individuals, including people with asthma, asthmatics, children, and the elderly

The sum of nitric oxide (NO) and NO₂ is commonly called nitrogen oxides or NO_x. Other oxides of nitrogen, including nitrous acid and nitric acid, are part of the nitrogen oxide family. While EPA's NAAQS covers this entire family, NO₂ is the component of greatest interest and the indicator for the larger group of nitrogen oxides.

NO_x react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death.

Ozone is formed when NO_x and VOCs react in the presence of heat and sunlight. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are at

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risk for adverse effects from ozone. These include reduction in lung function and increased respiratory symptoms as well as respiratory-related emergency department visits, hospital admissions, and possibly premature deaths.

Emissions that lead to the formation of NO₂ generally also lead to the formation of other NO_x. Emissions control measures leading to reductions in NO₂ can generally be expected to reduce population exposures to all gaseous NO_x. This may have the important co-benefit of reducing the formation of ozone and fine particles both of which pose significant public health threats.

Sulfur Dioxide

Sulfur dioxide (SO₂) is one of a group of highly reactive gases known as “oxides of sulfur.” The largest sources of SO₂ emissions are from fossil fuel combustion at power plants (73 percent) and other industrial facilities (20 percent). Smaller sources of SO₂ emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur containing fuels by locomotives, large ships, and nonroad equipment. SO₂ is linked with a number of adverse effects on the respiratory system.

EPA first set standards for SO₂ in 1971. EPA set a 24-hour primary standard at 140 ppb and an annual average standard at 30 ppb (to protect health). EPA also set a 3-hour average secondary standard at 500 ppb (to protect the public welfare). In 1996, EPA reviewed the SO₂ NAAQS and chose not to revise the standards.

In 2010, EPA revised the primary SO₂ NAAQS by establishing a new 1-hour standard at a level of 75 parts per billion (ppb). EPA revoked the two existing primary standards because they would not provide additional public health protection given a 1-hour standard at 75 ppb.

The Clean Air Act requires EPA to set national ambient air quality standards for “criteria pollutants.” Currently, sulfur dioxide (SO₂) and five other major pollutants are listed as criteria pollutants. The others are ozone, lead, carbon monoxide, nitrogen oxides, and particulate matter. The law also requires EPA to periodically review the standards and revise them if appropriate to ensure that they provide the requisite amount of health and environmental protection and to update those standards as necessary.

EPA first set standards for SO₂ in 1971. EPA set a 24-hour primary standard at 140 parts per billion (ppb) and an annual average standard at 30 ppb (to protect health). EPA also set a 3-hour average secondary standard at 500 ppb (to protect the public welfare). In 1996, EPA reviewed the SO₂ NAAQS and chose not to revise the standards.

In 2010, EPA revised the primary SO₂ standards by establishing a new 1-hour standard at a level of 75 ppb. EPA revoked the two existing primary standards because they would not provide additional public health protection given a 1-hour standard at 75 ppb.

In 2012, EPA took final action to retain the current secondary standard for SO₂ of 500 ppb averaged over three hours, not to be exceeded more than once per year

Health

Current scientific evidence links short-term exposures to SO₂, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including bronchoconstriction and increased asthma

symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (e.g., while exercising or playing).

Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.

EPA's NAAQS for SO₂ is designed to protect against exposure to the entire group of sulfur oxides (SO_x). SO₂ is the component of greatest concern and is used as the indicator for SO_x. Other gaseous sulfur oxides (e.g. SO₃) are found in the atmosphere at concentrations much lower than SO₂.

Emissions that lead to high concentrations of SO₂ generally also lead to the formation of other SO_x. Control measures that reduce SO₂ can generally be expected to reduce people's exposures to all gaseous SO_x. This may have the important co-benefit of reducing the formation of fine sulfate particles, which pose significant public health threats.

SO_x can react with other compounds in the atmosphere to form small particles. These particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. EPA's NAAQS for particulate matter (PM) are designed to provide protection against these health effects.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON AIR QUALITY

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse effects on air quality would result from increased vehicle use to transport seismic work crews and equipment to drill shotholes. Combustion engine emissions include VOCs, NO_x, CO, PM₁₀ and PM_{2.5} and SO₂. The primary pollutants of concern are NO_x, which are formed in the high temperature, pressure, and excess-air environment of combustion in diesel engines. Lesser amounts of CO and hydrocarbons are also emitted. Some SO₂ is emitted due to the burning of gasoline and diesel (which can contain minor amounts of sulfur). The amount of engine emissions depends on the number and type of gasoline or diesel-fueled vehicles, shothole drilling equipment used, and the length of use. The majority of impacts associated with 3D seismic surveys are limited in extent because of the temporary nature of the survey. For particulates impacts tend to be localized and for other pollutants VOCs and NO_x (or even SO₂, which transforms to SO₄ fine particles downwind), these impacts may be localized, but could contribute to regional air quality impacts. In general, for small scale oil and gas operations, emissions tend to be small and will not significantly impact air quality. However, for oil and projects that require a NEPA analysis, the air quality impacts will be evaluated during the NEPA process.

Impacts of Well Drilling and Production

The primary impacts on air quality from well drilling and production include emissions from vehicles and heavy equipment during construction and maintenance, as well as, emissions released during drilling and production activities. Vehicles and heavy equipment used for the construction and maintenance of access roads, well pads, flowlines, and pipelines, and well drilling could introduce NO_x, VOCs, CO, SO₂, PM₁₀, PM_{2.5}, and odors from operating large engines, pumps and auxiliary equipment. This can result in short-term (construction activities and drilling operations) to long-term (roads, production operations, and flowlines and pipelines) impacts on air quality.

Environmental Consequences

Hydrocarbons and volatile components of well treatment chemicals would continue to be released at existing drilling, production, or transport operations.

Drilling activities can involve continuous operation of combustion engines over a 15- to 120-day period depending on the depth and complexity of the well drilled. This activity would introduce emissions of NO_x, CO, and SO₂. Large diesel engines, which are used to power the drill, rigs, pumps, and auxiliary equipment emit NO_x as primary pollutants of concern. Nitrogen oxides are formed in the high temperature, pressure, and excess-air environment of combustion diesel engines. Smaller amounts of CO and hydrocarbons would also be emitted. Some SO₂ would be emitted due to the burning of gasoline and diesel (which contain minor amounts of sulfur). The amount of engine emissions depends on the drilling rig size (horsepower), percent sulfur in the fuel burned, gallons of diesel fuel burned per hour, the hours per day, number of days the diesel rigs operate, and the use of any emission control devices. For a comparison, a recent analysis of existing impacts on air quality from drilling operations at NPS's Big South Fork National River and Recreation Area determined the amount of NO_x and VOCs that would be produced per well for oil drilling. Using a typical horsepower of 350 hp and the assumption of 7 days to drill a well, the Big South Fork analysis estimated that emissions from one drilling operation would be about 0.7 tons per year of NO_x (USNPS 2012). VOC emissions would be minimal.

Hazardous air pollutants that can be released during oil and gas operations are benzene, toluene, ethylbenzene, and xylene (known as the "BTEX" chemicals); hydrogen sulfide (H₂S); arsenic (As); and mercury (Hg). These pollutants demonstrate a high toxicity and can lead to increased rates of cancer and respiratory disease in humans either acutely or chronically exposed to high concentrations in the environment. Existing concentrations of and potential exposures to these pollutants vary widely depending upon the physical characteristics of the site, the proximity of human populations, the level of oil and gas production, and the type of production equipment employed (Mall et al. 2007).

Drilling activities can produce H₂S when equipment encounters gas or fluids under pressure. Hydrogen sulfide presents a serious localized air quality concern because it is extremely toxic at very small concentrations. If encountered H₂S is extremely hazardous to normal oil field operations because of its potential adverse health effects and its contribution to drilling equipment metal fatigue. When zones containing gas or fluids under pressure are encountered, the drilling mud system can be adjusted (mud weight is increased) to prevent the release of hydrogen sulfide. Drilling can be discontinued until the pressure is stabilized and there is essentially no gas entering the hole. The small amount of gas that could reach the surface is then vented from the system by using a de-gaser unit and a flare to combust the gas. Drilling and producing of hydrocarbons containing toxic gases can be performed safely if the appropriate safety and precautions procedures are followed.

Odors from drilling and production operations could affect visitors and refuge employees. The possibility and extent for odor would depend on wind speed and direction and the nature of the drilling equipment and material encountered during drilling operations (particularly the presence of H₂S -bearing zones). Odor would be more noticeable during light breezes and less evident during periods of stronger winds.

For both existing and future operations, hydrocarbons could volatilize and enter the atmosphere as the result of a leak or spill. In the vicinity of the leak or spill, concentrations of gas and other constituents could present health hazards to animal and plant life. In addition, a leak or spill could provide a source for explosion or fire. These impacts could be serious on a very local level; however, with

mitigation, and prompt response in the event of a spill, impacts would be short-term. These impacts could be localized event but can contribute to regional air quality impacts.

Photochemical reactions between hydrocarbons and NO_x produce ozone (Bradbury et al. 2013). Although the concentration of all these pollutants would increase as the fields are developed, the levels are expected to be low and are required to comply with Federal and State standards and conform to all local air quality State implementation plans (SIPs). The extent of impacts caused by increases in pollutants may range from areas near each well to longer ranges with low-level contributions to regional impacts, like ozone and haze formation.

In some areas of the country, ambient levels of ozone cause visible injury to vegetation, including dark stippling and chlorosis (i.e., bleaching), and decreased plant growth and productivity. Elevated ozone levels have also been linked to significant changes in plant community composition due to the effect of ozone on growth and reproduction, and to reduced ecosystem water quantity, due to ozone's effect on water use efficiency in plants (USEPA 2013b).

NO_x and SO_x in the air can damage the leaves of plants, decreasing their ability to produce food – photosynthesis- and decrease their growth. In addition to directly affecting plants, atmospheric nitrogen deposition acts as fertilizer, favoring some plants, including invasive species, and leaving others at a competitive disadvantage. Sulfur oxides can acidify sensitive ecosystems resulting in a range of harmful deposition-related effects on plants, soils, water quality and fish and wildlife. This creates an imbalance in natural ecosystems, and over time may lead to shifts in the types of plant and animal species present, increases in insect and disease outbreaks, disruption of ecosystem processes (such as nutrient cycling), and changes in fire frequency. Arid grasslands and shrublands are particularly vulnerable to changes caused by nitrogen deposition. Nitrogen deposition may disrupt soil nutrient cycling and alter plant communities. Invasive grasses thrive in areas with high nitrogen deposition, displacing native vegetation adapted to low nitrogen conditions. The fire risk subsequently increases due to extensive areas of weedy grasses.

Greater use of motor vehicles during construction of access roads and pads, and during drilling, would increase particulate matter from vehicle exhaust and dust from paved and unpaved roads. Exhaust from machinery used during construction and drilling also would contribute to an increase in particulate matter. As a result of increased particulate matter emissions, visibility may be slightly impacted during construction and drilling in any localized area where these activities are undertaken. There could be some added impact on regional visibility due to transport of fine particulate matter and haze produced by secondary aerosols (i.e., particulate matter formed from gaseous emissions of SO_2 , NO_x , and VOCs, in particular). Particulate matter emissions would be greatest during any necessary construction of roads, pads, flowlines and oil and gas pipelines, due to the higher number of vehicles and earthmoving activities.

The amount of air pollution generated over the productive life of oil or gas wells depends on the characteristics of the product and the production practices used. Emissions associated with production are usually considerably less than the emissions from well drilling. However, over the life of some production operations, emissions could exceed those of drilling operations. Oil and gas production operations release gaseous pollutants such as CO, hydrocarbons, NO_x , and SO_2 . These production operation air pollutants are released from separation facilities, disposal of liquid waste and unwanted gas, burning of waste petroleum products, routine emission of objectionable odors, and venting of noxious vapors from storage tanks.

Impacts of Plugging and Reclamation

Increased vehicle use and removal of roads, pads, flowlines, and pipelines could increase particulate matter emissions as well as emissions from vehicle engines. Leaks and spills of hydrocarbons could occur during well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities. These activities would result in emissions of gaseous pollutants and present a potential source for explosion or fire. Plugging and reclamation impacts generally are short-term and localized, but can contribute to regional air quality impacts.

Impacts on air quality from reclamation of wells directionally drilled from outside the refuge boundaries could vary based on the distance from the refuge boundary. These impacts would be expected to be similar to those described above. Impacts could be localized as well as contribute to regional air quality impacts.

Once wells are plugged and sites reclaimed, there would be no future emissions associated with that operation.

Impacts of Alternatives on Air Quality

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on air quality.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of air quality on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, air quality associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for air quality would vary from slight to moderate depending on proximity of those operations to refuge boundaries, as well as state rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., emissions standards).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to air quality on refuges depending on the proximity of the operations. The impact on air quality from wells directionally drilled and produced from outside refuge boundaries are expected to be similar to those described for operations within refuge boundaries; however, the intensity of impacts on air quality inside the refuge would vary with the location of the well and any prevailing winds.

Under Alternative A, direct impacts to air quality within the refuge from these operations would be avoided because there is some incentive for operators to locate their operations outside refuge units. The location of surface operations outside refuge boundaries avoids direct impacts to air resources within the refuge. However, depending on the proximity of these operations to the refuge, some indirect impacts to air quality on a refuge could occur, because the Service would not be imposing preventive measures on these operations. For example, the use of diesel fuel with a higher sulfur content or poorly maintained construction equipment could result in greater emissions impacting the regional air quality. Intensity of impacts on refuge resources would depend on proximity of operations to the refuges; site-specific environmental conditions, such as steepness and direction of slope; and mitigation measures being employed.

As discussed previously, Alternative B provides an even greater incentive for operators to locate their operations outside refuges. Therefore, it is likely that direct impacts to air quality from new production and drilling operations would be avoided to a greater extent than in Alternative A. Indirect impacts on air quality from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Alternative C would provide some additional protection from the indirect impacts of these operations to refuge air quality by requiring mitigation measures that would reduce air emissions adjacent to refuge units, and thus their transport across the refuge boundary. However, Alternative C eliminates the incentive to locate an operation outside of a refuge, so there would likely be a significant increase in the number of drilling and production operations located on refuges, as well as the direct impacts to the air quality associated with these operations. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, and long-term impacts to refuge air quality.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection for air quality. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service and, where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to air quality.

Under Alternative A, there would be unnecessary impacts to air quality from the estimated 4,000 pre-existing oil and gas production operations not under an Service-issued permit, including those described above under Typical Impacts of Oil and Gas Operations on Air Quality due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect air

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quality and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect air quality.

The primary effects on air quality are related to heavy equipment use, including the continuous use of a combustion engine during drilling activities, and releases of hydrocarbons from oil storage and venting. Operations under an SUP could experience a reduction in impacts to air quality if the SUP included stipulations for reducing air emissions, avoiding or minimizing the use of flares, and controlling the venting of VOCs.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, evaluation of air quality impacts, performance-based standards to avoid or minimize impacts to air quality, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of air quality from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these pre-existing operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to air quality would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State air quality standards. The Service expects that issues related to ongoing impacts on air quality could be resolved by compliance with State laws and regulations in States that have oil and gas regulations specific to air emissions.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation. The requirement for an operations permit during the reclamation phase of pre-existing operations could slightly reduce impacts on air quality (e.g., requiring dust suppression during plugging operations). Reclamation standards such as plugging all wells would eliminate any direct, long-term impacts to air quality within the refuge units by preventing releases of VOCs from these closed wells.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to air quality compared to Alternative A. For example, Colorado requires oil operators to install devices that capture 95 percent of emissions, including VOCs and methane.

Alternative C would require all operators on refuges to obtain a permit for their operations; including pre-existing operations. Compared to Alternative B, Alternative C would reduce impacts to air quality caused by pre-existing wells during the production phase. Impacts to air quality would be reduced in the same manner as described under Alternative B for new operations. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge geology and soils. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect air quality on adjacent Federal surface estate. Thus, for these operations, the impacts on air quality would be similar to Alternative B.

Performance Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in Service-issued permits that serve to minimize or avoid impacts on air quality. For instance, impacts to air quality could be reduced if the SUPs include prescriptive measures to reduce air emissions, flaring, and the venting of VOCs, if such measures are not already required under state law. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to air quality. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to air quality. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting air quality. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge air quality in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. However, since mitigation of air quality impacts above those required by Federal and State rules are typically not necessary to protect the Service's property interests in easements (e.g., wetlands, native prairie), Alternative B would not likely provide any further protection of air quality on easements.

The rule also includes standards for achieving successful well plugging and surface reclamation once operations end. As described above, reclamation may result in short term air quality impacts but in the end ensuring wells are plugged according to Service standards would result in no future emission associated with that operation.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to Alternative B, Alternative C may provide for implementation of higher standards for protection of air quality during the production phase to a higher number of wells.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge air quality. However, since mitigation of air quality impacts above those required by Federal and State rules are typically not necessary to protect refuge resources and uses from locations on inholdings and non-Federal surfaces, Alternative B would not likely provide any further protection of air quality from these operations.

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Air quality would mainly be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could serve to lower an already low risk of a well blowout, but in practice, the

Environmental Consequences

Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to air quality related to our downhole regulation under Alternative C.

Cumulative Impacts

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect air quality of the refuges. Management planning, such as fire management, ORV, and oil and gas management plans, can result in greater protection for an airshed. Conversely, actions that cause disturbance of air quality would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include heavy construction equipment. Past, present, and reasonably foreseeable activities that would have beneficial or adverse effects on air quality in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on air quality are listed in Table 4-3.

TABLE 4-3. CUMULATIVE IMPACTS ON AIR QUALITY (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Air Quality
State greenhouse gas regulations	Long-term beneficial effects of reductions in greenhouse gas emissions as a result of new statewide regulatory revisions concerning greenhouse gas emissions requirements for the permitting of oil and gas operations.
Prescribed fires and fire management actions	Short-term adverse effects on air quality from controlled burns, namely, particulate matter; short- and long-term impacts from fire line construction that requires digging and burning of surface litter, resulting in decreased visibility and increased particulate matter. Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire and associated emissions.
Service facility and road construction	Short-term adverse effects on air quality during road grading and construction using heavy equipment.
Trails development and maintenance	Short-term adverse effects on air quality from construction equipment during clearing, grading, and surfacing of trails.
ORV use	Long-term adverse effects on air quality from the vehicle emissions
Increased on-road vehicle use	Short- and long-term adverse effects on air quality from increased regular traffic and vehicle use in and around refuges.
Abandoned mine lands reclamation	Short-term adverse effects on air quality from any equipment use during reclamation-related disturbances.

Past, Present, and Reasonably Foreseeable Activity	Impacts on Air Quality
Mining and logging activities	Short-term adverse effects on air quality from heavy equipment use
Ranching, agricultural and uses	Short- and long-term adverse effects from operations that require heavy equipment for agricultural uses or emissions, as well as methane emission from concentrated livestock operations.
Land development: residential and nonresidential (commercial, industrial) and uses, including road construction	Short-term adverse effects on air quality from construction equipment and increased vehicle emissions.
Future oil and gas development on adjacent lands	Direct effects on airshed from additional operations; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on air quality from reclamation related construction activities due to use of equipment and grading

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-3).

Alternative B would contribute to cumulative impacts from the continued operations of permitted and newly regulated operations, which would continue to have long-term direct adverse effects on air quality, as described in the above analysis. Bringing new operations and the reclamation phase of pre-existing operations under regulation would potentially add beneficial impacts on air quality. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing potential beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on air quality as a result of oil and gas operations that would continue to affect air quality where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulations and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and the reclamation phase of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries.

Environmental Consequences

Under all alternatives, GHG emissions would continue. EPA (2015) estimates GHG emissions from oil and gas production at 2.8 million tons of VOCs, 185 million metric tons (MMt) CO₂ Equivalent (CO₂ Eq.) of methane (EPA 2015). Currently, non-Federal oil and gas producing (active) wells on refuges comprise 0.16 percent of the total number of producing wells (1,050,637) in the United States in 2011 as reported by the EPA (EPA 2015). Though the service does not have the data necessary to calculate GHG from non-Federal oil and gas operations on refuges, the volume could be a similar ratio. Alternatives B and C could result in permit requirements that serve to reduce GHG emissions such as limitations on flaring or required use of control valves that do not vent natural gas.

WATER RESOURCES

METHODOLOGY

Potential impacts on water resources are assessed based on the actions being proposed and characteristics of the water resources in refuges. Resource-specific context for assessing impacts of the alternatives to water resources includes the following:

- the susceptibility of surface waters to pollution from runoff and spills from oil and gas sites
- the susceptibility of groundwater resources to contamination from drilling, including hydraulic fracturing operations
- special designations given to surface or ground water found in the refuges, such as Wild and Scenic Rivers or Outstanding Natural Resource Waters

For the programmatic analysis, a qualitative analysis of the potential impacts of oil and gas operations on water resources was conducted based on actual experience of the Service in management of non-Federal oil and gas operations and their effects on water resources.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON WATER RESOURCES

Impacts from Geophysical Exploration

During the geophysical exploration phase, the loss or modification of vegetation, ORV use, and shothole drilling and detonation could result in increased sedimentation and turbidity and degrade water quality in nearby surface waters. For example, vegetation clearing would increase the potential for runoff into nearby surface waters by exposing the surface to water and wind, and survey crews traversing the area could also cause soil compaction, reducing the soil's water-holding and infiltration capacities. Cleared areas with compacted soils would be more subject to runoff of surface waters and accelerated erosion (Duiker 2004; Pennsylvania State University 2009). This could lead to an increase in sediment load to nearby receiving surface waters. Also, the use of overland vehicles to transport equipment and personnel could increase the potential for turbidity if vehicles need to cross surface waters to access shothole locations and stir up bottom sediments.

Seismic operations generally have slight impacts on groundwater quantity or quality. Shothole detonation could dislodge or mobilize clays within an aquifer and cause a decrease in water quality or a reduction in flow. These effects are very uncommon and usually of short duration, unless the aquifer has limited geographic extent such as a localized perched water table. Explosives that are occasionally left undetonated in shotholes could introduce small quantities of organic chemical compounds that are biodegradable in a few years. The quantities of explosives used in each individual shothole vary from one-half to 12 pounds and are typically spaced approximately 110 to

440 feet apart and therefore are not expected to appreciably affect groundwater chemistry. Soils such as fragipans that support surface waters in wetland areas (called aquitards) could conceivably be disturbed by shothole drilling and possibly fractured from shothole detonation. Design of shothole depths and explosive sizes used with respect to depths of aquitards would serve to minimize the risk of adverse effects, as would proper plugging of shotholes.

Impacts of Well Drilling and Production

During drilling and production, the construction, maintenance, and use of access roads, well pads, flowlines, and pipelines could increase soil erosion and consequently increase sedimentation and turbidity in nearby water bodies (McBroom et al. 2012). Clearing of vegetation for these activities would expose soils to erosion, which could move downslope and increase turbidity and sedimentation in nearby surface waters. This could also create ruts or gullies that channel surface water flows. Road construction and the use of compacted road fill could also reduce infiltration rates on road surfaces, increasing surface runoff (Trombulak and Frissell 2000). Access roads and pads could also disrupt natural surface flow patterns and might result in an increase or decrease in the amount of water in some areas. Additional roads in the refuges could increase access, which in turn could result in unauthorized additional land disturbance and erosion. If roads are used during wet conditions, rutting could result and might concentrate surface water flows. Slopes are particularly susceptible to erosion caused from road and well pad construction.

In addition to impacts associated with soil erosion and sedimentation, water resources could become contaminated if hazardous substances are released into them during drilling, production, servicing, or transport. In some locations, drilling operations could encounter formations with H₂S or high pressures and associated uncontrolled flows of oil, gas, brine, or freshwater. Blowouts could occur during drilling and release hydrocarbons, water, and drilling mud. The Service recognizes that unplanned incidents associated with oil and gas operations such as well blowouts present a risk of release of contaminants that can adversely impact water resources. However, the incident rates for such incidents are low and are not a typical expectation of project implementation. In the event that the refuge's resources or values are damaged, the Service could seek remedy both in the form of reclamation and monetary compensation.

There could also be accidental spills of drilling mud, diesel fuel, and other chemicals during drilling operations, or leaks from containers or flow lines. If drilling mud, fuels, or other chemicals are spilled on the ground and there is no impermeable liner on the well pad, the fluids could infiltrate into shallow aquifers or reach nearby surface waters, resulting in changes in water quality and possible violations of water quality standards if these are not detected and remediated. Contamination from the release of produced waters that contain salts and other well drilling fluids and chemicals could also impact surface and ground water. For example, such instances of leaks from salt-water disposal wells and flowlines conveying oilfield brine, subsequent contamination from mechanical problems and improper operating practices have been documented at Hagerman and Aransas National Wildlife Refuges in Texas and the Anderson Waterfowl Production Area in northeastern Montana (M. Maddux and M. Borgreen pers. comm.). The risk of releases reaching more area of the well pad or offsite locations is greater for those wells that are not under an SUP permit because these wells are not required to have some of the more protective measures that are required under SUPs permits.

Risks to groundwater resources include leaching of surface oil and produced water leaks and spills into shallow groundwater, and groundwater contamination from poorly cased or cemented wells.

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Well drilling and servicing can include the use of hydraulic fracturing well stimulation operations. These operations require large quantities of water, use a variety of chemicals to stimulate well production, and generate produced flowback or wastewater. The term “hydraulic fracturing” has been expanded by the public beyond just the actual stimulation process to become the term for all activities associated with a well that is hydraulically fractured—from site construction through waste disposal. With the surge in the use of hydraulic fracture stimulation for shale development, the subject has drawn recent controversy.

The U.S. Environmental Protection Agency (USEPA 2004) began a study on hydraulic fracturing used in coalbed methane reservoirs in 1999 to evaluate the potential risks to underground sources of drinking water. The study focused on coalbed methane reservoirs because they are typically closer to the surface and in greater proximity to underground sources of drinking water compared to conventional gas reservoirs. EPA published the coalbed methane study, entitled *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs* (USEPA 2004). The published study received both internal and external peer review, and public comment on study design and incident information. EPA concluded that there was little to no risk of fracturing fluid contaminating underground sources of drinking water during hydraulic fracturing of coalbed methane production wells. EPA retained the right, however, to conduct additional studies in the future. As a precautionary measure, EPA also entered into a Memorandum of Agreement in 2003 with companies that conduct hydraulic fracturing of coalbed methane wells to eliminate use of diesel fuel in fracturing fluids.

EPA recently conducted an expanded study to include all aspects of well development that use hydraulic fracturing at the request of Congress to better understand the potential impacts of hydraulic fracturing on drinking water resources. Many States have added or are in the process of adding to regulations to address potential environmental impacts of these operations. Release of a draft assessment report for public comment and peer review by EPA occurred in June 2015 (External Review Draft | EPA/600/R-15/047a | June 2015 | www.epa.gov/hfstudy). The assessment considered potential impacts to sources of drinking water related to 1) water acquisition needed for hydraulic fracturing, 2) mixing of chemicals, sand, and water to create the fracturing fluid, 3) well injection, 4) flowback of fracturing fluid and produced fluids, and 5) wastewater treatment and waste disposal. Major findings were summarized in the Executive Summary of the report:

“From our assessment, we conclude there are above and below ground mechanisms by which hydraulic fracturing activities have the potential to impact drinking water resources. These mechanisms include water withdrawals in times of, or in areas with, low water availability; spills of hydraulic fracturing fluids and produced water; fracturing directly into underground drinking water resources; below ground migration of liquids and gases; and inadequate treatment and discharge of wastewater.

We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States. Of the potential mechanisms identified in this report, we found specific instances where one or more mechanisms led to impacts on drinking water resources, including contamination of drinking water wells. The number of identified cases, however, was small compared to the number of hydraulically fractured wells.

This finding could reflect a rarity of effects on drinking water resources, but may also be due to other limiting factors. These factors include: insufficient pre- and post-fracturing data on the quality of drinking water resources; the paucity of long-term systematic studies; the

presence of other sources of contamination precluding a definitive link between hydraulic fracturing activities and an impact; and the inaccessibility of some information on hydraulic fracturing activities and potential impacts.”

Hydraulic fracturing requires large volumes of water; hydraulic fracturing fluids are usually water-based, with approximately 90 percent of the injected fluid composed of water (GWPC and ALL Consulting 2009). Estimates of water needs per well have been reported to range from 65,000 gallons for coalbed methane production up to 13 million gallons for shale gas production, depending on the characteristics of the formation being fractured and the design of the production well and fracturing operation (GWPC and ALL Consulting 2009; Nicot et al. 2011). Hydraulic fracturing operations require large quantities of supplies, equipment, water, and vehicles. Onsite storage, mixing, and pumping of hydraulic fracturing fluids may result in accidental releases, such as spills or leaks. Released fluids could then flow into nearby surface water bodies or infiltrate into the soil and near-surface groundwater, potentially reaching drinking water resources.

The hydraulic fracturing fluid is pumped down the well at pressures great enough to fracture the oil- or gas-containing rock formation, and leaks could result from well construction failure. When the injection pressure is reduced, the direction of fluid flow reverses, leading to the recovery of flowback and produced water. This water may contain chemicals injected as part of the hydraulic fracturing fluid, substances naturally occurring in the oil- or gas-producing formation, hydrocarbons, and potential reaction and degradation products. Onsite transfer and storage of hydraulic fracturing wastewater may result in accidental releases, such as spills or leaks, which may reach nearby drinking water resources. The potential impacts on drinking water resources from flowback and produced water are similar to the potential impacts identified in the chemical mixing stage of the hydraulic fracturing operation, with the exception of different fluid compositions for injected fluids and wastewater (USEPA 2012).

Poor well construction, substandard well control practices, and surface mismanagement of contaminants have generally caused the impacts on ground and surface waters from hydraulic fracturing operations (Rozell and Reaven 2012, AWWA 2013, Darrah et al. 2014). Hydraulic fracturing of older wells that are not constructed to withstand the pressure of the operation could contaminate groundwater if the casing is breached. Where hydraulic fracturing operations include the use of diesel, the operations would be subject to EPA’s Underground Injection Control (UIC) programming permitting guidance specific to oil and gas hydraulic fracturing activities using diesel fuel. Many of the guidance’s recommendations are appropriate for hydraulic fracturing operations whether or not diesel is used. Incorporation of such guideline would serve to further minimize the risk to groundwater.

Because production could continue for 20 years or longer, the potential for leaks and spills of hazardous substances from production operations (including flowlines and pipelines) is greater than for any other phase of oil and gas operations. Adverse impacts on water quality could occur from accidental leaks and spills of drilling fluids or waste waters, hazardous waste spills (including diesel fuel), well blowouts, ruptures of flowlines and pipelines, and spills from tanker trucks. Chronic small leaks and spills could spread through various pathways, and over an extended period of time could become substantial and costly to remediate. The chances of undetected spills are greater if routine inspections are not performed. Faulty installation or corrosion of production casing might go undetected and could adversely impact groundwater, if hydrocarbons and/or produced waters migrate into an aquifer and contaminate groundwater. The severity of the impact would depend on the type of substance spilled (hydrocarbons, produced waters, chemicals, solvents, and fuels) and the size of area

impacted, but impacts could be substantial. Oilfield brine spills can increase the bioavailability of some heavy metals as well as destroy the soil structure resulting in the significant reduction of infiltration rates (Vavrek et al. 2004). These brine impacted soils are usually devoid of vegetation and are susceptible to erosion. The loss of infiltration will result in increased runoff with impacts to nearby surface water in terms of salinity, and siltation. Impacts to the soils from oilfield brine spills remain for years (Vavrek et al. 2004).

The types of impacts related to runoff of sediments and contaminants for directionally drilled wells are expected to be similar to those described above for operations inside refuges. However, direct impacts to water resources would occur on adjacent land instead of in the refuge. The risk of indirect impacts and their intensity on refuge resources would vary with the location of the well with respect to the refuge boundary and direction of surface runoff. The risk of impacts on refuge resources would be greater for directionally drilled operations sited closer to refuge boundaries with surface gradients toward the refuge, where sediments and contaminants can be transported downslope into a refuge through adjacent streams, gullies, or overland flow. Severity of impacts would depend on proximity of operations to the refuge, site-specific environmental conditions, such as steepness and direction of slope and surface hydrology, sensitivity of resources, and mitigation measures being employed.

Impacts of Plugging and Reclamation

In cases involving older, idle wells in which roads and well pads have become overgrown with vegetation, clearing vegetation from oil and gas access roads and well pads and the use of heavy equipment and vehicles would temporarily increase localized erosion potential. In addition, there is the potential for release of liquid hydrocarbons and/or contaminating or hazardous substances into surface and groundwater from vehicles, wellhead equipment, or flowlines during well plugging and reclamation activities. These temporary activities could cause detectable, localized changes to water quality in the case of wells located near surface waters.

When drilling and production operations end, well plugging and surface reclamation results in overall beneficial impacts on water resources. Surface disturbance from earth-moving equipment also occurs during plugging operations, which could result in sedimentation and turbidity in nearby waterways. However, these disturbances are temporary. There are also beneficial effects on water resources once cleanup is successfully completed and the site is reclaimed to natural conditions and processes. Reclamation involves returning the topography of a site to approximate the original contours, replacing any stockpiled soils, and re-establishing natural vegetation communities. Revegetating disturbed areas provides erosion control in areas of previous impacts from oil and gas operations, thus limiting impacts from runoff. Sources of potential leakage such as wellhead equipment and flowlines are also removed during plugging and reclamation. Based on site history and conditions, refuge staff would conduct a more thorough testing for contamination at each site. If contamination is found, subsequent steps would be taken to remove or neutralize contaminating substances. As a result, there would be long-term beneficial effects on water resources once reclamation is complete.

IMPACTS OF ALTERNATIVES ON WATER RESOURCES

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on water resources.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of water resources on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, water resources associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for water resources would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge boundaries avoids direct impacts to water resources within the refuge. However, wells directionally drilled and produced from outside refuges to bottomholes beneath the refuge would directly impact water resources on adjacent lands as well as present a risk of indirect impacts within the refuges. Under current regulations, the Service cannot impose preventative measures such as mitigation. The risk and intensity of indirect impacts on refuge resources would increase for operations sited closer to refuge boundaries where water and sediment could be transported downslope into a refuge through streams, gullies, or overland flow. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures.

Alternative B provides an even greater incentive for operators to locate their operations outside refuges since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Therefore, it is likely that impacts to water resources from new production and drilling operations within refuges would be avoided to a greater extent than in Alternative A. Impacts on water resources from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would reduce water and sediment transport

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downslope into refuge units through streams, gullies, or overland flow and thus impacts to water resources within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge water resources.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection for water resources. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to water resources.

Under Alternative A, there would be unnecessary impacts on water resources from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Water Resources. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on water resources from oil and gas operations include soil erosion and sedimentation associated with disturbed areas, and possible water contamination from leaks and spills, leading to adverse impacts on water quality. As previously discussed, most of the impacts to water resources occurred when the operation was originally chosen and developed by the operator to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect water resources and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect water resources. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on water could include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, siting operations a minimum distance from surface waters, and removal of debris, waste, and equipment no longer needed in operations.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to water resources, and other administrative provisions such as financial assurance, cost recovery, and access fees that would

ensure protection of water resources from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to water resources would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soil from tank battery sites to protect soils and water, and clean-up standards for soils contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to impacts on water resources would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet the Service's reclamation standards, which would also greatly reduce any long-term impacts on refuge water resources as discussed further below in "Performance-Based Standards".

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to water resources compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to the rule, Alternative C may provide additional protections to a greater number of wells for water resources from impacts associated with pre-existing operations. Since the greatest impacts to water resources have already occurred, the Service would be focusing on maintenance issues, such as erosion control, spill containment and remediation, and removal of debris, waste, and equipment no longer needed in operations, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge water resources. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect water resources on adjacent Federal surface estate. Thus, for these operations, the impacts on water resources would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on water resources. These could include erosion control measures and spill prevention and control equipment and practices; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to water resources. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have

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reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to water resources. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting water resources. As previously discussed, new operations create the greatest additional impacts on water, so establishing performance-based standards that would include proper site planning, timing restrictions and the best management practices to avoid or minimize many of the typical impacts to water resources from oil and gas development. Also, the rule includes additional standards that would protect water resources, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge water resources in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include protections for water resources on these easements (e.g., ponds and marshes on wetland easements, or ephemeral streams on grassland easements).

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to pre-disturbance hydrologic functions, and restoring natural systems using native soil material that would indirectly reduce impacts to water resources within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on water resources compared to Alternative A

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to the rule, Alternative C may provide for implementation of higher standards for protection of water resources to a greater number of wells. Since the greatest impacts to water resources have already occurred, the Service would be focusing on maintenance issues, such as erosion control, removal or remediation of contaminated soils, removal of debris, waste, and equipment no longer needed in operations, in those cases where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge water resources. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to waters within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Water resources would only be impacted by accidents associated with well control. Given

present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to water resources related to our downhole regulation under Alternative C.

Cumulative Impacts of Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect water resources of the refuges. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on water resources in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on water resources are listed in Table 4-4.

TABLE 4-4. CUMULATIVE IMPACTS ON WATER RESOURCES (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Water Resources
Prescribed fires and fire management actions	Short-term and long-term adverse effects on surface waters from erosion and sedimentation from burned sites and sites disturbed by fire line construction. Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire and thereby improve vegetation cover and reduce runoff.
Service facility and road construction	Possible short-term and long-term adverse effects on surface waters from site runoff, although would be minimized with proposer erosion and sedimentation control measures.
Vegetation management	Long-term beneficial effects of erosion control from improved vegetative cover, which hold soils in place and reduce sedimentation in nearby water bodies.
Off refuge industrial discharges	Discharges of a variety of pollutants to receiving streams that can enter refuges.
ORV use	Short- and long-term adverse effects on surface waters if affected by runoff from compacted and eroded surface following vehicle-related disturbances to the soil surface.
Abandoned mine lands reclamation	Long-term beneficial effects of reduced erosion/runoff of contaminants to adjacent streams following re-establishment of vegetation cover; improvements to water quality through control and treatment of water discharges.
Mining and logging activities	Long-term adverse effects on surface waters from erosion and sedimentation stemming from legacy surface disturbances and vegetation removal and long-term effects of acid mine drainage.
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, create ruts that increase potential for increased runoff to surface waters containing sediments, pesticides, and nutrients (fertilizers).

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Water Resources
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects from compaction, erosion and sedimentation following construction-related disturbances, non-point pollution from fertilizers, oils, chemicals used in lawn and grounds maintenance, plus continuing discharges to groundwater from septic systems and to surface waters from runoff containing pesticides and fertilizers.
Future oil and gas development on adjacent lands	Indirect adverse impacts on refuge waters from “spill-over effects” of sedimentation and contamination from surface runoff from nearby sites; possible contamination of groundwater resources from improperly designed or installed wellbores; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside refuges	Long-term beneficial effects of restoration of natural contours, topsoil and vegetation cover that minimizes surface runoff and removes sources of contamination and contaminated soils.

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on water resources, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on water resources. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on water resources as a result of oil and gas operations that would continue to affect water resources where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

WETLANDS

METHODOLOGY

Potential impacts on wetlands are assessed based on the actions being proposed and characteristics of the wetland resources in refuges, and disturbance to unique features that may be affected. Resource-specific context for assessing impacts of the alternatives on wetland resources includes the following:

- Disturbance or loss of wetland vegetation caused by the oil/gas development.
- Uniqueness of wetland functions and values (groundwater recharge, stormwater storage and discharge, unique habitats, etc.) that are intrinsic to wetlands and cannot be easily duplicated or replaced.
- Quality of the particular wetland being impacted related to the functions and values performed by that wetland and their ability to recover.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON WETLANDS

Overall impacts on wetlands would include changes to wetland functions and values, impacts on rare and unique wetland communities; changes to hydrology; impacts on water quality from runoff and sedimentation; stormwater impacts; changes to the abundance and diversity of wetland plant species and wildlife use; the size and type of wetland affected; the area of disturbance; and wetland connectivity to adjacent habitats. Although soil, water, vegetation, and floodplain resources are addressed as separate topics in this EIS, they are also mentioned here because wetland areas often coincide with these other sensitive and ecologically important resources. For all phases of development, impacts to wetlands would be avoided, mitigated, or compensated for under Federal regulations, executive order directives, and Service policy.

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on wetland communities can result from localized vegetation clearing, ground disturbance, and crossing of small wetlands and would depend on the type of survey done, the equipment and vehicles used, the type of vegetation, and the season of the year. Vegetation clearing and trimming for surveying and increased vehicular traffic associated with seismic investigations would be minimized to the extent possible. Vegetation trimmed during line placement would be minimal and expected to recover over the short term. The introduction or spread of nonnative invasive vegetation could occur during this phase as a result of vehicular traffic, but this would be relatively limited in extent during this phase.

Leaks and spills from refueling vehicles used in the surveys could pollute soil and water, and harm or kill vegetation. Surface disturbance from survey crews traversing the area during geophysical exploration could cause localized soil compaction and rutting and damage to vegetation. Soil Hydrologic Groups C and D typically found in lowland areas (wetlands and floodplains) are very susceptible to adverse impacts from oil and gas operations. In general, these soils have high clay contents, low permeability, are moderately to highly compactable, and have low infiltration rates and recharge potentials (NRCS 2007). Wet or saturated soils are the most sensitive to disturbance from vehicle use. As described in *Geology and Soils*, compaction reduces the soil's water-holding and infiltration capacities which could increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009) and ultimately degrade existing soil and wetland communities. Disturbance of existing unpaved surfaces and resultant road runoff or the crossing of small areas of wetlands along tributary streams may also affect surface water and wetland resources. Where soils are compacted or rutted, surface hydrology and plant growth could be altered (DeJong-Hughes et al. 2001, McBroom et al. 2012).

The majority of impacts associated with these surveys are limited in extent and severity, because of the temporary nature of the disturbance and localized area disturbed by survey crews.

Impacts of Well Drilling and Production

In areas where drilling and production operations would be permitted, the construction and maintenance of roads, well pads, flowlines, and pipelines in or adjacent to wetlands could require the placement of fill material, removal of vegetation, and disruption of soils and surface hydrology, which would alter beneficial wetland functions and values. Under Federal regulations, executive order, and/or Service policy, impacts to wetlands would be avoided, mitigated, or compensated for, but impacts could still occur. The types of impacts on wetlands associated with drilling and production could include not only the visible loss of vegetation and disruption to soils, but the effects on the functions and values of the wetland community. Wetland functions that may be affected include surface water storage; shoreline stabilization; stream flow maintenance; groundwater recharge; sediment removal and nutrient cycling; aquatic productivity support; and provision of plant and wildlife habitat.

The degree to which a given wetland and its functions are impaired depends on a number of factors, including wetland type (e.g., wet meadow versus forested), landscape position (riverine versus wet meadow), level of impairment or impact, and success of restoration efforts (FERC 2004, DeJong-Hughes et al. 2001, McBroom et al. 2012). Different wetland types have different levels of importance and performance for these various functions, and site-specific functions and values would be assessed and included in the development of mitigation plans for any wetland disturbance that triggers Clean Water Act Section 404 permitting.

During site preparation, impacts on wetlands occur as a result of vegetation clearing, grading, cutting, filling, and leveling of the site using heavy construction equipment. Use of smaller, light-weight, or other low-impact vehicles as well as timber or artificial mats would reduce impacts on soil and wetland resources and protect wetland functions such as shoreline stabilization, groundwater recharge, and plant and wildlife habitat. During drilling and production, the construction, maintenance, and use of access roads, well pads, flowlines, and pipelines could cause soil compaction and rutting, thereby degrading wetland function through reducing the soil's water-holding and infiltration capacities (Duiker 2004). This would in turn reduce the root penetration capabilities of vegetation and hinder plant growth and affect wetland function. Compaction and rutting of existing unpaved surfaces and resultant road runoff or the crossing of small areas of wetlands along tributary streams may also affect wetland functions by altering surface hydrology and degrading plant communities and potential wildlife habitat (DeJong-Hughes et al. 2001, McBroom et al. 2012).

In addition to construction-related impacts associated with development of access roads and well pads, there is a risk of impact on wetlands from releases of hazardous or contaminating substances during drilling or production operations. These releases could occur from leaking equipment. As described in *Geology and Soils*, the unintentional or accidental release of hazardous or contaminated materials also includes the risk of release of drilling mud, and contamination from the release of produced waters containing salts, NORM, hydrocarbons and other well drilling fluids could also impact wetland vegetation in the refuge units. These substances may contain relatively large concentrations of dissolved salts, particularly sodium chloride, and can have salt concentrations greater than ocean water (Vavrek et al. 2004).

Salt stress is the major environmental factor that affects all vital plant processes such as growth, photosynthesis, protein synthesis, energy and lipid metabolism, and productivity (Parida and Das 2005). Instances of leaks from salt-water disposal wells and subsequent contamination occurring as the result of mechanical problems and improper operating practices have been documented at

Hagerman and Aransas NWRs and the Anderson WPA (M. Maddux and M. Borgreen, pers. comm.). Oilfield brine spills can increase the bioavailability of some heavy metals as well as destroy the soil structure resulting in the significant reduction of infiltration rates (Vavrek et al. 2004). These brine impacted soils are usually devoid of vegetation and are susceptible to erosion. The loss of infiltration will result in increased runoff with impacts to nearby wetlands in terms of salinity, and siltation. Impacts to the soils and wetlands from oilfield brine spills remain for years (Vavrek et al. 2004).

Release of drilling muds, hydrocarbons, produced waters, or treatment chemicals could occur during drilling, production, or transport, with notable adverse impacts.

The types of impacts related to wetland resources for directionally drilled wells are expected to be similar to those described for operations inside the refuge units; however, direct impacts to wetlands in refuge units would not occur. The risk of indirect impacts and their intensity would vary with the location of the well with respect to the refuge boundary and direction of surface runoff. The risk of impacts on refuge resources would be greater for directionally drilled operations sited closer to refuge boundaries with surface gradients toward the refuge, where water and sediment can be transported downslope into refuge unit wetlands through adjacent streams, gullies, or overland flow. Severity of impacts would depend on proximity of operations to the refuge units; type of construction; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; sensitivity of resources; and mitigation measures being employed.

Impacts of Plugging and Reclamation

When drilling and production operations end, well plugging and surface reclamation results in overall beneficial impacts on wetlands if conduct of operations had impacted wetlands. Although damage and loss of vegetation and soil disturbance during ground disturbing equipment occurs from plugging actions, these disturbances are temporary. There are also beneficial effects on wetland functions and values once cleanup is successfully completed and the site is reclaimed to natural conditions and processes. Reclamation involves returning the topography of a site to approximate the original contours, and re-establishing natural wetlands communities. Allowing vegetation in disturbed areas to recover provides erosion control in areas of previous impacts from oil and gas operations.

Clearing vegetation from oil and gas access roads and well pads and the use of heavy equipment and vehicles would temporarily increase localized erosion potential, causing increased turbidity and sedimentation in waterways, and alter surface water flows. In addition, there is the potential for release of liquid hydrocarbons and/or contaminating or hazardous substances into wetlands from vehicles, wellhead equipment, or flowlines during well plugging and reclamation activities. These temporary activities could cause detectable, localized changes to wetlands for wells located near surface waters. However, sources of potential leakage from wellhead equipment and flowlines are removed during the plugging and reclamation phase, reducing the overall impact.

Recovery of wetland communities would be primarily dependent on location, site conditions, precipitation, and type of wetland community desired. Except for forested and scrub-shrub wetlands, which are slow to regenerate, most wetland communities in the refuge units would be expected to re-establish in a relatively short time. If access roads are not reclaimed, but continue to be used for other administrative purposes, adverse impacts on adjacent wetlands could occur if visitors travel off established routes. Despite this potential effect, restoration of native wetland communities associated with plugging and reclamation would ultimately have long-term beneficial impacts.

Environmental Consequences

Impacts are based on the assumption that post-construction restoration efforts would be successful and no unforeseen conditions resulting from proposed oil and gas operations (e.g., potential spills) delay anticipated recovery rates. Note that a long-term or permanent effect or impact does not necessarily mean a permanent loss of wetlands habitat. For example conversion of scrub-shrub or forested wetlands to herbaceous wetlands is considered a permanent impact on those woody wetlands classes, but does not represent a complete loss of wetlands habitat; whereas a permanent wetlands loss would be a conversion of a wetland to upland as a result of the construction of a well pad or access road.

In forested and scrub-shrub wetlands, the effects of plugging and reclamation would be longer term due to the longer period needed to regenerate a mature forest or shrub community. Scrub-shrub and forested wetlands that would be initially cleared (cut to ground surface) for oil and gas operations would be allowed to regrow over time following plugging and reclamation. This would be considered a long-term impact based on the slower growth rate of trees and shrubs, which may require decades for complete regeneration, if at all (Stanturf et al. 2001). Impacts on emergent wetlands affected within the refuge units would likely be short-term to long-term, with successful re-establishment within 3 to 5 years.

Reclaiming the well pads and access roads would have a beneficial impact on wetlands by reducing soil erosion and re-establishing surface drainage flows, once re-contouring and planting and establishment of native vegetation in disturbed areas is complete. As a result, there would be long-term beneficial effects on wetlands once reclamation is complete.

Indirect impacts on wetlands in the refuge units from reclamation of wells directionally drilled from outside the Service boundary to bottomholes beneath Service land could result in impacts similar to those described above for operations, but the intensity of impact would depend on proximity to the refuge unit, site-specific environmental conditions, and mitigation measures employed; therefore, impacts could range from no impact on wetlands, to localized or widespread short- to long-term adverse impacts.

IMPACTS OF ALTERNATIVES ON WETLANDS

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on wetland resources.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of wetland resources on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, wetland resources associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for wetland resources would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and

operator's compliance with those rules) in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to wetlands within the refuge. However, wells directionally drilled and produced from outside refuges to bottomholes beneath the refuge would directly impact wetlands on adjacent lands as well as present a risk of indirect impacts within the refuges. Under current regulations, the Service cannot impose preventative measures such as mitigation. The risk and intensity of indirect impacts on refuge resources would increase for operations sited closer to refuge boundaries where water and sediment could be transported downslope into a refuge through streams, gullies, or overland flow. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures.

Alternative B provides an even greater incentive for operators to locate their operations outside refuges since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Therefore, it is likely that impacts to wetlands from new production and drilling operations within refuges would be avoided to a greater extent than in Alternative A. Impacts on wetlands from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would reduce water and sediment transport downslope into refuge units through streams, gullies, or overland flow and thus impacts to wetlands within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge wetlands.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations it provides additional protection for wetland resources. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to wetland resources.

Environmental Consequences

Under Alternative A, there would be unnecessary impacts on wetland resources from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Wetland Resources. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on wetland resources from oil and gas operations include soil erosion and sedimentation associated with disturbed areas, and possible wetland contamination from leaks and spills, leading to adverse impacts on wetland and sediment quality in wetlands. As previously discussed, most of the impacts to wetland resources occurred when the operation was originally chosen and developed by the operator to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect wetland resources and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect wetland resources. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on wetlands could include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, siting operations a minimum distance from wetlands, and removal of debris, waste, and equipment no longer needed in operations.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to wetland resources, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of wetland resources from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to wetland resources would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soil from tank battery sites, and clean-up standards for areas contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to impacts on wetland resources would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet the Service's reclamation standards, which would also greatly reduce any long-term impacts on refuge wetland resources as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to wetland resources compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to the rule, Alternative C may provide additional protections for more wells for wetland resources from impacts associated with pre-existing operations. Since the greatest impacts to wetland resources have already occurred, the Service would be focusing on maintenance issues, such as erosion control, spill containment and remediation, and removal of debris, waste, and equipment no longer needed in operations, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge wetland resources. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect wetland resources on adjacent Federal surface estate. Thus, for these operations, the impacts on wetland resources would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs, that serve to minimize or avoid impacts on wetland resources. These could include erosion control measures and spill prevention and control equipment and practices; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to wetland resources. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to wetland resources. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting wetland resources. As previously discussed, new operations create the greatest additional impacts on wetlands, so establishing performance-based standards that would include proper site planning, timing restrictions, and best management practices to avoid or minimize many of the typical impacts to wetland resources from oil and gas development. Also, the rule includes additional standards that would protect wetland resources, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge wetland resources in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include protections for wetland resources on these easements (e.g., ponds and marshes on wetland easements, or ephemeral streams on grassland easements).

Environmental Consequences

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would indirectly reduce impacts to wetland resources within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on wetland resources compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to the rule, Alternative C may provide for implementation of higher standards for protection of wetland resources to a greater number of wells. Since the greatest impacts to wetland resources have already occurred, the Service would be focusing on maintenance issues, such as erosion control, removal or remediation of contaminated soils, removal of debris, waste, and equipment no longer needed in operations, in those cases where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge wetland resources. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to wetlands within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Wetland resources would only be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to wetland resources related to our downhole regulation under Alternative C.

Cumulative Impacts of Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect wetland resources. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on wetland resources in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on wetlands are listed in Table 4-5.

TABLE 4-5. CUMULATIVE IMPACTS ON WETLANDS (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Wetlands
Prescribed fires and fire management actions	<p>Short-term and long-term adverse effects on wetland function and values from loss of productivity following removal of vegetation that may be preventing erosion and sedimentation; short- and long-term impacts from fire line construction that requires digging and displacement of soils and loss of organic matter from burning of surface litter and topsoil and altered hydrology.</p> <p>Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire; improved productivity and erosion control from vegetative cover that is established after these treatments.</p>
Service facility and road construction	Short-term and long-term adverse effects on wetland function and values from direct loss of soils and vegetation when removed for development, altered hydrology, and compaction and rutting of soils during road grading and construction using heavy equipment; increased road runoff and crossing of small areas of floodplains along tributary streams.
Vegetation management	Long-term beneficial effects of erosion control from improved vegetative cover, which hold soils in place. 500-foot setbacks and use of buffers for workspaces and siting.
Trails development and maintenance	Short-term and long-term adverse effects on wetland function and values from compaction and rutting during clearing, grading and surfacing of trails, and removal of vegetation in trail footprint, altered hydrology.
ORV use	Short- and long-term adverse effects on wetland function and values from compaction and rutting, erosion and sedimentation following vehicle-related disturbances to surfaces; altered hydrology.
Abandoned mine lands reclamation	<p>Short-term adverse effects on wetland function and values from compaction and rutting during reclamation-related disturbances; altered hydrology.</p> <p>Long-term beneficial effects of improved surface (revegetation) and reduced erosion following re-establishment of natural contours and wetland restoration.</p>
Mining and logging activities	Long-term adverse effects on wetland function and values from erosion stemming from legacy surface disturbances and vegetation removal and long-term effects of acid mine drainage on wetland function and values (degradation).
Recreational use	<p>Short- and long-term adverse effects on wetland function and values from visitor activities including trampling and associated compaction and rutting.</p> <p>Long-term beneficial effects on wetland-dependent wildlife viewing and aesthetics.</p>
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, create ruts that increase potential for erosion.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects on wetland function and values from direct loss of soils and vegetation in development footprint and compaction, rutting, erosion and sedimentation following construction-related disturbances; altered hydrology. Many private developments may not undergo rigorous regulatory oversight or permitting and have more impacts on wetlands, especially small, isolated wetlands.
Future oil and gas development on adjacent lands	Direct effects on wetlands on adjacent property and indirect adverse impacts on wetlands soils from “spill-over effects” of sedimentation and contamination from surface runoff; possible severe adverse impacts in the unlikely event of a well blowout, fire, or major

Environmental Consequences

Past, Present, and Reasonably Foreseeable Activity	Impacts on Wetlands
	release; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on wetland function and values from reclamation related disturbances due to use of equipment on site and grading. Long-term beneficial effects of restoration of natural contours and hydrology, topsoil and vegetation cover that protects soils from erosion; removal of sources of contamination and contaminated soils, wetland restoration.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-5).

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on wetlands, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on wetlands. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on wetlands as a result of oil and gas operations that would continue to affect wetlands where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

FLOODPLAINS

METHODOLOGY

Potential impacts on floodplains are assessed based on the actions being proposed and characteristics of the floodplains in refuges, and disturbance to unique features that may be affected. Resource-specific context for assessing impacts of the alternatives on floodplains includes the following:

- the susceptibility of soil types found in floodplains to disturbance (particularly high erosion or shrink/swell potential, compaction characteristics)
- the susceptibility of floodplains to contamination or other effects of oil and gas activities
- disturbance or loss of riparian vegetation caused by the oil/gas development
- the type and amount of disturbance (such as type and location of access roads and pads)

For the programmatic analysis, a qualitative analysis of the potential impacts of oil and gas operations on floodplains was conducted based on actual experience of the Service in management of non-Federal oil and gas operations and their effects on floodplains.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON FLOODPLAINS

Impacts from Geophysical Exploration

The primary impacts from geophysical exploration on floodplains are similar to those described for geology and soils, water resources, wetlands, and vegetation, and would be from the use of vehicles to transport equipment and personnel. Vehicles, if permitted to travel within the floodplains, could damage vegetation, reduce the soil's water-holding and infiltration capacities, increase compaction and rutting of soils, reduce the vegetation's root-penetration capabilities, and hinder plant growth and soil formation. Soil Hydrologic Groups C and D typically found in lowland areas (wetlands and floodplains) are very susceptible to adverse impacts from oil and gas operations. In general, these soils have high clay contents, low permeability, are moderately to highly compactable, and have low infiltration rates and recharge potentials. Wet or saturated soils are the most sensitive to disturbance from vehicle use. Exposed, compacted soils increase runoff of surface waters and accelerate soil erosion. Erosion of floodplain soils could increase turbidity and sedimentation in surface waters and wetlands.

In many areas of the refuge units, the use of vehicles for geophysical exploration operations would not meet a technologically feasible, least damaging standard, thereby eliminating the adverse impacts associated with their use. Drilling shotholes with a hand-held auger could be done in areas where vehicle access would cause damage and unnecessary loss of vegetation, or where soils would be damaged by vehicle use. The drilling of seismic shotholes is expected to have localized adverse impacts on floodplain resources. There could be small blowouts measuring up to several feet in diameter from the detonation of explosives in seismic shotholes.

During the geophysical exploration phase, adverse impacts on floodplains can also result from localized vegetation clearing, ground disturbance, and crossing of floodplains and small areas of tributary floodplains, and would depend on the type of survey done, the equipment and vehicles used, and the season of the year. As noted in Geology and Soils, compaction reduces the soil's water-holding and infiltration capacities which could increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009) and ultimately degrade existing soil and floodplain resources. Disturbance of existing unpaved surfaces and resultant road runoff or the crossing of small areas of tributary floodplains may also affect floodplain resources. Where soils are compacted or rutted, surface hydrology and plant growth could be altered (DeJong-Hughes et al. 2001, McBroom et al. 2012). Leaks and spills from ORVs could damage vegetation, contaminate soils, and degrade surface and groundwater.

Impacts of Well Drilling and Production

Where drilling and production operations are permitted in floodplains, the construction and maintenance of access roads, well pads, flowlines, and pipelines could remove vegetation, expose soils to erosion and contamination, compact and rut soils, and introduce nonnative construction materials (i.e., gravel) and nonnative vegetation, reduce soil permeability, and introduce sediments in waterways. Impacts on floodplain resources would be short-term for construction activities and drilling operations and long-term for roads, production operations, and flowlines and pipelines.

Environmental Consequences

During site preparation, impacts on floodplains occur as a result of vegetation clearing, grading, cutting, filling, and leveling of the site using heavy construction equipment. Use of timber mats would reduce impacts on soil and floodplain resources. During drilling and production, the construction, maintenance, and use of access roads, well pads, flowlines, and pipelines could cause soil compaction and rutting, thereby reducing the soil's water-holding and infiltration capacities. This would in turn reduce the root penetration capabilities of vegetation and hinder plant growth and affect floodplain function. Compaction and rutting of existing unpaved surfaces and resultant road runoff or the crossing of small areas of tributaries may also affect floodplains by altering surface hydrology and degrading plant communities and potential wildlife habitat (DeJong-Hughes et al. 2001, McBroom et al. 2012).

In addition to construction-related impacts associated with development of access roads and well pads, there is a risk of impact on floodplains from releases of hazardous or contaminating substances such as drilling muds, hydrocarbons, produced waters, or treatment chemicals, during drilling or production operations, or during the transportation of hydrocarbons. These releases could occur from leaking equipment or flowlines. As described in Geology and Soils, the risk of releases reaching more area of the well pad or offsite locations is greater for those wells that are not under an SUP permit because these wells are not required to have the more protective measures that are required under SUPs. Wet or saturated soils are the most sensitive to disturbance from overland vehicle use. Exposed, compacted soils increase runoff of surface waters and accelerate soil erosion. Degradation of the floodplain function and value would result from erosion of floodplain soils resulting in increased turbidity and sedimentation in surface waters. Leaks and spills from ORVs crossing floodplains could harm or kill vegetation, and contaminate soils and surface and groundwater. Siting of drilling or production operations in a floodplain could also pose a safety hazard to oil and gas operator's workers and contractors, Service staff, and visitors due to the potential for soil instability and the potential for flooding events.

Indirect effects on floodplains may also result if sites are developed outside, but adjacent to, floodplains/riparian areas when lateral drainage is interrupted by road or well-site construction or increased erosion impacts the water quality of streams.

The types of impacts related to floodplain resources for directionally drilled wells are expected to be similar to those described for operations inside the refuge units. Direct impacts to floodplains within the refuges would be avoided, but the intensity of indirect impacts on floodplains would vary with the location of the well and its proximity to a floodplain. Impacts on refuge resources would be greater for directionally drilled operations sited closer to refuge boundaries, where water and sediment can be transported downslope into refuge unit floodplains through adjacent streams, gullies, or overland flow. The degree of impacts on floodplains would depend proportionally on the proximity of operations to refuge units; type of construction; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed.

Impacts of Plugging and Reclamation

When drilling and production operations end, well plugging and surface reclamation results in overall beneficial impacts on floodplains. Well plugging, shutting down and abandoning/removing flowlines and pipelines, and use of heavy equipment and vehicles during reclamation activities could, however, increase soil erosion, alter surface water flows and hydrology, increase sedimentation in waterways, and contaminate soils, surface, and groundwater. Abandonment and reclamation could

require cutting and clearing of vegetation. Reclamation involves returning the topography of a site to approximate the original contours, and re-establishing the natural floodplain. Allowing vegetation in disturbed areas to recover provides erosion control in areas of previous impacts from oil and gas operations.

Indirect impacts on floodplains in the refuge units from reclamation of wells directionally drilled from outside the refuge units to bottomholes beneath the refuge units could result in impacts similar to those described above for operations inside the refuge unit, but the intensity of impact would depend on proximity to the refuge unit, site-specific environmental conditions, and mitigation measures employed; therefore, adverse impacts could range from no impact on floodplains, to localized or widespread impacts that are short- to long-term in duration.

ALTERNATIVES COMPARISON OF IMPACTS TO FLOODPLAINS

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on floodplains.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of floodplains on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, floodplains associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for floodplains would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to floodplains within refuge units. However, wells directionally drilled and produced from outside refuge units to bottomholes beneath the refuge units could still directly impact floodplains on adjacent lands as well as present a risk of indirect impacts within the refuge units, if poorly sited. Under current regulations, the Service cannot impose preventative measures such as mitigation. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where spills, leaks, water, and sediment could be transported downslope into refuge units through streams, gullies, or overland flow. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures.

Environmental Consequences

Under Alternative C, all phases of pre-existing operations within the refuge boundary would be subject to all provisions of the rule as described under Alternative B. Pre-existing operations on private surface estate within a refuge boundary, as well as pre-existing operations outside and adjacent to the refuge boundary, would continue production activities but would eventually require an operations permit to ensure compliance with the reclamation standards of the rule. Impacts to floodplains would be reduced as described under Alternative B.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge and operations on private surface estate within a refuge boundary. Directional drilling operations would be subject to the full regulatory requirements of a new operation. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would reduce water and sediment transport downslope into refuge units through streams, gullies, or overland flow and thus impacts to floodplains within the refuge boundary.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection for floodplains. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to floodplains.

Under Alternative A, there would be unnecessary impacts on floodplains from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Floodplains. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effect on floodplains is similar to that of geology and soils and wetlands from oil and gas operations and stems from the fact that soils are taken out of beneficial use where they have been disturbed. Within the footprint of the disturbance, potential impacts include the loss of soils from grading or construction of facilities, soil compaction, soil erosion and sedimentation associated with disturbed areas, and possible soil contamination from leaks and spills, leading to adverse impacts on soil chemistry and productivity. So, as previously discussed regarding time/place/manner considerations, most of the impacts to floodplains occurred when the operator chose and developed the site to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect floodplains and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect floodplains. Typical mitigation measures that would minimize

ongoing impacts from pre-existing operations on floodplains could include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, and removal of debris, waste, and equipment no longer needed in operations.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to floodplains, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of floodplains from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to floodplains would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soils from tank battery sites to protect soils and water, and clean-up standards for soils contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to ongoing impacts on floodplains would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet the Service's reclamation standards, which would also greatly reduce any long-term impacts on floodplains as discussed further below in Performance-Based Standards. Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to floodplains compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to Alternative B, Alternative C may provide additional protections for floodplains from impacts associated with pre-existing operations. Since the greatest impacts to floodplains have already occurred, the Service would be focusing on maintenance issues, such as erosion control, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect floodplains. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect floodplains on adjacent Federal surface estate. Thus, for these operations, the impacts on floodplains would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs, that serve to minimize or avoid impacts on floodplains. These could include erosion control measures and spill prevention and control equipment and practices; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address

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impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to geology and soils. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to floodplains. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting floodplains. As previously discussed, new operations create the greatest additional impacts on floodplains, so establishing performance-based standards that would include proper site planning, timing restrictions and best management practices would avoid or minimize many of the typical impacts to floodplains from oil and gas development. Also, the rule includes additional standards that would protect floodplains, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations and to avoid areas identified as floodplains. For operations on refuge units in Alaska, the Service could consider these performance-based standards on a case by case basis for inclusion in a ROW permit to ensure protection of floodplains in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include protections for floodplains on these easements (e.g., hydric soils on wetland easements).

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would reduce impacts to floodplains within refuges. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on floodplains compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to Alternative B, Alternative C may provide for implementation of higher standards for protection of floodplains to a greater number of wells. Since the greatest impacts to floodplains have already occurred, the Service would be focusing on maintenance issues, such as erosion control, in those cases where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge floodplains. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to waters within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Floodplains would only be impacted by accidents associated with well control. Given

present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to floodplains related to our downhole regulation under Alternative C.

CUMULATIVE IMPACTS

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect floodplain resources. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance to these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on floodplain resources in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on floodplains are listed in Table 4-6.

TABLE 4-6. CUMULATIVE IMPACTS ON FLOODPLAINS (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Floodplains
Prescribed fires and fire management actions	<p>Short-term and long-term adverse effects on floodplain function and values from loss of productivity following removal of vegetation that may be preventing erosion and sedimentation; short- and long-term impacts from fire line construction that requires digging and displacement of soils and loss of organic matter from burning of surface litter and topsoil and altered hydrology.</p> <p>Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire; improved productivity and erosion control from vegetative cover that is established after these treatments.</p>
Service facility and road construction	<p>Short-term and long-term adverse effects on floodplain function and values from direct loss of soils and vegetation when removed for development; altered hydrology; compaction and rutting of soils during road grading and construction using heavy equipment; improper flood-proofing; increased road runoff and crossing of small areas of tributary floodplains.</p>
Vegetation management	<p>Long-term beneficial effects of erosion control from improved vegetative cover, which hold soils in place. Setbacks and restricting staging areas, access roads, and restricting placement of staging, well pads, and flowlines to areas outside the 100-year floodplain, where practicable.</p>
Trails development and maintenance	<p>Short-term and long-term adverse effects on floodplain function and values from compaction and rutting during clearing, grading and surfacing of trails, and removal of vegetation in trail footprint, altered hydrology.</p>

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Floodplains
ORV use	Short- and long-term adverse effects on floodplain function and values from compaction and rutting, erosion and sedimentation following vehicle-related disturbances to surfaces; altered hydrology.
Abandoned mine lands reclamation	Short-term adverse effects on floodplain function and values from compaction and rutting during reclamation-related disturbances; improper flood-proofing; altered hydrology. Long-term beneficial effects of improved surface (revegetation) and reduced erosion following re-establishment of natural contours and floodplain restoration.
Mining and logging activities	Long-term adverse effects on floodplain function and values from erosion stemming from legacy surface disturbances and vegetation removal and long-term effects of acid mine drainage on floodplain function and values (degradation)
Recreational use	Short- and long-term adverse effects on floodplain function and values from visitor activities including trampling and associated compaction and rutting. Long-term beneficial effects on floodplain-dependent wildlife for enhanced viewing and aesthetics.
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, create ruts that increase potential for erosion, and alteration of hydrology.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects on floodplain function and values from direct loss of soils and vegetation in development footprint and compaction, rutting, erosion and sedimentation following construction-related disturbances; altered hydrology Construction may increase erosion and deposition of sediments that could alter the topography, modify surface water flows and hydrology, and indirectly adversely affect vegetation, fish, and wildlife. Excavation activities associated with construction, the installation of subsurface drainage, and extensive groundwater or surface water withdrawals for agricultural, industrial, or residential uses may disrupt surface and subsurface water flow, which could cause reductions in water levels and/or changes in frequency, duration, or extent of water distribution.
Future oil and gas development on adjacent lands	Direct effects on floodplain on adjacent property and indirect adverse impacts on floodplain soils from “spill-over effects” of sedimentation and contamination from surface runoff and improper flood-proofing; possible severe adverse impacts in the unlikely event of a well blowout, fire, or major release; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside	Short-term adverse effects on floodplain function and values from reclamation-related disturbances due to use of equipment on site and grading. Long-term beneficial effects of restoration of natural contours and hydrology, topsoil and vegetation cover that protects soils from erosion; removal of sources of contamination

Past, Present, and Reasonably Foreseeable Activity	Impacts on Floodplains
and outside refuges	and contaminated soils, floodplain restoration. Recontouring and revegetating disturbed areas should reduce soil erosion and re-establish surface drainage flows.

Under Alternative B, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development that were considered in the cumulative scenario. These are described under Alternative A and would be the same under Alternative B. Alternative B would contribute to cumulative impacts from the continued operations with SUPs and ROWs and of pre-existing operations, which would continue to have long-term direct adverse impacts on floodplains, as described in the above analysis. Bringing operations with SUPs and ROWs, new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on floodplains. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Cumulative impacts from actions under the cumulative impact scenario would be the same as described under alternative A. Similar to Alternative B, there would be effects on floodplains as a result of oil and gas operations that would continue to affect floodplains where impacts cannot be avoided, and benefits from bringing all operations under regulations and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing all operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

VEGETATION (INCLUDING PLANT SPECIES OF SPECIAL MANAGEMENT CONCERN)

METHODOLOGY

Potential impacts on vegetation and plant species of management concern (also referred to as “special-status species”) are assessed in this section, based on the actions being proposed and characteristics of the vegetation in the refuge units. Resource-specific context for assessing impacts of the alternatives to vegetation and special-status plant species includes the following:

- the type and amount of disturbance (such as duration of operation and type and location of access roads and pads)
- the potential for nonnative invasive species-related impacts occurring from oil and gas activities.

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- the susceptibility of vegetation, including special-status species, to disturbance, removal, contamination, or other effects of oil and gas activities.
- the presence of special-status species in refuge units and their potential to be present in areas of oil and gas development

For the programmatic level analysis, a qualitative analysis of the potential impacts of oil and gas operations on the species was conducted based on actual experience of the Service in management of non-Federal oil and gas operations, professional judgment, and information available in the literature.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON VEGETATION (INCLUDING PLANT SPECIES OF SPECIAL MANAGEMENT CONCERN)

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on vegetation can result from localized clearing and trimming for surveying and increased vehicular traffic associated with seismic investigations. The introduction or spread of nonnative invasive vegetation could occur as a result of vehicular traffic, but this would be relatively limited in extent during this phase. Surface disturbance from survey crews traversing the area during geophysical exploration could also cause localized soil compaction. Compaction reduces the soil's water-holding and infiltration capacities, which could increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009). Erosion and loss of soil could ultimately degrade existing plant communities. The majority of impacts associated with geophysical surveys is limited in extent and severity because of the temporary nature of the disturbance and localized area disturbed by survey crews.

Impacts of Well Drilling and Production

Vegetation removal and ground disturbance associated with the construction and installation of well pads, pipelines, access roads, and other facilities would affect vegetation both directly and indirectly. Direct effects would include removal of vegetation by clearing, grading, cutting, filling, and leveling of the site using heavy construction equipment during site preparation. This activity may also modify habitat structure, species composition, and the extent of vegetation cover types. Site clearing to accommodate a well drilling rig and associated equipment would remove about 1.5 to 4 acres of vegetation for each well pad, resulting in a permanent conversion of the vegetation cover type to an industrial use. The degree of impact would depend on the type and amount of vegetation affected, the rate at which the vegetation would regenerate after construction, and the frequency of vegetation maintenance conducted during operation.

During drilling and production, the construction, maintenance, and use of access roads, well pads, flowlines, and pipelines could directly impact vegetation and plant root system integrity by removal or crushing of plants. Indirect effects associated with disturbances to vegetation could include increased soil erosion and compaction (see Geology and Soils section). Increased erosion rates and reduction in soil stability and productivity could prevent successful reclamation with native species and composition. Surface disturbances could cause soil compaction, thereby reducing the soil's water-holding and infiltration capacities. This, in turn, would reduce the root penetration capabilities of vegetation and hinder plant growth and further soil formation (Crush and Thom 2011). Vegetation established at the edges of well pads could also experience "edge effect," such as changes in microclimate (e.g., sunscald or scorch) in the adjacent open areas and potential changes in herbivory (Adams et al. 2011).

In addition to construction-related impacts associated with development of access roads and well pads, there is a risk of impact on vegetation from releases of hazardous or contaminating substances during drilling or production operations, including well workovers and servicing. The presence of oils and other well development chemicals in soils and site runoff could kill vegetation or adversely impact overall plant health.

Contamination from the release of produced waters containing salts and other well drilling fluids could also impact vegetation in the refuge units. These substances may contain relatively large concentrations of dissolved salts, particularly sodium chloride, and can have salt concentrations greater than ocean water. Salt stress is the major environmental factor that affects all vital plant processes such as growth, photosynthesis, protein synthesis, energy and lipid metabolism, and productivity (Parida and Das 2005).

Accidental release of produced waters would likely damage or kill vegetation in the immediate area and possibly adjacent areas. Immediate adverse impacts on vegetation could occur through direct contact of foliage with the released material. Long-term, systemic impacts could also occur through uptake of the material from the soil by plant roots, thereby reducing the species' ability to recover and re-establish (Adams et al. 2011). Instances of leaks from salt-water disposal wells and subsequent contamination occurring as the result of mechanical problems and improper operating practices have been documented at the Anderson Waterfowl Production Area in Montana, and Hagerman and Aransas NWRs in Texas (M. Maddux and M. Borgreen, pers. comm.).

Ground disturbance and removal of existing vegetation could also promote the introduction of nonnative plant species. Invasive species actively outcompete and replace native species and are a threat to the overall ecological health of the refuge units. Introduction of invasive plant species through seeds or other propagules may increase due to greater vehicular traffic for well site construction and maintenance, improper erosion control and restoration methods, and through other ground-disturbing/clearing activities that would disturb fallow seed (weed) banks. Such introductions could negatively affect native plant communities, reduce diversity, reduce forest health and productivity, and degrade native wildlife habitat (Vila 2011; Tylianakis 2008). Such vegetation is present in every Service refuge and various management efforts are ongoing to deal with the establishment and spread of invasive species.

The types of impacts related to vegetation for directionally drilled wells are expected to be similar to those described for operations inside the refuge units; however, direct impacts to vegetation in the refuges would not occur. The risk of indirect impacts and their intensity would vary with the location of the well with respect to the refuge boundary and direction of surface runoff. The risk of impacts on refuge resources would be greater for directionally drilled operations sited closer to refuge boundaries with surface gradients toward the refuge, where water and sediment can be transported downslope into refuge units through adjacent streams, gullies, or overland flow. Severity of impacts would depend on proximity of operations to the refuge units; type of construction, site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; the presence of hazardous substances in the runoff, sensitivity of resources, and mitigation measures being employed.

Impacts of Plugging and Reclamation

When drilling and production operations end, well plugging and surface reclamation results in overall beneficial impacts on vegetation. Although damage and loss of vegetation during ground-disturbing equipment occurs from plugging actions, these disturbances are temporary and occur in

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previously disturbed areas. Accidental spread and establishment of exotic species in the project area during well plugging and surface reclamation would be minimized through monitoring and best management practices. There are also beneficial effects on vegetation once cleanup is successfully completed and the site is reclaimed to natural conditions and processes. Reclamation involves returning the topography of a site to approximate the original contours, and re-establishing natural vegetation communities. Allowing vegetation in disturbed areas to recover provides erosion control in areas of previous impacts from oil and gas operations. Sources of potential leakage such as wellhead equipment and flowlines are also removed during plugging and reclamation. Beneficial impacts of plugging and reclamation are realized in the short term and over the long term.

Recovery of vegetation communities would be primarily dependent on location, soil conditions, precipitation, and type of community desired. Except for rare vegetation communities that are susceptible to the adverse impacts of oil and gas operations, most vegetation communities in the refuge units would be expected to re-establish in a relatively short time. If access roads are not reclaimed, but continue to be used for other administrative purposes, adverse impacts to vegetation could occur if visitors travel off established routes.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON SPECIAL-STATUS PLANT SPECIES

The refuges addressed in this EIS provide habitat that supports many species of plants that are threatened, endangered, or of special concern at the national, regional, and local levels. The Service recognizes that the conservation of special-status plants and their habitats, as well as natural communities, is integral to maintaining biological diversity (601 FW 3). Consistent with DOI policy, the Service manages State and locally listed species within refuge units in a manner that assists those States and localities meet their planning objectives (43 CFR 24.4).

Some of these species and their habitats may occur in areas suitable for oil and gas development. Given the programmatic nature of this analysis, the exact locations of future operations are unknown, and site-specific data for presence or absence of special-status species at existing wells may not be available. Wells with current SUPs permits would have gone through a review for the presence of special-status species at the time of permitting.

Impacts on special-status plants from oil and gas operations can occur during geophysical exploration, drilling and production, or reclamation phases of development. Impacts such as damage and loss of vegetation resulting in modification of the existing plant community structure and composition in the project area, soil compaction and rutting, reduced soil permeability and root integrity, increased erosion and reduced vegetation health and productivity, and potential contamination of soils and vegetation from leaks and spills could occur as a result of oil and gas operations.

As noted in the following analysis, impacts to special-status plants are usually avoided or mitigated through intra-Service consultation with the Service's Ecological Services field office, use of project area surveys, and completion of biological assessments where adverse impacts could occur.

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on special-status plant communities would be similar in nature to those of common vegetation communities. Localized vegetation

clearing and trimming for surveying and increased vehicular traffic associated with seismic investigations could lead to injury or destruction of sensitive plant species and habitat where exploration operations are permitted. These operations would be required to avoid affecting species of special concern and their habitat, which would be identified through consulting refuge biologists or biological surveys, if determined necessary by the Service through consultation with Federal or State agency biologists. When species of special concern and their habitat are found to be within the project area, application of mitigation measures, including sufficient setbacks and/or timing restrictions for sensitive periods in a given species' life cycle, would likely result in avoiding or minimizing potential adverse effects.

Surface disturbance from survey crews traversing the area during geophysical exploration could introduce or spread nonnative invasive vegetation, but this would be relatively limited in extent during this phase. Surface disturbance could also cause localized soil compaction and dust emissions which would ultimately degrade existing sensitive plant communities. Upon the completion of operations, reclamation of disturbed areas would be required, and recovery of any vegetation disturbed is expected to occur over the short term. The majority of impacts associated with geophysical exploration is limited in extent and minor because of the temporary nature of the disturbance and localized area disturbed by survey crews.

Impacts of Well Drilling and Production

Drilling and production operations would not likely directly affect species of special concern or their habitat in areas afforded protection under current SUPs permits, including ESA regulations. However, operations could result in indirect impacts on special-status plant species, primarily from the disturbance related to construction of new well pads, access roads, flowlines, and pipelines. Impacts would be similar in nature to those of common vegetation communities, including loss of vegetation and habitat, surface disturbances leading to soil compaction, erosion and sedimentation, and nonnative species introduction. If vegetation clearing is unavoidable, it would be limited in extent and mitigation would require that least damaging methods are used for site preparation. In sensitive plant communities, a large effort would be made during the planning of new operations to avoid or minimize alteration of the surface area more than necessary.

Releases of hazardous or contaminating substances and any maintenance activities that are needed pose the greatest threat to special-status plant species. Potential source and nonpoint source pollution from releases and runoff could kill plants or impact the overall health and survival of affected special-status species.

Drilling and production operations could range in duration from short-term (weeks or months for well drilling and construction of roads, well pads, flowlines, and pipelines) to long-term (lasting 20 years or more for road, flowline, pipeline, well, and production operations). Construction and maintenance of roads, pads, flowlines, and pipelines could require vegetation clearing and could result in loss of special-status plants if these are not identified.

Potential effects on special-status plant species would depend on where drilling and production operations are located within refuges. Careful siting of developments based on biological survey and/or assessment results could avoid or minimize these impacts substantially. Through biological surveys and/or assessments and intra-Service consultations, potential impacts on special-status species and their habitat would be identified, and the application of appropriate mitigation measures would reduce or eliminate adverse impacts.

Impacts of Plugging and Reclamation

Well plugging, removing flowlines and pipelines, and use of heavy equipment and vehicles to reclaim sites could have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill protected plants. However, ongoing consultation under the ESA; performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations; identifying listed species; and applying appropriate mitigation would result in reduction or elimination of adverse impacts on listed species.

Plugging and reclamation would require clearing vegetation at the well and access roads, which may temporarily affect nearby sensitive vegetation communities. However, reclamation would result in overall beneficial impacts to sensitive vegetation similar to those of common vegetation communities. With minimal use of equipment used to clear well pads and access roads, and revegetation of the area with weed-free native seed mix, the area affected would be small. Access roads that have been developed or allowed to remain open for the primary purpose of allowing access for oil and gas operations would be reclaimed at the completion of operations, returning the area to its natural conditions. Wherever possible, habitats would be improved to perpetuate the viability of the plant communities and habitats and increase the survivability of nearby special-status species. The outcome of these activities, in returning natural conditions to the operations area, would have long-term beneficial impacts.

If restored properly, few effects on sensitive plant community size, integrity, or continuity would be anticipated and impacts would not affect the overall viability of these plant communities. Avoiding areas of known sensitive species and timing of reclamation to avoid conflicts with critical growth periods would reduce impacts on special-status vegetation and encourage restoration success during this phase. Monitoring site recovery and success would be determined by measuring species survival, native vegetation density and diversity, percent cover, etc. Allowing sensitive vegetation in disturbed areas to recover also provides erosion control in areas of previous impacts from oil and gas operations.

IMPACTS OF ALTERNATIVES ON VEGETATION (INCLUDING PLANT SPECIES OF SPECIAL MANAGEMENT CONCERN)

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on vegetation and plant species of special management concern.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of vegetation and plant species of special management concern on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, vegetation and plant species of special management (e.g., emergent and submergent vegetation on wetland easements, or native vegetation on grassland easements) concern associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for vegetation and plant species of special management concern would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., installation and maintenance of secondary containment for all equipment and facilities using or containing contaminating substances such as oil, brine, formation water, or well stimulation chemicals, the removal of any contaminating substances, requiring operators to control the introduction of noxious and invasive species on their area of operations, and directing operators to use methods that minimize the need for vegetative trimming).

In addition to the further protection and consistency afforded under Alternative B, Alternative C would reduce unnecessary impacts to vegetation and plant species of management concern caused by operations conducted on non-Federal surface location drilling under a refuge. The level of increased protection would vary from slight to moderate depending on proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts.

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to vegetation and plant species of management concern within refuge units. However, wells directionally drilled and produced from outside refuge units to bottomholes beneath the refuge units would directly impact vegetation and plant species of management concern on adjacent lands as well as present a risk of indirect impacts within the refuge units. Under current regulations, the Service cannot impose preventative measures such as mitigation. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where soil disturbance could increase erosion potential and exacerbate the spread of invasive species if not properly controlled. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units, site-specific environmental conditions, and mitigation measures.

Alternative B provides an even greater incentive for operators to locate their operations outside refuges since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Therefore, it is likely that impacts to vegetation and plant species of management concern from new production and drilling operations within refuges would be avoided to a greater extent than in Alternative A. Impacts on vegetation and plant species of management concern from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would require better control of erosion and noxious plants, thus reducing impacts to vegetation and plant species of management concern within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and

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production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge vegetation and plant species of management concern.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations it provides additional protection for vegetation and plant species of management concern. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; and, where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to vegetation and plant species of management concern.

Under Alternative A, there would be unnecessary impacts on vegetation and plant species of management concern from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Vegetation (Including Plant Species of Special Concern. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on vegetation and plant species of management concern is similar to that of geology and soils, and wetlands from oil and gas operations and stems from the fact that soils are taken out of beneficial use where they have been disturbed. Within the footprint of the disturbance, potential impacts include the loss of soils from grading or construction of facilities, soil compaction, soil erosion and sedimentation associated with disturbed areas, and possible soil contamination from leaks and spills, leading to adverse impacts on soil chemistry and productivity. So, as previously discussed regarding time/place/manner considerations, most of the impacts to vegetation and plant species of management concern occurred when the operator chose and developed the site to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect vegetation and plant species of management concern and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect vegetation and plant species of management concern. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on vegetation and plant species of management concern could include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, and removal of debris, waste, and equipment no longer needed in operations, and control of noxious weeds.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to vegetation and plant

species of management concern, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of vegetation and plant species of management concern from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to vegetation and plant species of management concern would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soils from tank battery sites to protect soils and water, and clean-up standards for soils contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to ongoing impacts on vegetation and plant species of management concern would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet the Service's reclamation standards, which would also greatly reduce any long-term impacts on vegetation and plant species of management concern as discussed further below in Performance-Based Standards. Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to vegetation and plant species of management concern compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to Alternative B, Alternative C may provide additional protections for vegetation and plant species of management concern from impacts associated with pre-existing operations to a greater number of wells. Since the greatest impacts to vegetation and plant species of management concern have already occurred, the Service would be focusing on maintenance issues, such as erosion control, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect vegetation and plant species of management concern. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect vegetation and plant species of management concern on adjacent Federal surface estate. Thus, for these operations, the impacts on vegetation and plant species of management concern would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on vegetation and plant species of management concern. These could include erosion control measures and spill prevention and control equipment and practices; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring

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and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to vegetation and plant species of management concern. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to wetland resources. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting vegetation and plant species of management concern. As previously discussed, new operations create the greatest additional impacts on vegetation and plant species of management concern, so establishing performance-based standards that would include proper site planning, timing restrictions, and best management practices to avoid or minimize many of the typical impacts to vegetation and plant species of management concern from oil and gas development. Also, the rule includes additional standards that would protect vegetation and plant species of management concern, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge vegetation in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include protections for vegetation and plant species of management concern on these easements (e.g., ponds and marshes on wetland easements, or vegetative community and ephemeral streams on grassland easements).

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would indirectly reduce impacts to vegetation and plant species of management concern within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on vegetation and plant species of management concern compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to the rule, Alternative C may provide for implementation of higher standards for protection of vegetation and plant species of management concern to a greater number of wells. Since the greatest impacts to vegetation and plant species of management concern have already occurred, the Service would be focusing on maintenance issues, such as erosion control, removal or remediation of contaminated soils, removal of debris, waste, and equipment no longer needed in operations, control of noxious weeds, in those cases where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect vegetation and plant species of management concern. The level of

increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control, invasive species control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to wetlands within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Vegetation and plant species of management concern would only be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to vegetation and plant species of management concern related to our downhole regulation under Alternative C.

CUMULATIVE IMPACTS

Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect vegetation in the refuges. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on vegetation in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on vegetation are listed in Table 4-7.

TABLE 4-7. CUMULATIVE IMPACTS ON VEGETATION (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Vegetation
Prescribed fires and fire management actions	Short-term and long-term adverse effects on vegetation from loss of productivity following removal of vegetation; short and long-term impacts from fire line construction that requires digging and displacement of vegetation matter Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire; improved productivity and erosion control from vegetative cover that is established after these treatments.
Service facility and road construction	Short-term and long-term adverse effects on vegetation from direct loss or damage to vegetation when removed for development and compaction of soils and damage to vegetation during road grading and construction using heavy equipment. Short-term to long-term adverse impacts from the loss of vegetation and ground disturbance/soil erosion and compaction.
Vegetation management	Short-term adverse impacts due to vegetation clearing and effects on soils. Long-term beneficial effects of erosion control from improved vegetative cover. Short term adverse impacts with long-term beneficial effects from site reclamation.

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Vegetation
	Long-term beneficial effects of controlling the introduction and spread of nonnative invasive plant species.
Trails development and maintenance	Short-term and long-term adverse effects on vegetation from clearing, grading, and surfacing of trails, removal of vegetation in trail footprint for maintenance, and potential introduction of nonnative plant species.
ORV use	Short- and long-term adverse effects on vegetation from compaction and vehicle-related disturbances to the plant communities.
Abandoned mine lands reclamation	Short-term adverse effects on vegetation during reclamation-related disturbances. Long-term beneficial effects of improved surface (revegetation) and reduced erosion following re-establishment of vegetation cover and natural contours.
Mining and logging activities	Long-term adverse effects on soils from erosion stemming from legacy surface disturbances and vegetation removal and long-term effects of acid mine drainage on vegetation (change in health and productivity).
Recreational use	Short- and long-term adverse effects on vegetation from visitor activities including trampling and associated compaction; possible introduction of nonnative plant species.
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, grazing pressure.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects on vegetation from direct loss in development footprint and compaction, erosion and sedimentation. Benefit from re-establishment of vegetation following construction-related disturbances.
Future oil and gas development on adjacent lands	Direct effects on vegetation on adjacent property and indirect adverse impacts on refuge vegetation from “spill-over effects” of erosion, sedimentation, and contamination from surface runoff; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on vegetation from reclamation-related disturbances due to use of equipment on site and grading. Long-term beneficial effects of restoration of natural contours, topsoil and vegetation cover that protects soils from erosion; removal of sources of contamination and contaminated soils to reduce impact on vegetation.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-7).

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on vegetation, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on vegetation and plant species of management concern. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on vegetation and plant species of management concern as a result of oil and gas operations that would continue to affect vegetation and plant species of management concern where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

WILDLIFE AND AQUATIC SPECIES (INCLUDING ANIMAL SPECIES OF SPECIAL MANAGEMENT CONCERN)

METHODOLOGY

Potential impacts on wildlife and aquatic species (including species of special management concern, also referred to as “special-status species”) are assessed in this section, based on the actions being proposed and characteristics of the wildlife and aquatic species in the refuge units, and disturbance to their habitat that may be affected. Resource-specific context for assessing impacts of the alternatives to wildlife and aquatic species resources includes the following:

- the type and amount of disturbance (threats) to wildlife and aquatic species and their habitat, including nonnative invasive species-related impacts occurring from oil and gas activities.
- the susceptibility of certain wildlife and aquatic species (including species of special management concern) to disturbance, loss, or modification of habitat from oil and gas activities.
- the presence of special-status wildlife and aquatic species in refuge units and their potential to be present in areas of oil and gas development.

For the programmatic level analysis, a qualitative analysis of the potential impacts of oil and gas operations on the species was conducted based on actual experience of the Service in management of non-Federal oil and gas operations, professional judgment, and information available in the literature. Impacts on special-status animal species are addressed in a subsection following the discussion of impacts on wildlife in general.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON WILDLIFE AND AQUATIC SPECIES

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on wildlife and aquatic species habitat can result from localized vegetation clearing and trimming for surveying and increased vehicular traffic associated with seismic investigations. Wildlife and aquatic species could be displaced or could experience increased stress and mortality and decreased production as a result of work crews

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trimming vegetation or laying lines, and there could be temporary disturbance during the use of the seismic survey technologies due to noise and ground vibration. The removal of vegetation, particularly in forest communities, to accommodate seismic surveys can create linear corridors that fragment the landscape. These linear corridors can change wildlife movement patterns, species interactions, and abundance (Brittingham 2014). Seismic detonations or vibrations could disturb fossorial or burrowing wildlife species. Impacts related to noise are usually temporary, with most wildlife avoiding or moving away from the source, but returning after noise is reduced or eliminated. Very little is known on the effects of anthropogenic sounds, such as seismic detonations, on aquatic organisms such as fish and invertebrates (Hawkins et al. 2015). Seismic survey disturbance would be very localized and intermittent, with the level of impact dependent on the strength of the vibration and proximity to the source. This impact would be relatively limited in extent during this phase. The introduction or spread of nonnative invasive vegetation could occur as a result of vehicular traffic. Invasive species have the ability to outcompete native plant communities and could influence the quality and availability of suitable wildlife habitat within the refuge sites through its invasion.

Surface disturbance from survey crews could also cause localized soil compaction which can increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009), ultimately degrading wildlife habitat and nearby aquatic environments. The majority of impacts associated with these surveys are limited in extent and severity, because of the temporary nature of the disturbance and localized area disturbed by survey crews and their activity.

Impacts of Well Drilling and Production

Vegetation removal and soil disturbance associated with the construction and installation of well pads, pipelines, access roads, and other facilities would affect wildlife both directly and indirectly. Indirect effects would include loss of habitat through removal of vegetation by clearing, grading, cutting, filling, and leveling of the site using heavy construction equipment during site preparation. This activity may also affect habitat structure, species composition, and the extent of vegetation available to wildlife. The removal of vegetation, particularly in forest communities, for road construction can create linear corridors that fragment the landscape. These linear corridors can change wildlife movement patterns, species interactions, and abundance (Brittingham 2014). Other indirect impacts may include changes in distribution, stress, or activity caused by increased human disturbances associated with energy development (e.g., traffic, noise, human use) (Sawyer et al. 2002). Site clearing to accommodate a well drilling rig and associated equipment would remove 1.5 to 4 acres of vegetation for each well pad resulting in a long-term conversion of the habitat type to an industrial use.

The degree of impact would depend on the type and amount of habitat affected, the rate at which the site would regenerate after construction, and the frequency of maintenance conducted during operation. For example, surface disturbance to sagebrush steppe vegetation may adversely affect wildlife species that depend on sagebrush for some life history function, as it may take 10 to 20 years for the vegetation to become re-established. Loss of a specific habitat type may also affect neotropical migrant bird species, many of which prefer a more mature tree canopy that could be removed in more heavily forested areas. Also, disturbances or habitat loss in refuge units with larger holdings of wetlands and floodplains, such as Upper Ouachita, Deep Fork, Tensas River, and Atchafalaya NWRs, could affect migratory bird species during seasonal stopovers by reducing the quality and availability of resting and feeding grounds.

Fragmentation of existing wildlife habitats, which can occur from oil and gas well development, can also decrease an area's functional capacity to support wildlife populations at nonimpacted levels (Trombulak and Frissell 2000). Fragmentation refers to breaking up contiguous areas of vegetation/habitat into smaller patches that become progressively smaller and isolated over time. The removal of vegetation, particularly in forest communities, to install flowlines or pipelines, can create linear corridors that fragment the landscape. These linear corridors can change wildlife movement patterns, species interactions, and abundance (Brittingham 2014). Among other effects, fragmentation of habitat allows predator access to breeding sites used by birds and small mammals along newly created corridors and through edges of habitats that were previously continuous (Johnson 2001).

Direct impacts to wildlife include increased mortality that could result from vehicles, construction activities, and increased access into previously inaccessible areas. Wildlife and aquatic species, particularly small mammals, invertebrates, and herpetofauna (reptiles and amphibians), that cannot escape an area during construction, could be killed, and increased mortality of small mammals is also likely to occur along access roads. New access roads may increase ease of access by humans into formerly remote areas, opening up areas to increased poaching and legal hunting and fishing, and possibly promote new uses such as logging, agriculture, mining, and development (Trombulak and Frissell 2000). Such changes in land cover and land and water use may result in severe and persistent adverse effects on wildlife and wildlife habitat in the refuge units. The refuge unit management, however, can close or restrict motorized public access on roads that are to be used for oil and gas development, if necessary. With this authority, the Service can mitigate the effects of increased public access via oil and gas access roads.

Species that inhabit or frequent areas with sites that have had releases of oil or other chemicals could be harmed or killed through direct exposure with the released materials or indirectly through degraded water quality (e.g., low pH, reduced dissolved oxygen, or sediment toxicity). If releases are transported into waterways, wildlife and aquatic species occupying or using the water could be directly impacted. The severity of impacts would depend on the type and amount of pollutant released, physical and environmental factors of the site, the method and speed with which cleanup occurs, and the sensitivity of wildlife and aquatic species to these impacts during different stages of their life cycle. The Service recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the refuge present a risk of release of contaminants that can adversely impact wildlife and aquatic species.

Contamination from the release of produced waters containing salts and other well drilling fluids could impact wildlife resources in the refuge units. For example, such instances of leaks from oilfield brine flowlines and subsequent contamination resulting from mechanical problems and improper operating practices have been documented at the Anderson Waterfowl Production Area in Montana, and Hagerman and Aransas NWRs in Texas (M. Maddux and M. Borgreen, pers. comm.). These substances may contain relatively large concentrations of dissolved salts, particularly sodium chloride, and can have salt concentrations greater than ocean water. Releases of produced waters (brine) can create salt licks, which may affect the behavior of large mammals and ungulates (Wiles and Weeks 1986). Oilfield brine spills can increase the bioavailability of some heavy metals as well as destroy the soil structure resulting in the significant reduction of infiltration rates (Vavrek et al. 2004). These brine impacted soils are usually devoid of vegetation and are susceptible to erosion. The loss of infiltration will result in increased runoff with impacts to nearby surface water in terms of salinity, and siltation. Releases of produced water with high salinity levels may cause mortality of

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aquatic organisms such as invertebrates, freshwater mussels, and fish sensitive to increased levels of salinity (Brittingham et al. 2014).

Ground disturbance could also promote the introduction of nonnative plant species by altering habitats, stressing native species, and providing movement corridors (Trombulak and Frissell 2000). A landscape invaded by nonnative species would not support native wildlife populations as effectively as a landscape with native vegetation. Construction that alters the canopy structure of forests, for example, can promote invasion by understory plants, which affects animal communities (e.g., food, nesting, and screening). Such vegetation is present in every Service refuge and various management efforts are ongoing to deal with the establishment and spread of invasive species.

There may be aquatic species habitat degradation from road construction and use, construction of well pads, and placement of pipelines in drainages where these species occur. These effects could decrease the long-term viability of populations as a result of increased sedimentation from construction activities and long-term use. Some risk of direct mortality of aquatic species could occur if a pipeline ruptures at a stream crossing or if toxic materials (such as diesel fuel or produced waste water) are spilled into streams.

Noise from drilling or well servicing operations would also impact wildlife. Potential adverse effects from well drilling and production could include changes in species distribution and use of the area, increased energy expenditure, decreased reproductive success (breeding and nesting success), deafness in species with specialized hearing, and increased stress levels from the noise and disturbance associated with these activities (Sawyer et al. 2002). Increased noise levels during the breeding season can create acoustic masking for species, such as birds, that communicate by sound (Bayne et al. 2008, Francis et al. 2009, Brittingham 2014). Drilling operations introduce noise with the highest measurements in the 90 dBA (A-weighted decibel) range for a period of a week or two up to a few months, with noise coming mostly from multiple diesel engines. Therefore, noise impacts could be severe, but limited to a localized area and of relatively short duration.

Some facilities associated with production operations (i.e., heater treater units, separator units) kill bats, migratory birds, and raptors through asphyxiation or incineration.

Impacts of Plugging and Reclamation

Although well plugging and surface reclamation results in overall beneficial impacts on wildlife and aquatic species, activities associated with the reclamation process may have negative effects. Plugging and abandonment operations and site preparation during reclamation would introduce heavy equipment, along with increased noise levels, for a short time. This could disturb wildlife and aquatic species and cause them to temporarily avoid the area. Vehicle use on and vegetation clearing of access roads and well pads may adversely affect wildlife and aquatic species by increasing poaching in open areas and may temporarily disrupt feeding, denning, spawning/reproduction, and other wildlife behaviors. Plugging and reclamation activities may increase human access and edge effects and temporarily alter wildlife and aquatic species composition and migration. The use of heavy equipment and vehicles to plug and reclaim sites could have the potential for releases of oil and other contaminating and hazardous substances, which could harm or kill aquatic and wildlife species. Recovery of vegetation communities, and ultimately habitat, would be primarily dependent on location, soil conditions, precipitation, and type of community desired. Except for rare vegetation communities that are susceptible to the adverse impacts of oil and gas operations, most vegetation communities in the refuge units would be expected to become re-established.

Wherever access roads have been built or are used for the primary purpose of allowing access for oil and gas operations, access roads would be reclaimed at the completion of operations. This should return the area to its natural conditions, thereby having a beneficial impact on the refuge environment. As oil and gas operations are plugged and abandoned, wildlife and aquatic species habitat would be reclaimed. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of species. The reclamation of the previously disturbed areas, including monitoring and control of exotic species, would also enhance native plant communities in the project areas, and over time, reduce fragmentation. Reclamation of sites would have a beneficial impact on habitat for many species, including many birds and small mammals, when the areas have regrown. This would result in long-term beneficial impacts on native species, their habitat, and the natural processes sustaining them.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON SPECIAL-STATUS SPECIES

The refuges included within the network provide habitat that supports many species of wildlife and aquatic species that are threatened, endangered, or of special concern at the national, regional, and local levels. The Service will manage State and locally listed species within refuge units in a manner similar to its treatment of federally listed species to the greatest extent possible. The conservation of special-status species and their habitats is integral to maintaining biological diversity.

Some of these species and their habitats may occur in areas suitable for oil and gas development. For instance, the federally endangered ocelot is present in South Texas, including Laguna Atascosa, Santa Ana, and Lower Rio Grande Valley NWRs. Given the programmatic nature of this analysis, the exact locations of future operations are unknown and site-specific surveys for presence or absence of special-status species at all existing wells may not have been completed. Wells with current permits would have gone through a review for the presence of special-status species at the time of permitting.

Impacts to special-status animals from oil and gas operations can occur during geophysical exploration, drilling and production, or reclamation phases of development. As noted in the following analysis, impacts on special-status animals are usually avoided or mitigated through intra-Service consultation with the Service's Ecological Services field office, use of project area surveys, and completion of biological assessments where adverse impacts could occur.

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on special-status species and their habitat would be similar in nature to those of common wildlife and aquatic species habitats if exploration activities are permitted. Localized trampling of vegetation for surveying and increased vehicular traffic associated with nearby seismic investigations could lead to injury or destruction of sensitive species and their habitat. These operations would be required to avoid impacting species of special concern and their habitat, which would be identified through consulting refuge biologists or through biological surveys, if determined necessary by the Service through consultation with Federal or State agency biologists. When species of special concern and their habitat are found to be within the project area, application of mitigation measures, including sufficient setbacks and/or timing restrictions for sensitive periods in a given species' life cycle, would result in avoiding or minimizing potential adverse effects.

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Potential effects from exploration operations could include increased displacement, increased risk of mortality, decreased reproductive succession, and increased stress levels from the noise and disturbance associated with nearby seismic survey activities (Sawyer et al. 2002). These effects could be caused by seismic crews traveling to access the area to be surveyed and by pedestrian travel along receiver lines, as well as the vibrations from the seismic operations, trimming vegetation, and using vehicles on existing roads. Surface disturbance from vehicles could also cause localized soil compaction which can increase runoff of surface waters and accelerate soil erosion (Duiker 2004; Pennsylvania State University 2009), ultimately degrading sensitive habitats. Surface disturbance from survey crews traversing the area during geophysical exploration could also introduce or spread nonnative invasive vegetation. The majority of impacts associated with these surveys would be limited in extent and severity, because of the temporary nature of the disturbance and localized area disturbed by survey crews and their activity.

Listed species could be particularly impacted by the noise associated with seismic survey work, especially vehicle noise. Impacts related to noise are usually temporary, with nearby species avoiding or moving away from the source but returning after noise is reduced or eliminated. Geophysical operations are short term and would have very limited impact on animals given the short duration of operations and pre-operations surveys.

The current regulations do not specifically require minimization of erosion, sedimentation, and other impacts on water quality and quantity that could adversely impact aquatic species such as invertebrates and fish. Mitigation measures included in existing SUPs and ROWs can include setbacks and/or timing restrictions, which result in avoiding or minimizing potential adverse effects on many special-status species. Additionally, upon the completion of exploration operations, reclamation of any disturbed areas could be required by the SUPs, and recovery of any habitat that was disturbed is expected to occur over the short term. Application of these requirements would result in short-term and small adverse impacts on special-status species or their habitat from geophysical exploration.

Impacts of Well Drilling and Production

Although drilling and production operations could directly impact species of special concern or their habitat in general, these operations would not be permitted under the ESA if the operations would result in excessive take or jeopardy of the species. However, operations could result in indirect impacts on special-status species, primarily from the disturbance related to construction of new well pads, access roads, flowlines, and pipelines. These impacts would be similar in nature to those of common wildlife and aquatic species. Drilling and production operations could range in duration from short term (weeks or months for well drilling and construction of roads, well pads, flowlines, and pipelines) to long term (lasting 20 years or more for road, flowline, pipeline, well, and production operations). Construction and maintenance of roads, pads, flowlines, and pipelines could require the clearing of vegetation and could result in habitat loss or fragmentation. Construction of open pits to hold large volumes of drilling mud and drill cuttings could also be a source of mortality for birds, reptiles, amphibians, and other wildlife within the refuge units.

Habitat (forest) fragmentation could adversely affect some neotropical migrants that are species of special concern. Potential effects on species of special concern would depend on where drilling and production operations are located. Careful siting of development based on biological survey and/or site assessment results could avoid or minimize these impacts substantially.

If vegetation clearing is unavoidable, it would be limited in extent and mitigation would require that least damaging methods are used for site preparation. In sensitive communities, a large effort would be made during planning and operation to avoid or minimize alteration of the surface area more than necessary, which might include drilling multiple wells from one pad.

Water-dependent species (including fish, mussels, and other invertebrates) could be impacted by the construction and long-term maintenance of roads, pads, flowlines, and pipelines if stream crossings result in alteration of streamflow, water quality, or temperature or in increased sedimentation. Waterways are inherently a part of floodplains (riparian corridors) and wetland areas, and as such receive added protection under various regulatory and policy requirements which protect, streamflows, water quality, and water temperature. When there are no practicable alternatives to locating an operation or activity in floodplains and wetlands, careful siting of facilities and application of stringent mitigation measures would be expected to avoid potential adverse impacts on special-status species and their habitat. Required mitigation for direct and indirect impacts on wetlands could be used to restore wetland habitats and increase species of special concern habitat values.

Displacement of wildlife would continue from initial well pad construction to exploratory drilling, and if the well is placed in production, during the life of the producing well. The increase and ease of public access routes may serve to increase public motorized travel, or if the roads are closed to public motorized travel, they would still serve as access routes on foot, horseback, and mountain bike.

Noise from drilling operations would also impact protected wildlife species. Drilling operations introduce noise with the highest measurements in the 90 dBA range for a period of a week or two up to a few months, with noise coming mostly from multiple diesel engines. Therefore, noise impacts on terrestrial species would be moderate, but limited to a localized area and of relatively short duration. Preconstruction surveys would be done to ensure that impacts on species of special concern, such as bats and birds, would not be excessive.

Some facilities associated with production operations (i.e., heater treater units/separator units) could cause the mortality of special-status bats or birds through asphyxiation or incineration, and mitigation such as a cone device placed on top of all vent stacks could be required to prevent perching and access. Open containers that collect stormwater may be required to have netting or covers to prevent wildlife species from accessing stormwater that may have contacted and mixed with oil, gas, and other contaminating and hazardous substances.

Releases of hazardous or contaminating substances could also pose a threat to special-status species, because exposure to or ingestion of these substances could result in death of a species or impact overall health and survival of affected special-status species and their habitats.

Potential effects on special-status species would depend on where drilling and production operations are located within the units. Careful siting of developments based on biological survey and/or assessment results could avoid or minimize these impacts substantially. Through the required biological surveys and/or assessments and consultations with the Service and other State agency biologists, potential impacts on special-status species and their habitat would be identified, and the application of appropriate mitigation measures would reduce impacts.

Impacts of Plugging and Reclamation

Reclamation actions such as well plugging; shutting down, abandoning, and removing flowlines and pipelines; and the use of heavy equipment and vehicles to reclaim sites could potentially release oil and other contaminating and hazardous substances which could harm or kill special-status species. However, ongoing consultation under the ESA, performing biological surveys of the area that could be potentially impacted by proposed plugging, abandonment, and reclamation operations, identifying protected species, and applying appropriate mitigation would likely result in localized and minimal adverse impacts on special-status species.

Plugging operations and site preparation during reclamation would introduce heavy equipment and people, along with increased noise levels, for a short time. These operations would generally result in localized minimal adverse impacts, but the effect would depend on the season, the background sound levels, and the proximity of operations to species of special concern. Seasonal restrictions would include delaying activities until after a species' nesting or spawning seasons. Access roads that have been developed or allowed to remain open for the primary purpose of allowing access for oil and gas operations would be reclaimed at the completion of operations, returning the area to its natural condition. Wherever possible, habitats would be improved to perpetuate the viability of habitats and increase the survivability of special-status species. The outcome of these activities, in returning natural conditions to the operations area, would have long-term beneficial impacts.

If restored properly, few effects on special-status species would be anticipated and impacts would not affect the overall viability of these species and their habitats. Avoiding areas of known sensitive species and timing of reclamation to avoid conflicts with critical growth periods would reduce impacts on special-status species and encourage restoration success during this phase. Overall, reclamation of the sites would promote beneficial effects on wildlife and their habitat over the long term.

IMPACTS OF ALTERNATIVES ON WILDLIFE AND AQUATIC SPECIES

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRs lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on wildlife and aquatic species.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of wildlife and aquatic species on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, wildlife and aquatic species associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for wildlife and aquatic species would vary from slight to moderate depending on proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., seasonal restrictions).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to wildlife and aquatic species within refuge units. However, wells directionally drilled and produced from outside refuge units to bottomholes beneath the refuge units would directly impact wildlife and aquatic species on adjacent lands as well as present a risk of indirect impacts within the refuge units. Depending on the proximity of these operations to the refuge, some indirect impacts to wildlife and aquatic species on a refuge could occur because the Service would not be imposing preventive measures, such as noise abatement standards. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where human activity could disturb wildlife and aquatic species, or affect important habitats. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as habitat quality; and mitigation measures.

Alternative B, the preferred alternative, would provide an increased incentive for operators to locate their operations outside refuges. Therefore, it is likely that direct impacts from new production and drilling operations would be avoided to a greater extent than in Alternative A. The risk and intensity of indirect impacts on refuges resources would similar to Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards could require better control of erosion and noxious plants thus reducing impacts to wildlife and aquatic species within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge wildlife and aquatic species .

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection for wildlife and aquatic species. The permitting process ensures ongoing communication between refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to wildlife and aquatic species.

Under Alternative A, there would be unnecessary impacts on wildlife and aquatic species from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Wildlife and Aquatic Species. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately

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6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on wildlife and aquatic species from oil and gas operations include noise and human activity associated with disturbed areas, injuries and mortality from traffic and activities on the pad, and potential for poisoning from chemical leaks and spills. As previously discussed, most of the impacts to wildlife and aquatic species occurred when the operation was originally chosen and developed by the operator to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect wildlife and aquatic species and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect wildlife and aquatic species. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on wildlife and aquatic species could include use of telemetry to reduce traffic, enforce speed limits, implement effective interim reclamation, or siting operations a minimum distance from important habitats.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to wildlife and aquatic species, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of wildlife and aquatic species from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to wildlife and aquatic species would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as requirements to address leaks and spills, handling of chemicals and fencing exploration and production waste sites (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §509). Overall, the Service expects that the large majority of issues related to impacts on wildlife and aquatic species would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet Service's reclamation standards, which would also greatly reduce any long-term impacts on wildlife and aquatic species as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to wildlife and aquatic species compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to the rule, Alternative C may provide additional protections for wildlife and aquatic species from impacts associated with pre-existing operations to a greater number of wells. Since the greatest impacts to wildlife and aquatic species have already occurred, the Service would be focusing on maintenance issues, such as spill containment and remediation, and removal of

debris, waste, and equipment no longer needed in operations, as well as potential seasonal activity restrictions in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect wildlife and aquatic species. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect wildlife and aquatic species on adjacent Federal surface estate. Thus, for these operations, the impacts on vegetation and plant species of management concern would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, current policy, which does not allow for the complete standardization of stipulations and conditions on oil and gas operations, would remain in effect. Oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. Generally, stipulations are applied to Service permits to include protection of air quality, soils, water, wildlife, wildlife habitat, and other refuge resources; however, a suite of performance-based standards for protection of refuge resources and uses would not be available. As a result, the levels of protection would vary widely across the NWRS with continued impacts on refuge resources.

Under Alternative B, the regulations establish performance-based standards for avoiding or minimizing impacts to wildlife and aquatic species from operations. The regulations also include standards for achieving successful surface reclamation once operations end. The use of standards or performance goals provides flexibility to resource managers and operators to achieve standards across various environments using new and evolving technology. The rule includes standards for surface use and site management, specific resource protections, spill prevention and response, waste management, and reclamation. These specific standards are all considered and incorporated into project design so that overall, operations are conducted in a manner most protective of refuge resources and uses while ensuring human health and safety. Use of the technologically feasible, least damaging methods takes into consideration all relevant factors, including environmental, economic, and technological factors and the requirements of applicable law. Performance-based standards would serve to ensure that impacts on wildlife and aquatic species within refuge units are avoided or minimized. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of wildlife and aquatic species in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge and operations on private surface estate within a refuge boundary. Directional drilling operations would be subject to the full regulatory requirements of a new operation. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would require minimization of human disturbance, reducing overall footprint of the operation, reductions in noise and adjusting lighting, and where appropriate, applying seasonal or spatial buffers, and thus reducing impacts to wildlife and aquatic species within the refuge boundary.

Under Alternative C, all phases of pre-existing operations within the refuge boundary would be subject to all provisions of the rule as described under Alternative B. Pre-existing operations on

private surface estate within a refuge boundary as well as pre-existing operations outside and adjacent to the refuge boundary would continue production activities but would eventually require an operations permit to ensure compliance with the reclamation standards of the rule. Impacts to wildlife and aquatic species would be reduced as described under Alternative B.

CUMULATIVE IMPACTS

Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect wildlife and aquatic species of the refuges. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on wildlife and aquatic species in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on wildlife and aquatic species are listed in Table 4-8.

TABLE 4-8. CUMULATIVE IMPACTS ON WILDLIFE AND AQUATIC SPECIES (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Wildlife
Prescribed fires and fire management actions	<p>Short-term and long-term adverse effects on species productivity following removal of vegetation and habitat; short- and long-term impacts from fire line construction that requires digging and displacement of vegetation matter from burning of surface litter and topsoil.</p> <p>Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire; improved productivity and erosion control from vegetative cover that is established after these treatments.</p>
Service facility and road construction	<p>Short-term and long-term adverse effects on species from direct loss or damage to soils and habitat when removed for development; compaction of soils and damage or loss of wildlife and habitat during road grading and construction using heavy equipment.</p> <p>Short-term to long-term adverse impacts from the loss of habitat and ground disturbance/soil erosion and compaction.</p>
Vegetation management	<p>Short-term adverse impacts due to vegetation clearing, habitat fragmentation, and effects on soils.</p> <p>Long-term beneficial effects of erosion control from improved habitat quality.</p> <p>Short term adverse impacts with long-term beneficial effects from site reclamation.</p> <p>Long-term beneficial effects of controlling the introduction and spread of nonnative invasive species.</p>
Trails development and maintenance	<p>Short-term and long-term adverse effects on wildlife habitat from clearing, grading and surfacing of trails, removal of vegetation in trail footprint for maintenance, habitat fragmentation, increased disturbance and predation, and potential introduction of nonnative plant species.</p>

Past, Present, and Reasonably Foreseeable Activity	Impacts on Wildlife
ORV use	Short- and long-term adverse effects on habitat from compaction and vehicle-related disturbances and mortality of wildlife species.
Abandoned mine lands reclamation	Short-term adverse effects on habitat during reclamation-related disturbances. Long-term beneficial effects of improved surface (revegetation) and reduced erosion following re-establishment of vegetation cover/habitat and natural contours.
Mining and logging activities	Long-term adverse effects on soils from erosion stemming from legacy surface disturbances and vegetation removal and long-term effects of acid mine drainage on wildlife and aquatic species.
Recreational use	Short- and long-term adverse effects on wildlife from visitor activities including trampling and associated compaction, noise and human disturbance, possible introduction of nonnative plant species.
Ranching, agricultural land uses	Short- and long-term adverse effects from operations that remove vegetation cover, compact soils, grazing pressure, and reduce habitat quality.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects on wildlife from direct loss of habitat in development footprint and compaction, erosion and sedimentation, habitat fragmentation, noise. Benefit from re-establishment of vegetation and habitat following construction-related disturbances.
Future oil and gas development on adjacent lands	Direct effects on wildlife from adjacent property and indirect adverse impacts on refuge resources from “spill-over effects” of erosion, sedimentation, and contamination from surface runoff; trends indicate that the exploration and production of shale gas, in particular, is anticipated to increase dramatically over the next 30 years.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on wildlife from reclamation related disturbances due to use of equipment on site and grading. Long-term beneficial effects of restoration of natural contours, topsoil and vegetation cover that protects soils from erosion and improves habitat quality; removal of sources of contamination and contaminated soils and water to reduce impact on wildlife habitat.
Industrial discharges to air and water from sources outside the refuge unit	Short- and long-term direct adverse effects on wildlife from discharges on adjacent property and indirect adverse impacts on refuge resources from “spill-over effects” of contamination.

ALTERNATIVE B: THE RULE (PREFERRED ALTERNATIVE)

Under Alternative B, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development that were considered in the cumulative scenario. These are described under Alternative A and would be the same under Alternative B. Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on wildlife and aquatic species, as described in the above analysis. Bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on wildlife and aquatic species. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long-term and both adverse and beneficial,

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with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

ALTERNATIVE C

Cumulative impacts from actions under the cumulative impact scenario would be the same as described under Alternative A. Similar to Alternative B, there would be effects on wildlife and aquatic species as a result of oil and gas operations that would continue to affect these species where impacts cannot be avoided. However, there would be benefits from bringing new operations and the reclamation phase of pre-existing operations under regulations and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and the reclamation phase of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall, under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

VISITOR USE AND EXPERIENCE

METHODOLOGY

Potential impacts on visitor use and experience are assessed based on the actions being proposed and the various visitor use and experiences available at refuges, with attention to characteristics such as health and safety, noise, visibility, and access that may affect visitor use and experience. Though not addressed separately, adverse impacts related to visitor access, scenic view, and soundscapes would reduce the opportunities for visitors to experience solitude. Topic-specific context for assessing impacts of the alternatives to visitor use and experience includes the following:

- the type of visitor experience desired (as noted in chapter 3, refuges are visited by people desiring a range of uses and experiences, from passive or casual use, to very active use and backcountry experiences)
- the proximity of the areas used by visitors to oil and gas operations (this can especially affect noise and visual impacts, which are addressed in more detail under separate topics)
- the particular health and safety issues related to oil and gas operations, including exposure to oils, gases, and other hazardous chemicals that are used in oil and gas exploration and development

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON VISITOR USE AND EXPERIENCE

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on visitor use and experience result primarily from the presence of seismic survey crews and equipment in and around the refuge, and the detonation of explosives. The following describes typical impacts that can occur:

Access—Seismic operations may preclude use of the survey areas including some refuge roads by refuge visitors while survey crews are working. Access limitations would be temporary because most surveys last a few weeks to a few months and affect only certain areas of the refuges at one time. For example, visitor access and seismic activity creates a use conflict during hunting seasons or times of prime bird watching.

Scenic Views—During geophysical operations, the presence of seismic survey personnel and their vehicles and equipment could cause adverse visual impacts for visitors that are seeking a refuge-like or natural experience. Flagging used to mark site lines can be distracting, and the cutting of survey lines through dense vegetation can require creation of paths for vehicles and crews and clear a line of sight that is not natural.

Noise—The noise associated with seismic surveys would occur from the use of vehicles, crews, and Vibroseis® trucks. Chainsaws are often used to clear a survey line of sight, and helicopters may be used to transport equipment. Noise generated by these seismic survey activities would be intermittent and typically occurs over a period of 3 weeks to 3 months. Helicopters, when used, are the primary noise source in seismic operations. Often two or more helicopters are used to support a seismic shoot. In these cases, the noise would be continuous during daytime operations, but limited to a 2- to 3-week time frame within the active area of operations.

Health and Safety—Seismic surveys can introduce some health and safety concerns by exposing refuge visitors to hazards associated with increased vehicular traffic and safety hazards to crews working with explosives. Visitor access is limited to areas to reduce the possibility of encounters.

Overall, given the short duration (weeks to a few months) of seismic surveys, the majority of impacts associated with geophysical surveys would be limited in extent.

Impacts of Well Drilling and Production

Access—the primary effect of well drilling and production is a reduction in access to any well pads and associated production facilities or access roads. All drilling and production operations would be closed to visitor access. Due to safety concerns, there may be additional restrictions to visitor access immediately adjacent to these sites. Indirect impacts, such as increased traffic, noise, dust, odors, night lighting, and human activity, would not necessarily preclude recreational access, but would decrease the quality of the visitor experience in the vicinity of the operation, especially in more remote portions of the refuges. Workovers and servicing of existing operations could also cause access delays or restrictions.

Scenic Views—Visual impacts on visitor experience from drilling and production operations could be more substantial than other types of impacts on visitors, especially if well pads were placed in relatively undisturbed or popular settings where visitors would be readily able to see the operation and all associated equipment and tanks, and visitors to that area were expecting or desiring a more natural experience. Drill rigs can reach heights of 180 feet, which would most likely be visible from several locations within the refuges. Initial site clearing would remove approximately 1.5 to 4 acres of vegetation for each well pad (SHIP 2013), and access road construction would often result in visible cuts through refuge vegetation or creation of a definitive pathway, depending on the location and refuge. The operations, especially drilling, would increase the presence of work crews and equipment. Since drilling is a 24-hour, 7-day a week operation, these impacts would be continuous, and could last a week or two up to a few months. Hydraulic fracturing operations would require a few more weeks for completion. Production operations, although having a less intrusive human

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presence compared to drilling, could be visible for 20 years or longer. Please see the scenic views and night sky resources topic for more details on this aspect of visitor experience.

Coming across an oil drilling rig or production site could be an unpleasant experience for visitors seeking a natural, outdoor experience. The visual presence of oil and gas operations in a natural setting could adversely impact the areas by displacing the visitor or lessening the quality of the visitor experience. The impacts would be less for those visitors who are less concerned with the presence of such operations, and where operations are naturally screened from view.

Noise—As discussed in more detail under the Natural Soundscapes and Acoustic Environment topic, there would be increased noise from construction activities (vehicles, chainsaws, and earthmoving equipment), drilling rigs, and the drilling or workover crew that could adversely affect human health, visitor use and experience, wildlife, and the overall acoustic environment. Operations involving hydraulic fracturing would result in greater truck traffic and associated vehicular and compressor noise, which could cause temporary disturbance to visitors using the same roadways in the refuge or areas located near these operations, and could last an additional 2 to 4 weeks compared to regular drilling operations. These noises would be different from the types of noises common in the visitor use areas, or general background noises elsewhere in the refuge. As noted in the Natural Soundscapes and Acoustic Environment section, noise from a typical rotary drilling rig is estimated to be approximately 63 dBA at a distance of 200 feet. Noise impacts would be unavoidable if they were close enough to a visitor use area to cause interference with the enjoyment or use of the area, and would conflict with a variety of refuge goals. In refuges where operations are located close to active recreation (e.g., motor boating), the noise associated with the oil and gas operations would not be as noticeable.

Noise from exploration, development, and extraction activities can be mitigated through a variety of ways including, but not limited to, use of quieter engines, quieter machinery, noise barriers, noise enclosures, and timing of operations to avoid the quietest times of day or certain seasons for which impacts would be greater (i.e., nesting season for sage grouse).

Production operations would also cause impacts because of the noise associated with production equipment and the short-term use of loud machinery and workover rigs onsite. These impacts would result from high sound levels while being temporary in nature. However, most noise levels associated with production would have lower sound levels than those generated by a drilling operation, yet would be continuous and could have other impacts to the soundscape, acoustic environment or the wildlife that rely on natural acoustic conditions.

Odors/Health and Safety—The primary source of odors would be from drilling or production operations, especially if spills or leaks occurred and oil or other chemicals were not quickly cleaned up and removed from the site. Drilling and production have the potential for well blowouts and releases of hydrocarbons or other hazardous substances, including drilling muds and gases such as hydrogen sulfide (H₂S). Pump jacks with automatic timers are also a safety hazard, as they can be activated at any moment. Visitors could also be drawn to well pads and sites out of curiosity, resulting in potential exposure to dangerous equipment or stored chemicals. Hunters, in particular, need to keep a safe distance from oil and gas operations; there is an inherent hazard of shooting near drilling rigs and production facilities (i.e., storage tanks, wellheads, and pump jacks) where bullets could penetrate equipment or cause ignition of flammables. There is the possibility of storm damage to drilling and production operations, which could spread hazardous and contaminating substances. Perforating or rupturing a storage tank containing oil or treatment chemicals at a production facility

would increase the threat of spills and subsequent harm to the public if they were to venture onto the site.

A potential impact on human health and safety is the possible exposure to hazardous substances. Materials stored at well sites include oils, chemicals, and lubricants. Also, oil and gas wells can release hydrogen sulfide gas. If well sites are not fenced and are open to the public, there is a chance of visitor exposure to these substances if visitors enter the unsecured site. Most wells would operate under an emergency response plan that would address hydrogen sulfide releases and other possible scenarios. For those wells that may emit hydrogen sulfide, a radius-of-exposure analysis would likely be performed prior to site selection. However, the Service recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of the refuge present a risk of release of contaminants that can adversely impact visitor use and experience by actual exposure to chemicals or from lack of access following an incident, depending on the location of the release.

For directionally drilled wells, the location of these wells outside the refuge boundary means that most of the impacts addressed above would not be experienced by visitors in the refuge. However, if these wells are close enough to the refuge boundary, noise and even lighting can carry into the refuge, and effects could be similar to those described for operations inside the refuge units. However, the intensity of impacts would vary with the location of the well. Impacts on refuge visitors could also occur if operations bordering the refuges but visible to visitors created unsightly and/or unnatural conditions. Severity of impacts would depend on proximity of operations to the refuge units; site specific environmental conditions, such as topography and vegetative cover that would provide natural screening; and mitigation measures being employed.

Impacts of Plugging and Reclamation

Access—Plugging and reclamation operations would have public access impacts similar to those described for drilling and production, but would be limited in duration to the time needed to plug and reclaim each operations site. Reclamation operations would not interfere substantially with visitor access, and when completed, would restore access to areas previously off-limits to visitors.

Scenic Views—The presence of heavy equipment and a service rig associated with plugging and reclamation activities would have similar impacts on scenic views and night sky resources as described for drilling and production operations. However, plugging and reclamation would end disturbances from production activities, and the sites would be restored to a more natural character, although some roads may be left in place for future use. Reclamation of the well pads following plugging of the wells would serve to eliminate the unnatural views of the site over time. The actual time required to reclaim the site's scenic views would depend on many factors, including the erosion potential of the site, productivity of the vegetation, topography, and soil characteristics, including the presence of any contamination. Artificial lighting would be removed and flaring activities would cease. Ultimately, the removal of the rig and associated structures and equipment, in conjunction with site reclamation, would improve the scenic views near the well sites. The effects on visitor experience would range from a beneficial effect of having a natural setting restored, to essentially no effect on visitors for those wells in areas far from visitor uses or in locations where visitors have not been bothered by the presence of the wells.

Noise—The operations involved in site closure would cause temporary increases in noise from earthmoving, demolition, and other equipment, as described for drilling and production. However, when closure and reclamation are completed, noise levels would return to ambient levels similar to

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those before the installation of the oil and gas operation and would have overall beneficial impacts to the soundscape and acoustic environment.

Odors/Health and Safety—There could be odors during plugging and reclamation operations from heavy-equipment exhaust and emanating from leaks and spills. Once plugging and reclamation is complete, plugging and reclamation of wells would remove threats associated with exposure to hazardous wellhead equipment, ignition of flammable gases, possible flowline ruptures, and ingestion, inhalation, or absorption of spilled or released hydrocarbons, contaminants, or hazardous substances and remove a risk to visitor health and safety.

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on visitor use and experience.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of visitor use and experience on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). Because most easements are not open to visitors, this expanded scope would not result in further protections for visitor use and experience.

The level of increased protection for visitor use and experience would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., minimizing lighting, siting well pads so they are screened from view by vegetation and topography if possible, painting drilling and production equipment to blend in with the surrounding environment, keeping sites clean, promptly cleaning up spills, and removing debris, waste, and equipment no longer needed in operations.).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The primary effects on visitor use and experience from oil and gas operations stem from the fact that these operations by their very nature exclude visitor use from refuge areas where these activities are located, therefore, operators locating operations off refuge lands and waters will provide the greatest protections to visitor use and experience. However, wells directionally drilled and produced from outside refuge units to bottomholes beneath the refuge units could indirectly impact visitor use and experience within the refuge units, primarily due to noise and the visibility of these operations. Depending on the proximity of these operations to the refuge, some indirect impacts to visitor uses on a refuge could occur because the Service would not be imposing preventive measures, such as noise abatement standards. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where noise and visibility would diminish the experience for refuge visitors.

Alternative C would expand Service jurisdiction under the regulations to encompass drilling operations on inholdings and non-Federal surface locations drilling underneath a refuge. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid

or minimize impacts on refuge resources and uses. Operational standards could reduce noise, and visual impacts to visitor use and experience within the refuge boundary. The further protections afforded by Alternative C on visitor use and experience would vary depending on the proximity of the operation to refuge boundaries.

However, Alternative C eliminates the incentive to locate an operation outside a refuge, so there would likely be a significant increase in the number of drilling and production operations located on refuges, as well as the direct impacts to visitor use and experience. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge visitor use and experience.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations, it provides additional protection of visitor use and experience. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to visitor use and experience.

Under Alternative A, there would be unnecessary impacts on visitor use and experience from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Visitor Use and Experience. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on visitor use and experience stem from the fact that those land and waters where operations are located can no longer be used by visitors. So, as previously discussed regarding time/place/manner considerations, most of the impacts to visitor use and experience occurred when the operator chose and developed the site to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect visitor use and experience and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect visitor use and experience. For instance, a typical mitigation measure that would minimize ongoing impacts from pre-existing operations on visitor use and experience would be timing restrictions on certain activities to minimize noise disturbances to visitors.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to visitor use and experience and other administrative provisions such as financial assurance, cost recovery, and access

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fees that would ensure protection of visitor use and experience from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to visitor use and experience would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing pit closure as well as the removal of oil-contaminated soils from tank battery sites to protect soils and water, and clean-up standards for soils contaminated by oil spills (GWPC 2014; La. Admin. Code tit. 43, Part XIX, §503). Overall, the Service expects that the large majority of issues related to ongoing impacts on visitor use and experience would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet the Service's reclamation standards, which would also greatly reduce any long-term impacts on visitor use and experience as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to visitor use and experience compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to Alternative B, Alternative C may provide additional protections for visitor use and experience from impacts associated with pre-existing operations to a greater number of wells. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect visitor use and experience. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect visitor use and experience on adjacent Federal surface estate. Thus, for these operations, the impacts on visitor use and experience would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on visitor use and experience. These could include site security to protect visitors from hazardous conditions, and seasonal restrictions to avoid periods of high visitor use; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to visitor use and experience. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to visitor use and experience. All new operations and pre-existing operations that are transferred to a new operator on NWRs lands and waters would be subject to consistent standards and requirements of the rule for protecting visitor use and experience. So, as previously discussed, new operations create the greatest additional impacts on visitor use and experience, so establishing performance-based standards that would include proper site planning, timing restrictions and the best management practices would avoid or minimize many of the typical impacts to visitor use and experience from oil and gas development. Also, the rule includes additional standards that would protect visitor use and experience, such as installation and maintenance of secondary containment for all equipment and facilities using or containing contaminating substances such as oil, brine, formation water, or well stimulation chemicals, the removal of any contaminating substances, noise reduction, and requiring operators to minimize the appearance of their facilities by blending the operations with the background environment. Standards would also include designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations and to avoid areas identified as important for wildlife-dependent recreation. For operations on refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of visitor use and experience in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would reduce impacts to geologic and soil resources within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on visitor use and experience compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to Alternative B, Alternative C may provide for implementation of higher standards for protection of visitor use and experience to a greater number of wells. Since the greatest impacts to visitor use and experience have already occurred, the Service would be focusing on ongoing issues, such as timing restrictions to avoid noise disturbances, and proper storage and removal of hazardous substances to ensure visitor health and safety where State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect visitor use and experience. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements), and the proximity of the surface location of operations on non-Federal surfaces to the refuge (e.g., noise disturbances).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Visitor use and experience would only be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well

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blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to visitor use and experience related to our downhole regulation under Alternative C.

Cumulative Impacts

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect visitor use and experience on refuges. Management planning, such as fire management, vegetation management, and ORV plans, can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on visitor use and experience in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on visitor use and experience are listed in Table 4-9.

TABLE 4-9. CUMULATIVE IMPACTS ON VISITOR USE AND EXPERIENCE (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Visitor use and Experience
Prescribed fires and fire management actions	Short-term and long-term adverse effects from loss of access to certain areas during burns, reduction in visibility from smoke, reduction in air quality/presence of strong odors from smoke and fires; visible burned areas detract from visitor experience. Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire that can affect visitor safety and continued use of the refuges.
Service facility and road construction	Short-term adverse effects on visitor use from loss of access, noise, and visible disturbance during construction, but long-term benefits from addition of visitor use facilities and roads.
Vegetation management	Short-term disturbance from presence of vegetation management crews (possible access disruption, noise, chemical use, odors); long-term beneficial effects of improved vegetative cover (improvement in the visible landscape).
Trails development and maintenance	Short-term adverse effects on visitor use from loss of access, noise, and visible disturbance during construction or maintenance, but long term benefits from addition of trails and improvement of condition.
ORV use	Short- and long-term disturbances to some visitor uses where the noise and presence of ORVs is disturbing, also visible damage to soils, vegetation; benefits to those visitors desiring this type of recreation where permitted.
Abandoned mine lands reclamation	Short-term adverse effects on visitors from lack of access to areas during reclamation. Long-term beneficial effects of addition of safety features and signage following re-establishment of vegetation cover and natural contours and closure of mine shafts.
Future oil and gas development on adjacent lands	Indirect long-term adverse impacts on refuge visitors if the operations are close enough to have any impacts from “spill-over effects” of sedimentation and contamination from surface runoff, or if noise carries into refuge or operations are visible from refuge visitor

Past, Present, and Reasonably Foreseeable Activity	Impacts on Visitor use and Experience
	use areas
Oil and gas well plugging and reclamation activities inside and outside refuges	<p>Short-term adverse effects on visitors from noise, visual disturbance and access restrictions that can occur on roads during reclamation.</p> <p>Long-term beneficial effects of restoration of sites, removal of sources of contamination and contaminated soils that are a safety hazard and visual eyesore</p>

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-9).

Under Alternative B, both adverse and beneficial cumulative impacts would occur from projects, plans, actions and trends in oil and gas development that were considered in the cumulative scenario. These are described under Alternative A and would be the same under Alternative B. Alternative B would contribute to cumulative impacts from the continued operations of permitted and newly regulated operations, which would continue to have long-term direct adverse impacts on visitor use and experience, as described in the above analysis. Bringing previously exempt operations under regulation would beneficially impact resources that form the basis for many types of visitor use and enjoyment. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Cumulative impacts from actions under the cumulative impact scenario would be the same as described under Alternative A. Similar to Alternative B, there would be effects on visitor use and experience as a result of oil and gas operations that would continue to affect visitor use and experience where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulations and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and the reclamation phase of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries.

Overall, under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial. However, Alternative C would remove regulatory incentives for operators to locate operations outside refuge units; thus, this alternative would have more impacts on resources within refuge boundaries.

SCENIC VIEWS AND NIGHT SKY RESOURCES

METHODOLOGY

Potential impacts on scenic views and night sky resources are assessed based on the actions being proposed and the various scenic qualities available at refuges, with attention to nighttime lighting, visual sensitivities and the natural lightscape. Topic-specific context for assessing impacts of the alternatives to scenic qualities and night skies includes:

- the type of scenic qualities available (as noted in Chapter 3, refuges contain an unusually large number of areas that possess a high degree of scenic quality and visual sensitivity)
- the proximity of the areas with scenic qualities and areas with no artificial light sources to oil and gas operations.
- The potential for light pollution in the form of sky glow or light trespass/glare to travel to the refuge unit and impact natural lightscapes.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON SCENIC VIEWS AND NIGHT SKY RESOURCES

Impacts from Geophysical Exploration

During geophysical operations, the presence of oil and gas personnel and their vehicles and equipment could cause adverse visual impacts for visitors that are seeking a refuge-like or natural experience. Flagging used to mark site lines can be distracting, and the cutting of survey lines through dense vegetation can require creation of paths for vehicles and crews and clear a line of sight that is not natural. Overall, given the short duration (weeks to a few months) of conventional surveys, the majority of impacts associated with geophysical surveys would be limited in both duration and geographic extent, although the line-of-sight cuts can persist until vegetation regrows. Based on the nature of exploration activities and their general limitations to the day-time hours impacts on night skies are not expected to occur.

Impacts of Well Drilling and Production

Visual impacts from drilling and production operations would be more substantial than other types of impacts, especially if well pads were placed in relatively undisturbed settings where visitors would be readily able to see the operation and all associated equipment and tanks. Although the type of rig used is highly variable, dependent on location and site-specific use requirements drill rigs can reach heights of 180 feet, which would be visible from multiple locations at greater distances and could intrude on a number of different viewsheds within different refuge units. Site clearing for well pad and access road construction would result in visible removal of refuge vegetation, creation of a pathway and an overall change in the natural scenery of the area, depending on the amount of clearing, location of the clearing and the refuge unit.

Lighting of drilling operations, which is typically provided using fluorescent high pressure sodium or metal halide lamps, could interfere with night sky resources. Depending on where the operations are sited, the design and installation of lighting, and the amount of activity and type of equipment used during the night, impacts include disturbance of night-sky views, increase in overall sky glow and anthropogenic light rations, and disruption of wildlife behaviors like migration, predation and

mating. The operations, especially drilling, would increase the presence of work crews and equipment. Since drilling is a 24-hour, 7-day a week operation, these impacts would be continuous, and could last a week or two up to a few months. Hydraulic fracturing operations would require a few more weeks for completion. Hydraulic fracturing requires significant road traffic which increases nighttime lighting from vehicles and can negatively impact night resources in those corridors.

Production operations, although having a less intrusive human presence, would be visible for 20 years or longer. Coming across an oil production rig could be an unpleasant experience for visitors seeking a natural, outdoor experience at the refuge unit. The visual presence of oil and gas operations in a natural setting would adversely impact the areas by intruding on scenic qualities and viewsheds and overall adversely impacting refuge unit scenic qualities in the area of the rig. Oil and gas facilities, pads, and roads introduce forms, lines colors, and textures that contrast with the natural visual setting. In other circumstances where visitors are passing through refuges and not focused on the natural setting, these impacts would not be as pronounced. The impacts would be less for those visitors who are less concerned with the presence of such operations, and where operations are naturally screened from view. Although unlikely in the event of oil spills, adverse impacts on visual qualities could occur, and depending on the severity and type of event could be long-term in nature and could potentially alter the viewshed.

Impacts of Plugging and Reclamation

The presence of earthmoving, demolition, and other equipment associated with plugging and reclamation activities would have similar impacts on scenic views and night sky resources as described for drilling and production operations. However, considering the smaller equipment that would be used compared to a drilling rig and the limited duration of reclamation, impacts would likely be shorter in nature and would only adversely impact scenic qualities during the time of site reclamation. Plugging and reclamation would end disturbances from production activities, and the site would be restored to its original character. Reclamation of the well pads following plugging of the wells would serve to reduce long-term visual impacts and eliminate the unnatural views of the site. The actual time required to reclaim the site's scenic views would depend on many factors, including the amount and severity of the area impacted, the erosion potential of the site, productivity of the vegetation, topography, and soil characteristics, including contamination. Ultimately, the removal of the rig and associated structures and equipment, in conjunction with site reclamation, would have long-term localized beneficial effects on scenic views near the well sites. The effects on scenic views would range from a beneficial effect of having a natural setting restored, to essentially no effect on visitors for those wells in areas far from visitor uses or in locations where visitors have not been bothered by the presence of the wells. Beneficial impacts on night sky resources would also occur as a result of plugging and reclamation as all activities and night skies intrusions that occurred would cease and artificial lighting would be removed.

IMPACTS OF ALTERNATIVES ON SCENIC VIEWS AND NIGHT SKY RESOURCES

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRs lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on scenic views and night sky resources.

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Under Alternative A, the Service scope of application of its regulation and policy provides protection of scenic views and night sky resources on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, scenic views and night sky resources associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for scenic views and night sky resources would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., minimizing lighting, shielding lights, directing lighting, screening operations from view by vegetation and topography if possible, and removal of debris, waste, and equipment no longer needed in operations).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as previously described. The location of surface operations outside refuge units minimizes direct impacts to scenic views and night sky resources within refuge units. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where human activity and oil operation activities could disrupt scenic views and light pollution could affect night sky resources. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as habitat quality; and mitigation measures.

Alternative B provides an even greater incentive for operators to locate their operations outside refuges since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Therefore, it is likely that impacts to scenic views and night sky resources from new production and drilling operations within refuges would be avoided to a greater extent than in Alternative A. Impacts on scenic views and night sky resources from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would reduce or minimize light pollution, screen operations from view, and require the removal of debris, waste, and equipment no longer needed in operations, thus reducing impacts to scenic views and night sky resources within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge scenic views and night sky resources.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations it provides additional protection for scenic views and night sky resources. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to scenic views and night sky resources.

Under Alternative A, there would be unnecessary impacts on scenic views and night sky resources from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Scenic Views and Night Sky Resources. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on scenic views and night sky resources from oil and gas operations include dead vegetation and oil-stained soils from contamination from leaks and spills, light pollution from drilling rig lights and gas flares. As previously discussed, most of the impacts to scenic views and night sky resources occurred when the operation was originally chosen and developed by the operator to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect scenic views and night sky resources. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on scenic views and night sky resources could include removal of contaminated soils, minimizing lighting, shielding lights, directing lighting, screening operations from view by vegetation and topography if possible, siting operations a minimum distance from visitor use areas, and removal of debris, waste, and equipment no longer needed in operations.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to scenic views and night sky resources, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of scenic views and night sky resources from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to scenic views and night sky resources would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing site lighting and visual impact mitigation. Overall, the Service expects that the large majority of issues

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related to impacts on scenic views and night sky resources would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet Service's reclamation standards, which would also greatly reduce any long-term impacts on refuge scenic views and night sky resources as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to scenic views and night sky resources compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to the rule, Alternative C may provide additional protections for scenic views and night sky resources from impacts associated with pre-existing operations to a greater number of wells. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge scenic views and night sky resources. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect scenic views and night sky resources on adjacent Federal surface estate. Thus, for these operations, the impacts on scenic views and night sky resources would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on scenic views and night sky resources. These could include minimizing lighting, shielding lights, directing lighting, screening operations from view by vegetation and topography if possible, and removal of debris, waste, and equipment no longer needed in operations; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to scenic views and night sky resources. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to scenic views and night sky resources. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting scenic views and night sky resources. As previously discussed, new operations create the greatest additional impacts on scenic views and night sky resources, so establishing performance-based standards that would include proper site planning, timing restrictions and the best management practices to avoid or minimize many of the typical impacts to scenic views and night sky resources from oil and gas development. Also, the rule includes additional standards that would protect scenic views and night sky resources, such as minimizing lighting, shielding lights, directing lighting, screening operations from view by

vegetation and topography if possible, and removal of debris, waste, and equipment no longer needed in operations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest.

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would indirectly reduce impacts to scenic views within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on scenic views compared to Alternative A

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to the rule, Alternative C may provide for implementation of higher standards for protection of scenic views and night sky resources to a greater number of wells. Since the greatest impacts to scenic views and night sky resources have already occurred, the Service would be focusing cost efficient means to reduce impacts. Most active production operations on refuges do not have artificial lighting.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge scenic views and night sky resources. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of pathways (e.g., waters that may be hydrologically connected to wetlands within a refuge).

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Scenic views and night sky resources would only be impacted by accidents associated with well control (e.g., indirect impacts associated with fires and damaged equipment, light pollution from burning oil and gas). Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to scenic views and night sky resources related to our downhole regulation under Alternative C.

Cumulative Impacts

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect scenic views and the night sky resources in the refuges. Management planning, such as fire management, vegetation management, ORV plans, can result in greater protection for refuge resources that are the basis for much of the refuges' scenic views and night sky resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, and any general construction or maintenance activities that include

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excavation, grading, or presence of work crews. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on scenic views and night sky resources in the area of analysis and a brief summary of the cumulative impacts of these actions on scenic views and night sky resources are listed in Table 4-10.

TABLE 4-10. CUMULATIVE IMPACTS ON SCENIC VIEWS AND NIGHT SKY RESOURCES (PROGRAMMATIC LEVEL FOR REFUGES)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Scenic Views and Night Sky Resources
Prescribed fires and fire management actions	Short-term and long-term adverse effects during controlled burns, which lead to a reduction in visibility from smoke. Visibly burned areas detract from scenic views. Long-term beneficial effects of reduced fire occurrences with managed burns that reduce the possibility of catastrophic and high intensity fire that can affect scenic views and the night sky.
Service facility and road construction	Short-term adverse effects on scenic views from visible disturbance during construction. Headlights from vehicles can have a short-term adverse effect on wildlife and visitors.
Vegetation management	Short-term disturbance from presence of vegetation management crews, long-term beneficial effects of improved vegetative cover leading to an improvement in the visible landscape.
Trails development and maintenance	Short-term adverse effects on scenic views from visible disturbance during construction or maintenance, and long-term adverse effects from addition of trails and development.
ORV use	Short- and long-term disturbances from dust and pollution emissions from ORV use and visible damage to soils and vegetation; benefits to those visitors desiring this type of recreation to obtain access to viewsheds. Headlights from vehicles can have a short-term adverse effect on wildlife and visitors.
Abandoned mine lands reclamation	Short-term adverse effects on viewsheds from construction during reclamation. Long-term beneficial effects to scenic views after the re-establishment of vegetation cover and natural contours and closure of mine shafts.
Future oil and gas development on adjacent lands	Indirect long-term adverse impacts on scenic views of refuges if the operations are close enough to have any impacts from “spill-over effects” of sedimentation and contamination from surface runoff, or if operations are visible from refuge visitor use areas and if lighting from these operations impacts the night sky resources within the refuge unit.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on scenic views from presence of construction equipment during reclamation. Long-term beneficial effects of restoration of sites, removal of sources of contamination and contaminated soils that are visually detracting from the surrounding natural environment. Any lighting or flaring activities would cease and therefore have a long-term beneficial effect on night sky resources.
Development on lands adjacent to refuge units	Long-term adverse impacts on night skies from spill-over effects of lighting for commercial and residential development.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans, actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-10).

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on scenic views and night sky resources, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on scenic views and night sky resources. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on scenic views and night sky resources as a result of oil and gas operations that would continue to affect scenic views and night sky resources where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

NATURAL SOUNDSCAPES AND ACOUSTIC ENVIRONMENT

METHODOLOGY

Certain key terms are important to this impacts analysis. *Acoustic resources* are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence). The *acoustic environment* is the combination of all the acoustic resources within a given area—natural sounds as well as human-caused sounds. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls. *Soundscape* is the component of the acoustic environment that can be perceived and comprehended by humans. The character and quality of the soundscape influence human perceptions of an area, providing a sense of place that differentiates it from other regions. *Noise* refers to sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds. *Cultural soundscapes* include opportunities for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which the refuges were established.

Impacts on natural soundscapes and the acoustic environment can be compared to natural ambient conditions and are typically assessed based on the distance between a sound source and the receptor, the characteristics of the land located between the source and the receptor, the nature of the receptor's activity, and the increase in sound level above natural ambient sound levels. Frequency, amplitude, and duration should all be considered when describing impacts.

Potential sound levels at various distances from pieces of heavy construction equipment typically used during geophysical exploration, drilling and production, and plugging and reclamation associated with oil and gas operations were estimated (Table 4-11). Additional sound sources that

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occur during production but are not addressed in Table 4-11 include generators, compressors, and pumps. The Federal Highway Administration's Roadway Construction Noise Model contains a database of common construction equipment. The database includes a list of the noise levels produced by each piece of construction equipment at a distance of 50 feet, per the equipment specifications. This database is an accepted resource for common construction equipment sound levels. Additionally, the Federal Transportation Administration Transit Noise and Vibration Impact Assessment guidelines contain typical equipment noise levels at 50 feet from the source (FHWA 2006). These references were subsequently used to approximate noise levels at distances beyond 50 feet, which may be audible within the refuge units. As the construction equipment may be thought of as point sources of noise, the radiation pattern is such that the sound level would drop off at a rate of 6 dBA per doubling of distance from the source, based solely on source geometry without taking site surface conditions into consideration (Caltrans 2013).

TABLE 4-11. EQUIPMENT NOISE LEVEL PREDICTIONS (dBA)

Distance from Source (feet)	Grader/Bulldozer/ Concrete Pump Truck/Chainsaw	Dump Truck	Front-End Loader	Drill Rig/Rotary Drilling	Concrete Mixer Trucks	Diesel Truck
50	85	84	80	75	82	88
100	79	78	74	69	76	82
200	73	72	68	63	70	76
400	67	66	62	57	64	70
800	61	60	56	51	58	64
1,600	55	54	50	45	52	58
3,200	49	48	44	39	46	52
6,400	43	42	38	33	40	46
12,800	37	36	32	27	34	40
25,600	31	30	26	21	28	34

Notes:

Equipment noise levels represent specification values for a reference distance of 50 feet from the equipment source.

Predicted noise levels beyond 50 feet from the source were estimated assuming a 6 dBA drop-off rate per doubling of distance for a point source (stationary equipment sources may be regarded as point sources) based solely on source geometry (Caltrans 2013).

Equipment noise levels at the distances shown in this table will vary based on additional attenuation measures, including vegetation, topography, and climate conditions.

Noise from a drill rig/rotary drilling was estimated based on a measured level of 63 dBA at 200 feet for a typical drill in Wyoming. This noise level is consistent with a report on air-rotary drilling published by the National Institute for Occupational Safety and Health Reinke and Ingram 2009). The report identified noise levels of approximately 90 dBA measured within 6 feet of the rig. This level was extrapolated to 50 feet and compared to the extrapolated level at 50 feet from the Wyoming data. The levels were within 2 decibels of each other.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON NATURAL SOUNDSCAPES AND ACOUSTIC ENVIRONMENT

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on natural soundscapes and the acoustic environment can result from equipment noise generated during vegetation clearing and road building, and noise from vehicles delivering survey equipment and personnel. Vehicles may include trucks, helicopters or ORVs. Chainsaws are often used to clear a survey line of sight. Additionally, noise associated with seismic surveys would occur from the use of Vibroseis® trucks (vehicle-mounted vibrators) or, alternatively, drilling holes in the earth, and detonating explosive charges in the holes.

Noise generated by these seismic survey activities would be intermittent and typically occur over a period of 3 weeks to 3 months. Helicopters, when used, are the primary noise source in seismic operations. Often two or more helicopters are used to support a seismic shoot. In these cases, the noise would be continuous during daytime operations but limited to a 2- to 3-week time frame within the active area of operations. However, these operations have the potential to produce sounds of

considerable amplitude. Helicopter noise would be intermittent and limited to certain flight paths to and from the survey operations, but would increase sound levels near flight paths.

Impacts of Well Drilling and Production

Most of the adverse impacts associated with oil and gas operations within refuge units would result from the drilling and production phase, because construction of the well necessitates the majority of the heavy construction equipment that have considerable sound levels, and production has a long duration. Potential sources of noise associated with drilling and production include the construction of roads and trails for accessing the site, preparation of the drill site, drilling operations, cement work, well servicing, and workover operations. Truck traffic would also add to noise. In the event that hydraulic fracturing is used for extraction, this would produce additional sound impacts, since that technology requires large truckloads of water, produced water, and chemicals and larger trucks to transport the equipment needed for drilling. Drilling that includes hydraulic fracturing operations also tends to add time to the overall operation, which would add to the duration of the noise impacts to the soundscape and acoustic environment, although the effect would still be a short-term impact.

Table 4-11 presents some of the typical construction equipment associated with each of these activities and their associated noise levels predicted at various distances from the source. As described in the Methodology section above, predicted levels are representative of noise attenuation at a rate of 6 dBA per doubling of distance from the sound source (the noise level drop-off rate from a stationary point source purely due to the geometry of the source). Though additional attenuation could be realized due to vegetation cover, intervening topography and meteorological conditions, low frequency sounds commonly produced by mechanized equipment (like vehicles, pumps, and drill rigs) travel great distances.

Accessing new well locations in remote areas could require upgrading of existing roadways and/or construction of new roads and trails to accommodate heavy construction equipment and increased truck traffic. Subsequently, once the drill site is accessed, clearing, grading, cutting, filling, and leveling of the well pad is required to prepare the drill site to accommodate the rig and other equipment. Common equipment used for the construction of access roads as well as preparation of the well pad includes graders, bulldozers, front-end loaders, and dump trucks. Concrete mixer and pump trucks may also be used for the cementing of oil-well casing. As shown in Table 4-11, graders, bulldozers, concrete mixer trucks, and dump trucks all produce similar noise levels (graders, bulldozers, and concrete mixer trucks produce 85 dBA at 50 feet, while dump trucks produce 84 dBA) and would be the loudest pieces of equipment used for site access and well pad preparation.

Generally, when numerous pieces of equipment are in use concurrently, the loudest piece of equipment dominates, especially when a large difference exists between the noise generated by each piece of equipment. Conversely, when sound power levels from two pieces of equipment in concurrent operation are the same, the combined level is approximately 3 dB higher. As such, during drilling and well construction activities, it can be expected that noise levels would reach 88 or 90 dBA at 50 feet from the operation. During production, noise would be generated by gas compressors or jack pumps (approximately 89 dBA and 82 dBA, respectively), depending on the resource being extracted.

Compared to this range of measured ambient noise levels within refuge units of 17 to 35 dBA, and considering a worst case condition of a hard, flat surface and no intervening vegetation, drilling and production noise levels could still exceed 17 dBA at a distance of 20 miles from such equipment. However, as identified in Chapter 3, under typical conditions where the surface is soft and vegetation

is present, noise levels would decrease at a rate of approximately 7.5 dB or more per doubling of distance. At a distance of 12,000 to 25,000 feet (2.3 to 4.7 miles), sound levels would start to decrease to natural ambient sound levels, although under conditions where little vegetation occupies flat landscapes, this distance could be as much as 10 miles or more, and the low frequency component of sounds may be audible even further. Actual sound levels produced during site access and well pad preparation activities would be highly dependent, however, on the number of pieces of equipment used, combinations of equipment used in conjunction with one another, and the percentage of time the equipment is operating at full power. Additionally, actual noise levels at a distance from the sound sources would vary considerably depending on the frequency and amplitude of the sound, topographic features, surface conditions, and the types and density of vegetation cover.

After establishing access to the site and prepping the well pad, mobilizing the drill rig and beginning the drill work would elevate sound levels. Specifically, hauling the drill rig and other equipment to the location would require about 10 to 25 large truckloads, thereby resulting in a temporary increase in vehicular sources of sound. Diesel trucks operating around the site typically produce a noise level of 88 dBA at 50 feet, which would begin to decrease to the natural ambient sound levels at a distance of 12,000 to 25,000 feet (2.3 to 4.7 miles), without considering attenuation from intervening topography, vegetation, and terrain. Elevated noise levels would also arise during drilling, which is a continuous, 24-hour-a-day, 7-day-a-week operation. Rotary drilling is used almost universally in modern drilling. Based on the noise levels indicated in Table 4-11, noise from a rotary drill would begin to attenuate to approximately 33 dBA at a distance of 6,400 feet (1.2 miles), not accounting for additional attenuating factors such as vegetation and topography. Diesel-powered pumper trucks are used in hydraulic fracturing operations to pressurize the hydraulic fracturing fluid and create fractures in the oil and gas-bearing formations. The trailer-mounted compressor pumps in these pumper trucks can generate excessive noise during the actual fracturing process. Up to 20 pumper trucks operating simultaneously to fracture the formation can generate noise levels from 110 to 115 dBA at a distance of three feet and 73 to 78 dBA at a distance of 1,000 feet (NYDEC 2011); however, these noise levels are temporary, occurring for the duration of the actual fracturing operation.

As described above, vegetation, certain meteorological conditions, and topography could reduce the distance at which noise levels from heavy construction equipment would attenuate to the natural ambient level. Although noise levels associated with drilling operation equipment are similar to noise levels produced by construction and earthmoving equipment during the site access and well pad prepping activities, the intensity of the impacts during drilling would potentially be greater due to the continuous nature of the drilling operation. If the drilled wells are advanced to the production stage, the use of heavy construction equipment to lay pipelines would result in elevated sound levels similar to those described above for the site access, preparation, and drilling.

The production phase would necessitate the use of some equipment that produces considerable amounts of noise, including gas compressors and jack pumps. Noise from compressors (approximately 89 dBA at 50 feet), attenuating at 7.5 dB per doubling of distance, would be approximately 37 dBA at 6,400 feet and noise from jack pumps (approximately 82 dBA at 50 feet) would be approximately 30 dBA at 6,400 feet. These impacts would be continuous and long term, as pumping or gas compression would occur continuously over the life of the well. Additionally, over the course of time that the well is in production, well servicing and workover operations may be necessary. Depending on the maintenance necessary, well servicing may last only 1 or 2 days, requiring minor equipment and a workover rig (a scaled-down drilling rig). Major workover operations may last more than a month and could require some limited drilling operations.

Impacts of Plugging and Reclamation

In addition to the exploration, construction, and production phases, oil and gas extraction activities would generate noise in the plugging and reclamation phase. Activities associated with this phase that would potentially result in adverse impacts include the use of heavy construction equipment and trucks to reopen and repair access roads, remove production equipment and plug wells, and restore contours. Specifically, typical equipment used in opening up and/or repairing access roads includes a small bulldozer, backhoe, and hand tools (gas-powered chainsaw, shovels, axes, etc.). As indicated in Table 4-11, bulldozers and chainsaws could produce 85 dBA at a distance of 50 feet from the source, while a backhoe would produce a sound level of 80 dBA (FHWA 2006). If a chainsaw and bulldozer were used concurrently, generating sound levels of approximately 88 dBA, sound levels would begin to decrease to approximately 36 dBA at a distance of 6,400 feet, although attenuating factors including vegetation and topography could reduce this distance. Reopening and/or repair of access roads would likely be short term, lasting only a few days to weeks, depending on the condition of the roads.

During reclamation, similar earthmoving equipment would be necessary in addition to a small dump truck for the potential removal of contaminated soils. The dump truck would produce noise levels similar to that of the earthmoving equipment. Depending on the degree of contamination at the well site, reclamation could last a few days to a few years. During plugging, trucks and cement mixer and/or pumping trucks would be used, producing similar noise levels to the earthmoving equipment used during site access and reclamation. Plugging would be short term, lasting only 2 to 5 days, depending on the equipment in the well, wellbore conditions, number of plugs to be set, and other factors. Additional sources of noise associated with this phase would include the use of ORVs or pick-up trucks to transport people and supplies.

IMPACTS OF ALTERNATIVES ON NATURAL SOUNDSCAPES AND THE ACOUSTIC ENVIRONMENT

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRs lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on natural soundscapes and the acoustic environment.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of natural soundscapes and the acoustic environment on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, natural soundscapes and the acoustic environment associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e., an inholding). The level of increased protection for natural soundscapes and the acoustic environment would vary from slight to moderate depending on the proximity of those operations to refuge boundaries, as well as State rules (and operator's compliance with those rules) in place that serve to reduce such impacts (e.g., the incorporation of sound-absorbing materials and/or mufflers).

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The location of surface operations outside refuge units avoids direct impacts to natural soundscapes and the acoustic environment within refuge units. However, wells directionally drilled and produced from outside refuge units to bottomholes beneath the refuge units would directly impact natural soundscapes and the acoustic environment on adjacent lands as well as present a risk of indirect impacts within the refuge units. Under current regulations, the Service cannot impose preventative measures such as mitigation. The risk and intensity of impacts on refuge resources would increase for operations sited closer to refuge boundaries where human activity and the operation of equipment would transmit noise onto the refuge. Intensity of impacts on refuge resources would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as habitat quality; and mitigation measures.

Alternative B provides an even greater incentive for operators to locate their operations outside refuges since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others. So, as the operator's costs of operating on NWRS lands increase, so does the incentive to avoid those costs. Therefore, it is likely that impacts to natural soundscapes and the acoustic environment from new production and drilling operations within refuges would be avoided to a greater extent than in Alternative A. Impacts on natural soundscapes and the acoustic environment from those wells located on non-Federal surface locations would be same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Operational standards would reduce noise transmitted into refuge units depending on the proximity of the operation to the refuge and thus impacts to natural soundscapes and the acoustic environment within the refuge boundary.

However, application of regulation to surface and subsurface operations outside a refuge would largely remove an operator's incentive to avoid surface use in a refuge, so the number of drilling and production operations located on refuges would likely increase. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge natural soundscapes and the acoustic environment.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations it provides additional protection for natural soundscapes and the acoustic environment. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to natural soundscapes and the acoustic environment.

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Under Alternative A, there would be unnecessary impacts on natural soundscapes and the acoustic environment from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Natural Soundscapes and Acoustic Environment. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on natural soundscapes and the acoustic environment from oil and gas operations include noise generated from equipment and vehicles during road and well pad construction, and diesel engines powering the drilling rig equipment, hydraulic fracturing compressor pumps, vehicles, gas compressors, and pump jacks. Wildlife displacement can occur due to noise impacts. Noise from oil and gas operations can also be detrimental to visitor experiences. As previously discussed, most of the impacts to natural soundscapes and the acoustic environment occurred when the operation was originally chosen and developed by the operator to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect natural soundscapes and the acoustic environment. Typical mitigation measures that would minimize ongoing impacts from pre-existing operations on natural soundscapes and the acoustic environment could include sufficient setbacks and/or timing restrictions for sensitive periods in a given wildlife species' life cycle, and scheduling geophysical exploration and drilling activities during periods of lower visitor use.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to natural soundscapes and the acoustic environment, and other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of natural soundscapes and the acoustic environment from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to natural soundscapes and the acoustic environment would be reduced compared to Alternative A due to improved compliance with State rules that serve to lower such impacts, such as State rules addressing noise impacts from oil and gas operations. Overall, the Service expects that the large majority of issues related to impacts on natural soundscapes and the acoustic environment would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet Service's reclamation standards, which would also greatly reduce any long-term impacts on refuge natural soundscapes and the acoustic environment as discussed further below in Performance-Based Standards.

Assimilation of State laws and regulations during the production phase combined with reclamation to Service standards ensures a substantial and consistent long-term benefit to natural soundscapes and the acoustic environment compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to the rule, Alternative C may provide additional protections for natural soundscapes and the acoustic environment from impacts associated with pre-existing operations to a greater number of wells. Since the greatest impacts to natural soundscapes and the acoustic environment have already occurred, the Service would be focusing on maintenance issues, such as the incorporation of sound-absorbing materials and/or mufflers and placing enclosures around loud equipment and/or earthen berms situated between the sound source and receptors, in those cases where State laws and regulations do not meet Service operating standards. Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge natural soundscapes and the acoustic environment. In most cases, since the activity is occurring directly on private surface estate, the Service would not identify operational measures to protect natural soundscapes and the acoustic environment on adjacent Federal surface estate. Thus, for these operations, the impacts on natural soundscapes and the acoustic environment would be similar to Alternative B.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on natural soundscapes and the acoustic environment. These could include the incorporation of sound-absorbing materials and/or mufflers and placing enclosures around loud equipment and/or earthen berms situated between the sound source and receptors. However, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to natural soundscapes and the acoustic environment. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to natural soundscapes and the acoustic environment. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting natural soundscapes and the acoustic environment. As previously discussed, new operations create the greatest additional impacts on natural soundscapes and the acoustic environment, so establishing performance-based standards that would include proper site planning, timing restrictions and best management practices to avoid or minimize many of the typical impacts to natural soundscapes and the acoustic environment from oil and gas development. Also, the rule includes additional standards that would protect natural soundscapes and the acoustic environment, such as the installation of sound abatement equipment, such as hospital-grade mufflers, and constructing sound buffers.

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Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest.

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would indirectly reduce impacts to scenic views within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on scenic views compared to Alternative A

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to the rule, Alternative C may provide for implementation of higher standards for protection of natural soundscapes and the acoustic environment to a greater number of wells. The Service would be focusing on maintenance issues, such as proper lubrication of engines and other moving equipment to reduce noise.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect refuge natural soundscapes and the acoustic environment. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts, and the proximity of the surface location of operations on non-Federal surfaces to the refuge and the presence of natural or human-made features that serve to attenuate sounds.

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Natural soundscapes and the acoustic environment would only be impacted by accidents associated with well control (e.g., noise associated with fire suppression activities and equipment noise). Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to natural soundscapes and the acoustic environment related to our downhole regulation under Alternative C.

Cumulative Impacts of Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect soundscapes and the acoustic environment of the refuges. Management planning, such as fire management, vegetation management, and ORV plans can result in greater protection for these resources. Conversely, actions that cause disturbance of these resources would include activities such as prescribed burns, ORV use, mining, agricultural and logging activities, as well as any general development activities that include excavation, grading, or construction. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on natural soundscapes and the acoustic environment in the area of analysis (including both refuge lands and

adjacent lands) and a brief summary of the cumulative impacts of these actions on natural soundscapes and the acoustic environment are listed in Table 4-12.

TABLE 4-12. CUMULATIVE IMPACTS ON NATURAL SOUNDSCAPES AND ACOUSTIC ENVIRONMENT (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Natural Soundscapes and Acoustic Environment
Prescribed fires and fire management actions	Short-term adverse effects due to removal of vegetation that may be attenuating noise and noise related to firefighting actions. Long-term beneficial effects of improved noise attenuation from vegetative cover that is established after these treatments.
Service facility and road construction	Short-term and long-term adverse effects on soundscapes during road grading and construction using heavy equipment.
Vegetation management	Short-term adverse effects due to removal of vegetation that may be attenuating noise and noise related to firefighting actions. Long-term beneficial effects of improved sound attenuation from vegetative cover that is established after these treatments.
Trails development and maintenance	Short-term and long-term adverse effects on natural soundscapes and the acoustic environment during road grading and construction using heavy equipment.
ORV use	Long-term beneficial effects from improved vegetative cover due to increased noise attenuation.
Abandoned mine lands reclamation	Short-term adverse effects on natural soundscapes and the acoustic environment during clearing, grading, and surfacing of trails, and removal of vegetation in trail footprint.
Mining and logging activities	Short- and long-term adverse effects on natural soundscapes and the acoustic environment due to mobile sources of noise capable of affecting large areas.
Recreational use	Short-term adverse effects on natural soundscapes and the acoustic environment due to reclamation-related noise. Long-term beneficial effects of improved surface vegetation, removal of noise sources, and related noise attenuation.
Ranching, agricultural land uses	Short-term adverse effects due to noise from mining and logging machinery. Long-term adverse effects on natural soundscapes and the acoustic environment due to loss of noise-attenuating vegetation.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short- and long-term adverse effects soundscapes and the acoustic environment from human activities.
Future oil and gas development on adjacent lands	Short- and long-term adverse effects on natural soundscapes and the acoustic environment from operations that remove vegetation cover and the associated noise-attenuating effects.
Oil and gas well plugging and reclamation activities inside and outside	Short-term adverse effects on natural soundscapes and the acoustic environment due to construction equipment noise, and possible long-term adverse effects on natural soundscapes and the acoustic environment due to the introduction of noise generators.

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Natural Soundscapes and Acoustic Environment
refuges	
Industrial operations outside refuge boundaries	Long-term adverse impacts from noise generated by industrial activity, especially that from surface mineral extraction activities and manufacturing.
Traffic noise	Long-term adverse impacts due to increasing visitorship to refuges and increased travel to and from developments near refuge boundaries.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans and actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-12).

Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP, which would continue to have long-term direct adverse impacts on natural soundscapes and the acoustic environment, as described in the above analysis. On the other hand, bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on natural soundscapes and the acoustic environment. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Under Alternative C, similar to Alternative B, there would be effects on natural soundscapes and the acoustic environment as a result of oil and gas operations that would continue to affect natural soundscapes and the acoustic environment where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulation and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and all phases of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial.

CULTURAL RESOURCES

METHODOLOGY

Potential impacts on cultural resources are assessed based on the actions being proposed and the various cultural resources present at refuges, with attention to characteristics that may have an adverse effect upon the integrity of cultural resources. Resource-specific context for assessing impacts of the alternatives on cultural resources include:

- The type and amount of disturbance from oil and gas operations (such as type and location of well pads and access roads).

- The type of cultural resources affected and their susceptibility to disturbance, contamination, and noise or visual intrusion. Avoiding the destruction of a historic structure or an archeological site of modest size and defined boundaries could be expected to be relatively easy, while the issues posed by an extensive cultural landscape or ethnographic zone could be more problematic.

For the programmatic analysis, a qualitative analysis of the potential impacts of oil and gas operations on cultural resources was conducted based on actual experience of the Service in management of non-Federal oil and gas operations and their effects cultural resources and professional judgment.

The following is a discussion of the potential adverse impacts on one or more subcategories of cultural resource that oil and gas operations might cause. It is not a determination that they actually would occur; mitigation and consultation under section 106 of the National Historic Preservation Act (NHPA) are discussed under the Regulated Operations (Current and Future) section. Note that all currently regulated operations have been evaluated for compliance with section 106, and subjected to consultation if required.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON CULTURAL RESOURCES

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on cultural resources result primarily from the presence of seismic survey crews in and around the refuge, and the presence and detonation of explosives.

Historic Structures—Possible impacts on historic structures located within a vibration zone include cracking of foundations, breaking of glass window panes, settling and burial of artifacts located in soft soils, and collapse of structures and features due to oscillation and ground motion.

Cultural Landscapes—The presence of oil and gas personnel and their vehicles and equipment could cause adverse visual impacts for visitors that are seeking a cultural experience from the natural landscape of a refuge. Flagging used to mark site lines can be distracting, and the cutting of survey lines through dense vegetation can require creation of paths for vehicles and crews and clear a line of sight that is not natural. The noise from the seismic survey operations could adversely impact how visitors experience the cultural landscape at these sites. These impacts would be localized to the seismic survey area and short-term in duration.

Archeological Resources—Impacts on archeological resources could occur as a result of the vibrations caused by truck traffic and seismic survey technology, including settling and burial of artifacts located in soft soils, and collapses of features due to oscillation and ground motion. Increased access to areas by exploration crews could lead to intentional and unintentional vandalism and illegal collection of or damage to previously unidentified cultural resources listed or eligible for listing on the National Register.

Ethnographic Resources—Seismic surveys can introduce explosives into a refuge environment. Visitor access is limited to areas to reduce the possibility of encounters. It is possible that the geophysical exploration in a certain location could be seen by an Indian tribe as transgressing the character of a sacred site.

Impacts of Well Drilling and Production

Similar to geophysical surveys, drilling operations are relatively short term. However, the intensity of impacts is much higher, due to the equipment and materials needed to drill a well and the potential duration of the operation, which can be longer for hydraulic fracturing operations. Site preparation may include extensive clearing, grading, cutting, filling, and leveling of the well pad using heavy construction equipment that can destroy or disturb cultural resources. Soil material suitable for plant growth is often removed first and stockpiled for later use in reclamation. The operator may also dig reserve pits to hold large volumes of drilling mud and drill cuttings. Impacts on refuge cultural resources could also occur if water and sediment or contaminants were transported downslope into refuge units through adjacent streams, gullies, or overland flow, causing unsightly and/or unnatural conditions and providing a source of exposure to contaminated water or soils. Severity of impacts would depend on proximity of operations to the refuge units; site-specific environmental conditions, such as steepness and direction of slope and surface hydrology; and mitigation measures being employed.

Drilling and production operations could be more substantial than other types of impacts on cultural resources, especially if well pads are placed in locations that intrude upon historic structures or districts, cultural landscapes, areas of ethnographic significance, or archeological sites. Drill rigs can reach heights of 180 feet, which would most likely be visible from several locations within the refuges. Initial site clearing would remove approximately 1.5 to 4 acres of vegetation for each well pad (NYDEC 2011) and access road construction would often result in visible cuts through refuge vegetation or creation of a definitive pathway, depending on the location and refuge. The operations, especially drilling, would increase the presence of work crews and equipment. As drilling is a 24-hour, 7-day-a-week operation, these impacts would be continuous, and could last a week or two up to a few months. Production operations entail permanent equipment arrays such as pump jacks, oil tanks, and containment apparatus. Although these have a less intrusive human presence compared to drilling, they would be visible for 20 years or longer.

All Cultural Resources—Unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of a refuge present a risk of release of contaminants that can adversely impact cultural resources, especially historic structures and cultural landscapes if they are in the vicinity of the release or fire. However, the incident rates for such incidents are low and are not a typical expectation of project implementation. Therefore, no matter which type of operation is used for drilling and production (conventional or fracturing), there is a reasonable expectation that long-term adverse impacts from contamination would not occur or be limited to low levels of intensity, although there could be severe adverse impacts that could be considered long-term as impacts on cultural resources are generally not reversible. In the event that the refuge's resources or values are damaged, the Service could seek remedy both in the form of reclamation and monetary compensation.

Historic Structures—Structures and districts potentially eligible for the National Register, which have not been evaluated for National Register, may have their eligibility damaged by construction or operational activities associated with drilling and production. Impacts could include the visual intrusion, either temporary or permanent, of oil and gas operations and equipment into the setting of a historic structure/district; and the introduction of vibration, noise, odors, inappropriate artificial lighting, potentially detrimental gases or chemicals, and access routes into the setting of a historic structure or a historic district. Site alterations and destruction or collection of objects and structures at sites of historical, archeological, or cultural value could occur during drilling and operation activities

associated with oil and gas development. Direct impacts could occur through removal, destruction or alteration of historic structures contained within a historic district. Road construction and well drilling and production may indirectly impact historic structures and districts through vibrations which may result in accelerated deterioration of the resources.

Cultural Landscapes—Impacts on cultural landscapes from drilling and production operations could include visual intrusion, either temporary or permanent, of oil and gas operations and equipment into a cultural landscape; the introduction of vibration, noise, odors, inappropriate artificial lighting, potentially detrimental gases or chemicals, and access routes into a cultural landscape; and/or the alteration or destruction of a cultural landscape during drill site preparation. It should be noted that cultural landscapes in national wildlife refuges can be quite large and include many types of contributing features, such as natural systems and features, circulation patterns, spatial organization, land use, topography, buildings and structures, views and vistas, vegetation, and water features. Visual impacts from drilling and production operations on cultural landscapes would be more substantial if well pads were placed relatively close to the sites, where visitors would be able to see the operation and all associated equipment and tanks. Exploratory drill rigs can reach heights of 180 feet, which would be readily visible through clearings and open spaces. The operations, especially drilling, would increase the presence of work crews and equipment. Wells that would be developed using hydraulic fracturing would involve more equipment, more traffic, and a longer period of time (2 to 4 weeks) for drilling and development. Long term adverse impacts could occur to cultural landscapes from the visual presence of well pads and associated equipment.

Archeological Resources—Potential adverse impacts on archeological resources are possible from the construction and maintenance of access roads, well pads, flowlines, and pipelines. The destruction of archeological sites from the ground disturbing activities associated with oil and gas operations and equipment, including the passage of heavy trucks over access roads, can result in long-term adverse impacts on cultural resources. Refuge units typically have archeological survey data from past cultural resource investigations, but they are not necessarily comprehensive, nor is it possible to accurately predict the location of all subsurface resources. Increased access to sensitive areas could contribute to intentional and unintentional vandalism and looting of artifacts. Collection of or damage to previously unidentified cultural resources potentially eligible for listing on the National Register would constitute an indirect adverse impact. As indicated above, it is possible that important cultural sites may not be visible from the surface and could be damaged by construction activities associated with drilling and production. This would have a long-term adverse impact on individual archeological sites.

Ethnographic Resources—Ethnographic resources consist mainly of the cultural values of the tribes and other communities of interest claiming traditional associations with the area. New drilling and production could result in adverse impacts on potential ethnographic resources in the absence of appropriate consultation with communities of interest. Oil and gas drilling and production occurring in areas with significance to tribes, for example, would prevent access and cause interruptions to the symbolic associations between the people and the place itself. The intrusion of oil and gas operations into an ethnographic area, particularly an Indian sacred site, or the destruction or displacement of objects of Indian patrimony would result in adverse impacts on cultural resources, resulting in short- to long-term adverse impacts on cultural resources.

For directionally drilled wells, the location of these wells outside the refuge boundary means that most of the impacts addressed above would not be experienced in the refuge. However, if these wells are close enough to the refuge boundary, noise and even lighting can carry into the refuge, and

indirect effects would be similar to those described for operations inside the refuge units. The risk of indirect impacts and their intensity would vary with the location of the well with respect to the refuge boundary.

Impacts of Plugging and Reclamation

Full-scale reclamation could include the following removal of structures, equipment and debris used or generated during operations; replanting of vegetation; removal or remediation of contaminated soils; and recontouring of disturbed areas to near original grade.

Historic Structures—Potential adverse impacts on historic structures from plugging, abandonment, and reclamation operations include the displacement of or damage to built features from vibrations and/or movement of soils containing structural remains, resulting in localized long-term adverse impacts on historic structures throughout the refuge.

Cultural Landscapes—The presence of earthmoving, demolition, and other equipment associated with plugging and reclamation activities would have similar impacts on cultural resources as described for drilling and production operations. The noise from the drill rigs and the sight of the work crews and their equipment could adversely affect the cultural landscape at these sites and introduce ground disturbance to the landscape. However, plugging and reclamation would end disturbances from production activities, and the sites would be restored to a more natural character. Reclamation of the well pads following plugging of the wells would serve to eliminate the unnatural views of the site over time. The actual time required to reclaim the site's scenic views would depend on many factors, including the erosion potential of the site, productivity of the vegetation, topography, and soil characteristics, including the presence of any contamination. Ultimately, the removal of the rig and associated structures and equipment, in conjunction with site reclamation, would improve the scenic views near the well sites. Reclamation of sites and replanting with native vegetation would restore the natural character of the area, and may lessen any impacts related to disturbance in cultural setting or landscape. Overall, there could be both short-term adverse impacts and long-term beneficial impacts on cultural landscapes as a result of plugging and reclamation.

Archeological Resources—The use of heavy equipment and vehicles during reclamation activities—including well plugging and shutting down, abandoning, and removing flowlines and pipelines—could disturb and compact soil, increase soil erosion, and release oil and other contaminating and hazardous substances, resulting in short-term adverse impacts. It is assumed that previously some drilled wells may have already disturbed extant cultural sites. Ultimately, the removal of the rig and associated structures and equipment, in conjunction with site reclamation, would improve the scenic views near the well sites. Reclamation of sites and replanting with native vegetation would restore the natural character of the area, and may lessen any impacts related to disturbance in cultural setting or landscape. However, during reclamation activities, it is possible that soils containing cultural material would be disturbed, thus displacing or destroying subsurface artifacts and resulting in long-term adverse impacts. Overall, there could be both short-term and long-term adverse and beneficial impacts on archeological resources as a result of plugging and reclamation.

Ethnographic Resources—As described for other phases of oil and gas development, impacts could include limited access to or use of sacred sites or effects on the physical integrity of the sites. As a result, plugging and reclamation activities would result in adverse impacts on potential ethnographic resources.

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on cultural resources.

Under Alternative A, the Service scope of application of its regulation and policy provides protection of cultural resources on Service fee title lands.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements). As a result of active regulation by the Service, cultural resources associated with interests acquired on easements would have a consistent and higher level of protection compared to Alternative A.

Alternative C would expand the scope of regulation to operations conducted on non-Federal surface locations drilling under a refuge or any operation on private land within a refuge (i.e. an inholding). As a result of active regulation by the Service, cultural resources associated with these non-Federal lands would have a consistent and higher level of protection compared to Alternatives A and B.

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A, there would be an incentive for operators to locate their drilling and production operations outside refuge units. The location of surface operations outside refuge units avoids direct impacts to cultural resources within refuge units, because the primary effects on cultural resources from oil and gas operations stem from the fact that cultural resources could be displaced or destroyed during the construction of roads and well pads, the installation of flowlines, tanks, and other infrastructure, or during spill response activities. While unknown subsurface archaeological resources could be damaged by drilling through sites and cultural materials at drilling locations on adjacent lands outside refuges, it is unlikely that archeological sites in refuges would be disturbed, due to the depth of the directional boreholes. However, depending on the proximity of these operations to the refuge, some indirect impacts to cultural resources on a refuge could occur, because the Service would not be imposing preventive measures. Runoff or erosion could occur, impacting surface archeological sites within the refuge units. Visual effects and noise and vibration could impact historic sites, ethnographic resources, and cultural landscapes located on refuges adjacent to drilling operations. Highly unlikely, but possible, would be severe, adverse effects in the case of a well blowout, fire or uncontrolled release on these operations that reach cultural resources in the refuge.

As previously discussed, Alternative B provides an even greater incentive for operators to locate their operations outside refuges. Therefore, it is likely that direct impacts to cultural resources from new production and drilling operations would be avoided to a greater extent than in Alternative A. Indirect impacts from those wells located on non-Federal surface locations would be the same as Alternative A.

Under Alternative C, directional drilling operations on non-Federal surface locations would be subject to the full regulatory requirements of the rule. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses. Alternative C would provide some additional protection from the indirect impacts of these operations to cultural resources by requiring mitigation measures that would, for

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instance, reduce the risk of runoff or erosion damaging archaeological sites or possibly minimize noise and visual disturbances on cultural landscapes or ethnographic resources.

However, Alternative C eliminates the incentive to locate an operation outside of a refuge, so there would likely be a significant increase in the number of drilling and production operations located on refuges, as well as the direct impacts to cultural resources on refuges. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge cultural resources.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue to work to ensure new operations are under a Service-issued SUP, which would reduce the impacts of geophysical operations and new drilling and production operations. When an operator obtains a Service permit prior to conducting operations it provides additional protection for cultural resources. The permitting process ensures ongoing communication between Refuge staff and the operator; that an operator includes mitigation measures to avoid or minimize impacts to refuge resources and uses; and that an operator is aware of expectations to reclaim a site to restore refuge resources and ensure long term protection of refuge resources and uses. However, the permit requirement itself has not been consistent across the Service; where permits have been issued, the permit conditions have varied widely resulting in the possibility of unnecessary impacts to cultural resources.

Under Alternative A, there would be unnecessary impacts on cultural resources from the estimated 4,000 pre-existing oil and gas production operations not under an SUP, including those described above under Typical Impacts of Oil and Gas Operations on Cultural Resources. The Service estimates that the 4,000 pre-existing wells in 107 refuges have created approximately 6,000 acres of direct disturbance associated with well sites and access roads. Direct surface disturbances from well pads and roads in refuges range from 1 to 6 acres with the average area of disturbance estimated at approximately 1.5 acres per operation.

The primary effects on cultural resources from operations stem from the fact that cultural resources could be displaced or destroyed during the construction of roads and well pads, the installation of flowlines, tanks, and other infrastructure, or during spill response activities. So, as previously discussed regarding time/place/manner considerations, most of the impacts to cultural resources occurred when the operator chose and developed the site to accommodate their drilling and production operations.

However, some continuing unnecessary impacts may occur under Alternative A due to the lack of any requirement that these pre-existing operations have ongoing mitigation measures to protect cultural resources and the fact the Service does not currently have a way to ensure operations are complying with any State laws that would protect cultural resources. Typical mitigation measures that minimize further impacts from existing wells on cultural resources include removal of contaminated soils, effective erosion control, proper secondary containment around storage tanks, regular pump jack maintenance, and removal of debris, waste, and equipment no longer needed in operations. The level of monitoring and cooperation with operators to address impacts on cultural resources would continue to vary widely, resulting in unnecessary impacts to the environment.

Under Alternative B, all new operations and pre-existing operations that are transferred to a new operator would be under a consistent permitting process that would include required consultation with the Service, performance-based standards to avoid or minimize impacts to geology and soil, and

other administrative provisions such as financial assurance, cost recovery, and access fees that would ensure protection of geology and soils from the typical impacts of oil and gas development to the greatest extent practicable.

Similar to Alternative A, most pre-existing operations would not be required to obtain an operations permit during the production phase. However, in contrast to Alternative A, the Service would manage these operations by ensuring operations are in compliance with Federal laws concerning cultural resources and by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. So, during the production phase, impacts to cultural resources would be reduced compared to Alternative A due to improved compliance with section 106 of NHPA. Overall, the Service expects that the large majority of issues related to ongoing impacts on geology and soils would be resolved by compliance with State laws and regulations.

Additionally, under Alternative B, all operations, including pre-existing operations, would be required to have a Service-issued permit for reclamation that would ensure all operations meet Service's reclamation standards, which would also greatly reduce any long-term impacts on cultural resources as discussed further below in Performance-Based Standards.

Requiring that all pre-existing operations be in compliance with Federal laws, such as section 106 of NHPA, and other revisions that would give the Service greater enforcement authority during the production phase, combined with the requirement that all reclamation be done to Service standards ensures a substantial and consistent long-term benefit to cultural resources compared to Alternative A.

Alternative C would require all operators on refuges to obtain a permit for their operations, including pre-existing operations. Compared to Alternative B, Alternative C may provide additional protections for cultural resources from impacts associated with pre-existing operations to a greater number of wells. Since the greatest impacts to cultural resources have already occurred, the Service would be focusing on ongoing issues, such as erosion control, in those unlikely cases where compliance with Federal and State laws and regulations do not meet Service operating standards for protecting cultural resources.

Alternative C would also subject operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to the full requirements of the rule to the extent necessary to protect cultural resources. This would likely include further protections for cultural resources on these operations under section 106 of NHPA and other Federal laws concerning protection of cultural resources.

Performance-Based Standards

Under Alternative A, oil and gas operations would be managed on an individual unit basis, with protective stipulations developed in a site-specific manner. New operations would be subject to operating practices, as defined in SUPs that serve to minimize or avoid impacts on cultural resources. These could include erosion control measures and spill prevention and control equipment and practices, as well as timing restrictions and visual standards for equipment; however, the operating practices included in the SUPs are usually negotiated between the refuge manager and the oil operator. Thus, the levels of protection may vary somewhat from permit to permit and by refuge as the existing regulations do not provide specific operating standards for the protection of refuge resources. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts to cultural

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resources. For the 4,000 pre-existing operations, reclamation is conducted without regard for Service goals or only to the extent a refuge manager is able to negotiate to have reclamation goals addressed. Reclamation for these wells often falls short of Service reclamation standards.

Under Alternatives B and C, the rule establishes performance-based standards for avoiding or minimizing impacts to cultural resources. All new operations and pre-existing operations that are transferred to a new operator on NWRS lands and waters would be subject to consistent standards and requirements of the rule for protecting cultural resources. As previously discussed, new operations create the greatest additional impacts on cultural resources, so establishing performance-based standards that would include proper site planning, timing restrictions and the best management practices would avoid or minimize many of the typical impacts to cultural resources from oil and gas development. Also, the rule includes additional standards that would protect cultural resources, such as designing, constructing, operating, and maintaining access to the operational site to cause the minimum amount of surface disturbance needed to safely conduct operations and to avoid areas identified as containing sensitive cultural resources. For operations refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to ensure protection of refuge geology and soils in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Additionally, under the rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest. This would likely include further protections for cultural resources on these easements under section 106 of the NHPA and other Federal laws concerning protection of cultural resources.

The rule also includes standards for achieving successful surface reclamation once operations end. All operations, including pre-existing operations, would have to meet Service reclamation standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would reduce impacts to cultural resources within the refuge units. Therefore, eventually, the disturbance associated with the 4,000 pre-existing wells would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts on cultural resources compared to Alternative A.

Under Alternative C, all pre-existing operations would be required to abide by the performance-based standards established under the rule during the production phase. Compared to Alternative B, Alternative C may provide for implementation of higher standards for protection of cultural resources at a greater number of wells. Since the greatest impacts to cultural resources have already occurred, the Service would be focusing on ongoing issues, such as erosion control and noise and visual restrictions, in those cases where Federal or State laws and regulations do not meet Service operating standards.

Also, operations on inholdings and operations on non-Federal surfaces directionally drilling underneath a refuge would be subject to the performance-based standards established in the rule to the extent necessary to protect cultural resources. The level of increased protection would vary from slight to moderate depending on State rules in place that serve to reduce such impacts (e.g., spill control and cleanup requirements, erosion control), and the proximity of the surface location of operations on non-Federal surfaces to the refuge.

Finally, under Alternative C, performance-based standards would also be established for downhole operations. Cultural resources would only be impacted by accidents associated with well control. Given present day technology, events that result in loss of well control (blowouts) are extremely rare. Service regulation could possibly serve to lower an already low risk of a well blowout, but in practice, the Service finds that State requirements for well control and the expectation that companies will act in their own best interest would preclude the need for the Service to regulate aspects of drilling and production related to well control. Thus, the Service does not expect any reduction of impacts or risks of impacts to cultural resources related to our downhole regulation under Alternative C.

Cumulative Impacts

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect cultural resources in the refuges. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on cultural resources in the area of analysis and a brief summary of the cumulative impacts of these actions on cultural resources are listed in Table 4-13.

TABLE 4-13. CUMULATIVE IMPACTS ON CULTURAL RESOURCES (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Cultural resources
Abandoned mine lands reclamation	Long-term beneficial effects of addition of safety features and signage following re-establishment of vegetation cover and natural contours and closure of mine shafts.
Future oil and gas development on adjacent lands	Indirect adverse impacts on refuge cultural resources if the operations are close enough to result in “spill-over effects” such as sedimentation and contamination from surface runoff or noise and visual impacts that are audible or visible from cultural landscapes or ethnographic resources located within the refuge
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term adverse effects on cultural resources from noise, visual disturbance and access restrictions that can occur on roads during reclamation. Long-term beneficial effects of restoration of sites, removal of sources of contamination, and contaminated soils that are a visual eyesore. However, the frequent inability to restore or replace cultural resources that have lost integrity may render the effect negligible.
Other/private development not subject to federal cultural resource laws	Indirect adverse impacts on refuge cultural resources if development is close enough to result in “spill-over effects” such as sedimentation and contamination from surface runoff or noise and visual impacts that are audible or visible from cultural landscapes or ethnographic resources located within the refuge. Direct adverse effects on cultural resources located on private lands if no protection, including destruction of archeological and/or historic resources.

Under all three alternatives, there would be adverse and beneficial cumulative impacts from projects, plans and actions, and trends in oil and gas development as discussed in the cumulative scenario above (Table 4-13).

Under Alternative B, both adverse and beneficial cumulative impacts would occur from projects, plans and actions and trends in oil and gas development that were considered in the cumulative scenario. These are described under Alternative A and would be the same under Alternative B. Alternative B would contribute to cumulative impacts from the continued operations of pre-existing operations not under an SUP which would continue to have long-term direct adverse impacts on

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cultural resources, as described in the above analysis. Bringing new operations and the reclamation phase of pre-existing operations under regulation would add substantial beneficial impacts on cultural resources. When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts on overall cumulative impacts from the change in regulations.

Cumulative impacts from actions under the cumulative impact scenario would be the same as described under Alternative A. Similar to Alternative B, there would also be effects that would occur as a result of oil and gas operations that would continue to affect cultural resources where impacts cannot be avoided, and benefits from bringing new operations and the reclamation phase of pre-existing operations under regulations and the resultant reduction in adverse impacts, as described in the Alternative B analysis. Alternative C would contribute to cumulative impacts mostly by adding beneficial impacts of bringing new operations and the reclamation phase of pre-existing operations under regulation, but also by possibly adding adverse impacts from the change in directional drilling regulations that could result in more oil and gas development within refuge units as opposed to outside refuge boundaries. Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans and actions considered in the cumulative scenario. When combined with

The effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial. However, Alternative C would remove regulatory incentives for operators to locate operations outside refuge units; thus, this alternative would have more impacts on cultural resources within refuge boundaries.

REFUGE MANAGEMENT AND OPERATIONS

METHODOLOGY

Potential impacts on refuge management and operations are assessed based on the actions being proposed and by determining whether the administrative ability of refuge units would be adequate to manage the required permitting activities for surface uses that would be permitted for oil and gas development within the refuge units, as well as other natural-resource-related activities mandated by law, regulation, agreement or litigation. Because oil and gas development is driven to a large degree by individual operator's financial considerations within the context of the global petroleum economy, and because specific locations of hydrocarbon accumulations in all of the refuge units are unknown, the Service cannot speculate where individual operators would conduct their operations. It is therefore only possible to qualitatively assess impacts on refuge management and operations assuming that oil and gas development for which Service administrative oversight is required would continue into the foreseeable future. As previously discussed, in addition to the 107 refuge areas where existing development occurs, new development on 32 refuges and five WMDs is a reasonable expectation. In cases where oil and gas resources exist, this analysis assumes that all potentially productive areas would remain open for oil and gas activities.

Impacts of Alternatives

The main aspects of refuge management and operations that may be affected by actions under the alternatives include staffing and use of other refuge administrative resources and material support. refuges staff workloads and priorities may need to be rearranged to implement oil and gas management actions, and funding for management actions may exceed the current oil and gas management budget and would require additional personnel over and above what would normally be expected to be funded.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON REFUGE MANAGEMENT AND OPERATIONS

Service management incurs costs related to implementation of current regulations and policy by engaging refuge service personnel in activities such as the following:

- Processing permit applications;
- Monitoring operations to ensure that operators are in compliance with all applicable laws, regulations, and Service permits;
- Addressing incidents of noncompliance;
- Maintaining records, providing information to the public and congress, and addressing legal issues; and
- Preparing guidance and policy documents and participating in training or workshops related to oil and gas management.

As shown in Table 4-14, the Service has estimated the overall annual cost related to the administration of oil and gas management responsibilities to be approximately \$3.6 million. This baseline cost to the Service of implementing the regulations was assessed by compiling the salaries, benefits, and expenses of refuge personnel and central office personnel engaged in the above activities and allocating time to each of the above categories on a refuge-by-refuge and office-by-office basis.

TABLE 4-14. ANNUAL COST OF SERVICE ADMINISTRATION OF OIL AND GAS MANAGEMENT PROGRAM

Program Sector	Annual Cost
Permitting	\$850,000
Monitoring and Compliance	\$1,685,000
Administration and Legal Issues	\$515,000
Planning and Guidance and Training	\$590,000
Total Cost	\$ 3,640,000

Impacts from Geophysical Exploration

During the geophysical exploration phase, adverse impacts on refuge management and operations could result from increased workloads and demands for Service employees administering to the

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permitting and compliance, including conducting site inspections to monitor adherence to mitigation measures outlined in approved plans of operations. These demands may result in adverse impacts on refuge management and operations in cases where there are insufficient personnel available to staff these responsibilities at individual refuge units.

Impacts of Well Drilling and Production

During the operational phases of drilling and production, refuge staff and resources would be required to evaluate drilling and production. The effect on refuge resources, and problems, leaks and violations would be handled through base workload inspections and monitoring. These requirements extending over the operational lifetime of oil and gas facilities can result in continued adverse impacts on refuge management and operations, depending on the number of operations and level of activity occurring within the refuge at any one time. In addition, the enforcement of timing stipulations for drilling and production operations in special management areas of the refuge units would require dedicated time and resources of Service staff. Similarly, the increased truck traffic associated with drilling and production operations, especially those involving hydraulic fracturing, would require additional Service staff and resources to ensure effective management of roadway conditions and minimize impacts on visitor traffic. Accidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of refuge units could pose a severe impact on refuge management and operations. Depending on the degree of response and the amount of resources needed, these incidences could require additional staffing and the use of other refuge administrative and material resources.

Impacts of Plugging and Reclamation

The plugging and reclamation of wells impacts refuge management and operations because such activities may or may not be conducted under a Service SUP. Those not conducted under a Service permit can require more extensive staff time to cooperate and consult with, and ultimately convince, operators and other permitting agencies with varying objectives to implement surface reclamation that is acceptable to the Service. The effectiveness of staff time can vary widely. Service staff is then required to monitor site reclamation to ensure that refuge resources are returned to approximate pre disturbance conditions and that natural conditions and processes are restored. The administration of these requirements results in short-term adverse impacts on refuge management and operations. Once wells are plugged and reclaimed, there are typically long-term beneficial impacts due to prevention of further pollution and degradation associated with the unplugged wells that would require additional time and expense at the refuge level.

Purpose and Scope

The purpose of the regulation in all alternatives is to ensure that non-Federal oil and gas operations conducted on NWRS lands and waters avoid or minimize, to the greatest extent practicable, adverse effects on refuge land, water, and resources, as well as refuge wildlife-dependent recreational uses, and are conducted in a manner that protects employee and public health and safety.

Currently, the Service scope of application of its regulation and policy is to all operators conducting non-Federal oil and gas operations within refuges on lands or waters held by the United States in fee title.

Alternative B, the rule, would also apply as Alternative A and additionally clarifies that operations conducted on lands and waters where the property interests held by the United States are less than fee, such as easements, also fall within the scope to the extent necessary to protect those property interests. For example, where the Service has purchased a wetland easement, the regulations would be applied only as necessary to protect the values and functions of wetlands that could be affected by proposed operations on that property.

Region 6 (primarily in western North Dakota and eastern Montana) contains the vast majority of easement properties in the NWRS that also coincide with occurrence of oil and gas resources and industry activity. The Service estimates that expanding the scope of regulation to include easements could increase the number of projects for seismic by 1 to 2 and new well drilling by 5 to 20 per year respectively. However, the regulatory management of such activities would be limited to the resource (e.g., wetland, grassland) for which the easement was purchased. In most cases, oil and gas operations could be conducted to avoid impacts to the specific resource and also avoid conflict with the terms of the easement agreements. Thus, the administrative burden on refuge management and operations where the federal interest is less than fee would be substantially less on a permit-by-permit basis than for fee lands. Additionally, the Service currently spends much staff time in a non-regulatory role coordinating with operators on their proposed activities, and have largely been successful in avoiding direct impacts to the federal interests on easements.

Overall, expansion of scope under Alternative B could increase administrative costs somewhat compared to current practices, resulting in a long-term, slight adverse impact refuge management and operations. Given the resource specific focus for easements and potential for a much reduced permitting process, the regulatory program for protecting the Federal interest on easements could be highly efficient and effective.

Alternative C would further expand Service jurisdiction to regulate non-Federal oil and gas operations that occur on private surface within refuges (i.e., inholdings). The Service does not currently maintain statistics for the number of nonfederal oil and gas wells on inholdings. We estimate that inholdings compose less than 5% of land areas within refuges, and thus could represent up to a 5% increase in the number of wells (+200 wells) affected by Service regulation under the Modified Rule. Alternative C would also expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge as described in the next subtopic. We expect up to 5 drilling projects of this nature annually, or a 15% increase in permit applications for new operations compared to Alternatives A and B.

The \$3.6 million for management and administration costs presented in Table 4-14 would need to increase proportionally, perhaps to a \$3.8 million range annually, to gain the intended incremental resource protections of the expanded scope in the Modified rule, resulting in additional adverse and long-term impacts on refuge operations.

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternative A the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. Under existing regulations and policy, the Service has secured SUPs for most new drilling operations. Consequently, there exists a current incentive for operators to locate surface operations outside a refuge when feasible in order to avoid Service regulation and its associated administrative and operational costs. A surface location outside a refuge invariably meets intent of regulation (use of technologically feasible methods least

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damaging to refuge resources), while also relieving the Service of the administrative burdens of oil and gas management described above.

Alternative B, the rule, would result in an increased incentive for operators to locate their operations outside refuges. Under Alternative B, operators could face additional regulatory costs due to financial assurance, cost recovery, and access fees requirements. As in the no action alternative, the Service would be relieved of the administrative burdens of oil and gas management described above when operators choose to locate surface operations outside a refuge.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge. Directional drilling operations would be subject to the full regulatory requirements of a new operation. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses.

The historical number of wells being drilled beneath refuge lands to reach non-Federal oil and gas is not maintained by the Service, but is thought to range from 1 to 5 wells per year. This would increase the administrative burden of processing operations permit applications by nearly 15 percent from the current expected 35 permit applications ($\$850,000 * 15\% = \$130,000$ increase). More important, with little incentive for operators to choose surface drilling locations outside a refuge, some of the additional operations permit applications would be changed to surface operations inside a refuge. The Service's increased oversight and administrative burden would likely result in a higher degree of impacts to refuge resources and use.

The overall result of Alternative C would be a greater long-term adverse impact on park management and administration compared to Alternatives A and B.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, current regulations and policy would remain in effect where the Service has been able to secure either an SUP for the large majority of new operations such as seismic surveys or new well drilling. However, the permit requirement itself has not been consistent across the Service, and where permits have been issued, the permit conditions have varied widely.

The historical average of new drilling operations is about 25 well proposals per year, though yearly numbers can vary widely. That projected level of activity on Federal fee land is expected to stay at the same level. The level of seismic activity is expected to be approximately 10 proposals per year, which would typically be portions of larger 3D projects that include refuge lands and waters. As described in Table 4-14, the Service estimates that it incurs costs of approximately \$850,000 per year in the permit process.

Currently, pre-existing operations are not actively managed as a whole, but addressed on a case-by-case basis when substantial and unnecessary impacts to refuges resources and uses occur. Problems such as spills and unauthorized use of Federal surface are addressed through application of other laws and regulations, and cooperation with other permitting agencies and operators. Lacking clearly defined authorities and procedures, major issues such as spills and leaks would likely continue to require large Service resource expenditures and high demands for staff, resulting in long term adverse effects to refuge management and operations.

The Service estimates that the 4,000 pre-existing wells in 107 refuges create an estimated 6,000 acres of direct disturbance associated with well sites and access roads. The level of monitoring and cooperation with operators to address impacts on refuge resources and uses would continue to vary widely, resulting in unnecessary impacts on refuge management and operations.

Under Alternative B, all new operations would require an operations permit. Operations under an SUP would continue under those terms, which could be modified as necessary to meet the reclamation standards of the rule. Pre-existing operations would continue production activities with no permit requirement, but could eventually require an operations permit if an operator proposes major modifications to existing operations. In a transfer of pre-existing operations, the new operator would be required to obtain an operations permit. Pre-existing operations would also require an operations permit to ensure compliance with the reclamation standards of the rule.

The Service has been successful in obtaining SUPs for new operations, so the permit requirement for new operations under Alternative B would be similar to Alternative A. The management and administrative costs are expected to be commensurate with Alternative A for new operations.

Existing operations under an SUP would continue under those terms which could be modified as necessary to meet the reclamation standards of the rule. The management and administrative costs are expected to be commensurate with Alternative A for operations currently under a Service permit.

The requirement for an operations permit during the reclamation phase of pre-existing operations would create long-term benefits for refuge resources; however, this would result in increased demands on refuge management and operations. The demand would naturally be staggered as wells move from the production phase to reclamation.

Under Alternative B, the Service would manage pre-existing operations during the production phase by assimilating State laws and regulations into the rule, thereby increasing the Service's enforcement ability on refuge lands. Assimilating State oil and gas laws and regulations would create efficiencies in monitoring and enforcement providing a slight benefit to management and administrative costs compare to current conditions.

Also for pre-existing operations on easements, there would be increased management and administrative costs if such operations required action to remedy impacts to the Federal interest. Additionally, assimilating State oil and gas laws and regulations would also result in increased management and administrative costs in some cases where ongoing production was unnecessarily impacting the acquired easement interest.

Alternative C would require all new and existing operations within the scope of the Modified rule (both on federal and private surface estate within a refuge) to obtain an operations permit, including those operations that use directional drilling from private property surface locations to access oil and gas rights beneath the refuges.

Approximately 4,200 wells operated by perhaps 400 different operators on Federal surface estate in 107 refuges would fall under the operations permit requirement. Wells on private surface estate that are affecting Federal interests would also be subject to an operations permit requirement. Many wells could be grouped under a single operations permit by an operator, but the volume of operations permit applications required would likely exceed 1,000. Under Alternative B, the Service is expected to process about 40 to 50 operations permit applications per year, so it is evident that the Service would need to obtain funding for new staff to handle the workload or reallocate existing resources. In

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either event, there would be substantial adverse impacts on refuge management and administration costs in the short-term after implementation of this alternative. The permitting cost estimate of \$850,000 in Alternatives A and B could easily increase by \$1.7 million (tripling of current estimate) and the monitoring and compliance effort could double, adding another \$1.6 million to maintain the same level of oversight for the expanded permitting program under Alternative C.

Performance-Based Standards

Current regulation, policy and training have not established a suite of performance-based standards for protection of refuge resources and uses. Consequently, oil and gas permits are managed on an individual unit basis, with protective stipulations developed in a site-specific manner. This creates inefficiencies in the permitting process, which are included in the annual costs in Table 4-14 for permitting.

Under Alternative B, the regulations establish performance-based standards for avoiding or minimizing impacts to refuge resources or visitor uses during operations. The regulations also include standards for achieving successful surface reclamation once operations end.

The use of standards or performance goals provides flexibility to resource managers and operators to achieve standards across various environments using new and evolving technology. The rule includes standards for surface use and site management, specific resource protections, spill prevention and response, waste management, and reclamation. These specific standards are all considered and incorporated into project design so that overall, operations are conducted in a manner most protective of refuge resources and uses while ensuring human health and safety. Use of the technologically feasible, least damaging methods takes into consideration all relevant factors, including environmental, economic, and technological factors and the requirements of applicable law. For operations refuge units in Alaska, the Service could consider these performance-based standards as guidance on a case by case basis for inclusion in a ROW permit to balance environmental, economic, and technological factors in determining best methods for an operator in compliance with ANILCA, ANCSA, and the Department's implementing regulations.

Having a comprehensive suite of performance-based standards to evaluate and modify proposals creates efficiencies in the permitting process compared to current conditions.

Ensuring compliance with performance-based standards would have long term adverse impacts on management and administrative costs to refuge operations similar to Alternative A. Because operators in Alaska are already required to operate under stringent performance-based standards, there should be no impacts to management and administrative costs of ensuring compliance by using these standards as guidance.

Under Alternative C, the expanded scope and permitting requirements would substantially increase the overall adverse burden on refuge management and operations. In addition to the impacts described for expanded permit requirements, the Service would expand its regulation to downhole activities. This would require hiring of staff with appropriate skills to review permit application and monitor operations for compliance. The Service estimates additional costs for specialized staff to be approximately \$270,000 annually.

Well Plugging (Maintenance of Idle or Shut-In Wells)

Current regulations and policy do not address procedures for addressing wells that are no longer active, but are not scheduled to be plugged in the near future. Instead, the Service relies on State rules for maintaining wells in shut-in status. This adds to administrative costs for monitoring as operators have been able to leave wells idle or shut-in for decades in some cases.

Under Alternative B, the Service would be taking a more active role in managing wells that have been idle for extended periods of time. Currently, there are approximately 2,226 wells in the Service's database listed as inactive or shut in. Service staff would spend time researching and updating well status, contacting operators, processing applications to maintain wells in shut in status, and monitoring. This will create long-term, adverse impacts on refuge operations costs, which would be partially offset by less monitoring required as operators choose to plug and reclaim wells.

Under Alternative C, the Service would consider downhole conditions when processing applications to maintain wells in shut in status, which would involve approving and monitoring of mechanical integrity tests. Given the number of wells listed as inactive or shut in, the Service estimates an additional burden of approximately \$100,000 annually on refuge management and operations.

Permitting Process

Currently, the permitting process is described in policy in general terms and applied in various ways across the Service. The Management of Oil and Gas Activities on National Wildlife Refuge System Lands handbook provides guidance for obtaining a SUP as well as the minimum information contents that should be included in an SUP application. Refuge staff must often develop lists of information requirements based on the specific needs of individual projects only to identify gaps in information once the operator submits the application.

This creates back and forth communications between refuge and operator and adds to inefficiencies in the permitting process, which are included in the annual costs in Table 4-14 for permitting.

The rule establishes a uniform process for obtaining an operations permit. Since the processes used currently vary widely across the Service, the new efficiencies from a uniform process will alleviate workload in some cases and create workload in other cases. Overall, establishing a uniform process is expected to result in slightly beneficial impacts on refuge management and administrative costs compared to the no action alternative.

Under Alternative C, the permitting process would be the same as Alternative B, but the Service would actively regulate all phases of pre-existing and new operations and would regulate downhole operations as a matter of course. The modified rule would establish standards and information requirements relative to downhole operations. The expansion of permitting, monitoring, and well plugging to include downhole aspects of operations could easily expand program requirements (staff and expenses) by 50% over Alternatives A and B, creating a greater adverse long-term effect on refuge management and administration.

Performance Bond (Financial Assurance)

The Service does not typically require financial assurance as a condition of an SUP issued for non-federal oil and gas operations. Operators in Alaska are permitted using ROW under 43 CFR part 36, which does provide a requirement for financial assurance.

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Under Alternative A, in the event of operator default on its reclamation responsibilities, the Service would need to seek and acquire additional funding if necessary for reclamation. As a result, dedicated funding would be required along with additional staff and resources to perform the activities related to reclamation. The potential for additional administrative and financial burden and expanded responsibilities placed upon Service refuge resource specialists would result in adverse effects to refuge operation and management. These costs are included in Table 4-14 as a small, negligible portion of the administrative and legal issues cost estimate.

Alternative B would require financial assurance as a condition of approval for an operations permit. Financial assurance would be set equal to the estimated cost of reclamation. Service staff would spend time estimating the cost of reclamation, handling the performance bonds or other legal documents related to financial assurance, and monitoring for successful reclamation. These administrative costs are expected to have a negligible adverse cost effect on refuge operations.

The rule also holds that failure to comply with any provision of an Operations Permit could result in forfeiture of a portion of the financial assurance needed to remedy the condition of noncompliance. This provides the Service with an enforcement tool and provides an operator with additional incentive to remain in compliance with its permit. The effect on refuge management and administrative costs is expected to be negligible, but beneficial.

Alternative C would require financial assurance as a condition of approval for an operations permit as described under Alternative B, but would not consider an operator's in-kind reclamation as a means to reduce the bond amount. The effect on refuge management and administrative costs is expected to be the same as Alternative B.

Cost Recovery

The Service does not seek cost recovery for administration of SUPs for non-Federal oil and gas operations. Operators in Alaska are typically permitted using ROW under 43 CFR Part 36, which does provide for cost recovery.

Under the no-action alternative, lack of cost recovery and additional money that could be collected to support Service permitting, monitoring, and compliance programs would continue, resulting in administrative burdens upon Service refuge resource specialists. Consequently, adverse effects would accrue to refuge operation and management under the Alternative A.

Under alternatives B and C, the Service is proposing a requirement for operators to reimburse the Service for the costs of processing and administering temporary access permits and operations permits. The Service would determine the amount of reimbursement by the actual staff time spent directly processing permit applications and subsequently monitoring the operation for compliance.

The Service costs associated with administering a permit consist of a one-time fee for processing a permit application, and then a recurring annual fee for monitoring operations for compliance with the permit.

The one-time fee for processing permits would vary largely depending on the complexity of the permit, site location, and proximity to sensitive resources (i.e., species habitat, wetlands and water features, cultural resources, etc.). The Service estimates this one-time fee to range from \$500 to \$5,000, but trend towards the high-end of the range since most operations will have notable

implications on refuge resources and visitor values. Monitoring cost are expected to fall within \$100 to \$500 per well annually.

As a result of this provision, the refuge permitting, monitoring, and compliance program costs would be reduced. This would create long-term beneficial impacts on refuge management and operations under the Rule and the Modified rule.

Access Fees

Under current regulations and policy, the Service does not assess fees for an operator's use of a Federal surface for access to their oil and gas rights boundary.

Under Alternative A, the Federal government would not be compensated for damages and any associated loss of resources that result from privileged use of Federal surface estate. The responsibility of road maintenance would fall upon the Service, which must seek and acquire additional funding to perform the work required to protect refuge resources. In addition to dedicated funding, additional staff and resources to perform the activities would also be required. Under the no-action alternative, the potential for this additional administrative burden would result in adverse effects to refuge operation and management.

Under alternatives B and C, the Service would be compensated for use of Federal lands and waters outside the boundary of an operator's mineral right. The amount of the fee could vary widely mostly due to the differences in the amount of Federal acreage used, which could range from only a fraction of an acre up to dozens of acres for very long access roads. Also, the refuge could accept reclamation in kind or road maintenance agreements in lieu of fees. These options would require administrative costs to manage these activities, but would reduce Service costs of reclamation and maintenance. As a result, there would be both beneficial impacts from receipt of compensation and adverse impacts on refuge management and administration, with overall impacts being negligible on refuge operations budget.

Third-Party Monitoring

The use of monitors at the expense of an operator is not required, but is a common consideration in SUPs issued for 3D seismic operations. Under the no-action alternative, the continued practice lowers the administrative burden for monitoring resulting in beneficial effects to refuge operation and management.

Alternatives B and C would codify existing practices related to geophysical projects by allowing the Service to require that operators hire third party monitors when they are necessary to ensure compliance and protect refuge resources and values. Similar to Alternative A, this reduces the monitoring burden on refuge management and administration.

Third-party monitors could also be used in other phases of operations such as drilling, production, or well plugging and reclamation. The Service expects these instances to be rare, only occurring when refuge staff could not fulfill the monitoring role and an operator's self-reporting was deemed insufficient. Therefore, the ability to use third-party monitors in other phases beside geophysical is expected to cause negligible, but beneficial impacts on refuge management and administration.

Cumulative Impacts of Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect refuge management and operations at the refuges. Management planning, such as fire management, vegetation management, and ORV plans can result in beneficial impacts on refuge management and operations by providing guidance for improved management strategies and proper allocation of Service resources. However, preparation and administration of these plans creates a sizable demand on staff time. Actions that cause additional burdens on refuge administrative resources (such as prescribed burns, facility construction and mine reclamation) can result in adverse effects on refuge resources and management by placing additional demands on Service staff and material resources. Past, present, and reasonably foreseeable activities that would have beneficial or adverse impacts on refuge management and operations in the area of analysis (including both refuge lands and adjacent lands) and a brief summary of the cumulative impacts of these actions on refuge management and operations are listed in Table 4-15.

TABLE 4-15. CUMULATIVE IMPACTS REFUGE MANAGEMENT AND OPERATIONS (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Water Resources
Prescribed fires and fire management actions	Possible short-term adverse effects to refuge management and operations from increased administrative and financial burden during the period of management action. Long-term beneficial impacts on refuge management and operations by providing guidance for improved management strategies and proper allocation of Service resources.
Service facility and road construction	Possible short-term adverse effects to refuge management and operations from increased administrative and financial burden during the period of construction. Long-term beneficial impacts on refuge management and operations following improvements to infrastructure that provides for more efficient operations within refuge units.
Abandoned mine lands reclamation	Possible short-term adverse effects to refuge management and operations from increased administrative and financial burden during the period of reclamation. Long-term beneficial effects of improvements to refuge resources, resulting in a decrease of administrative and financial burden that would have been associated with deferred reclamation
Vegetation management	Long-term beneficial impacts on refuge management and operations by providing guidance for improved management strategies and proper allocation of Service resources.
Oil and Gas Management	Long-term beneficial impacts on refuge management and operations by providing guidance for improved management strategies and proper allocation of Service resources.
ORV use management	Long-term beneficial impacts on refuge management and operations by providing guidance for improved management strategies and proper allocation of Service resources.
Future oil and gas development on adjacent lands	Short and long-term indirect adverse impacts on refuge management and operations from the potential for damage to refuge resources from nearby sites and the need for administrative action, leading to an increase in administrative and financial burden to refuges

Cumulative Impacts of Alternative B

Under Alternative B, both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario. These are described under Alternative A and would be the similar under Alternative B. Alternative B would contribute to cumulative impacts from the continued administrative need to oversee permitted operations, which would have adverse impacts on refuge management and operations, as described in the above analysis. Additionally, bringing new operations and the reclamation phase of pre-existing operations under regulation would add some administrative burden on refuge resource staff pertaining to the requirements entailed in overseeing permitting and inspections of newly nonexempt oil and gas operations. Provision for cost recovery, access fees, financial assurance, and third-party monitoring would contribute beneficially to cumulative impacts. As a result, cumulative impacts on refuge management and administration would be slightly less adverse under the proposed alternative compared to the no action alternative.

Cumulative Impacts of Alternative C

Cumulative impacts from actions under the cumulative impact scenario would be the same as described under Alternative A. Similar to Alternative B, both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario. Alternative C would contribute to cumulative impacts from the continued administrative need to oversee permitted operations, which would have adverse impacts on refuge management and operations, as described in the above analysis. Bringing new operations and all phases of pre-existing operations under regulation would add a large administrative burden on refuge resource staff pertaining to the requirements entailed in overseeing permitting and inspections of oil and gas operations. Moreover, the addition of directionally drilled operations that would previously have opted to locate outside refuge boundaries but would now be located within the refuge would further contribute to this burden. Additional responsibilities involved in attending to new operations would increase the existing workload of refuge staff and would require additional full-time employees or other administrative or material resources. Overall, however, the contribution to cumulative impacts of Alternative C would be significant, given the wider context of cumulative actions affecting refuge management and operations. Impacts would likely be greater to refuge operations for those units with a high number of new operations and pre-existing operations and for those units that exhibit a greater potential for future operations due, for instance, to their proximity to Marcellus shale or the Tuscaloosa shale.

SOCIOECONOMICS

METHODOLOGY

Socioeconomic parameters that are being analyzed in this EIS include (1) oil and gas operator costs and project financial viability; and (2) local and regional economies. Potential impacts on socioeconomic resources are assessed based on the impacts that compliance with the regulations would have on operator costs and project viability. Impacts associated with local and regional economies are tied to project viability and production for affected operations.

A key component of assessing impacts to local and regional economies is the expectation that implementation of either action alternative would not affect the level of new development or the volume of oil and gas production.

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The primary method for assessing impacts on operators and project viability include describing the potential compliance costs associated with the alternatives, as described in the Service cost-benefit analysis (Service 2015) and identifying the number of operations and operators affected. Impacts on local and regional economies are based on an assessment of the impact that the compliance costs have on financial viability of the operation and the relative importance of production levels within the refuge.

The degree of potential impacts on local and regional economies from compliance costs depends on level of expenditures within the local economy, the impact of costs on project viability, the relative level of oil and gas activity in surrounding areas, and many other factors. Oil and gas production and development activity within the refuge, within the region, and within the State can provide an indication of how important these oil and gas activities are to the surrounding counties and the State. The Service does not track actual oil and gas production from non-Federal oil and gas wells within the NWRs. Based on average production rates from oil and gas wells in the United States (Energy Information Administration) multiplied by the number of active oil and gas wells on refuge lands, non-Federal oil production from refuge lands is estimated to be 3,500 barrels of oil per day, and natural gas production is approximately 220,000 thousand cubic feet per day. While this method of estimating production could vary from actual production by several fold, the percentage of production from refuge lands compared to U.S production is only a small fraction of a single percentage point. [Note: U.S. oil and gas production rate in 2013 was 7,450,000 barrels of oil per day and 82,000,000 thousand cubic feet per day. Actively producing wells was approximately 570,000 oil wells and 487,000 gas wells, yielding average production rates of 13 barrels of oil per day per oil well and 170 thousand cubic feet per day per gas well.]

A quantitative analysis is provided on compliance costs on a per well/operation basis, if possible, and aggregated to reflect costs across all refuges. Impacts on local and regional economies are described qualitatively.

People can attribute values and benefits to experiences of the environment, uses of natural resources, or the existence of particular ecological or environmental conditions, which often-times do not involve market transactions, and therefore lack prices. These nonmarket values for improved environmental qualities can be considerable but are often difficult and time-consuming to estimate. As a result, these values are described briefly in this methodology section and are further described in the relevant sections in the document, including visitor use and experience, geology and soils, water resources, health and safety, etc.

The current regulations and policies provide benefits to natural resources, the environment, and ecosystem services, including resource protection, visitor experience and recreation values, health and safety, soils, water resources, aesthetics, and others. The Service has been able to secure either an SUP for the large majority of new operations, such as seismic surveys or new well drilling. However, the permit requirement itself has not been consistent across the Service, and where permits have been issued, the permit conditions have varied widely. Where SUPs have not been issued, there could be unnecessary adverse effects on natural resources, the environment, and ecosystem services. For example, operations not under SUPs have the potential for continuing adverse impacts from improper operations, which could lead to spills, leaks and other releases of oils, produced water, or other chemicals that can contaminate soils and other refuge resources. Releases of oils or chemicals have contaminated resources and have not been cleaned up because of lack of regulation and oversight. These continuing environmental adverse effects can adversely affect the nonmarket values that the

refuge provides (i.e., visitor use and experience, aesthetics and viewscapes, geology and soils, water resources, health and safety, and others).

Study Area

The study area for socioeconomics includes the refuge units listed in Table 1 in Chapter 1 and communities and areas adjacent to the refuge units supporting oil and gas operations.

Impacts of Alternatives

Both permitted (SUP) and unpermitted oil and gas operations contribute to local and regional economies. Currently operations under an SUP pose additional costs to operators to comply with the current permit conditions. Typical socioeconomic impacts associated with oil and gas activity located within refuges include economic benefits, including jobs, income, taxes, and sales. The decision to develop and operate in an area is based on the financial viability of the operation or new investment. Operators assess individual well and field economics, such as the revenues or value of production, capital investment and other upfront costs, on-going production costs, and costs of plugging and abandonment in their decision. In addition to complying with many Federal, State, and local regulations for oil and gas activity, the oil and gas industry currently faces additional costs to comply with SUPs and ROWs in refuges that secure these permits compared to operating on lands outside refuge units.

TYPICAL IMPACTS OF OIL AND GAS OPERATIONS ON SOCIOECONOMICS

Operator Costs and Project Financial Viability

Industry currently faces an additional cost to comply with Service regulations in refuges.

Currently, costs categories specific to conducting private oil and gas operations under an SUP include the following:

1. Plan of operations preparation or permitting,
2. Compliance with Service permit requirements that exceed other Federal, State, and local requirements,
3. Compliance with Service reclamation standards that exceed other Federal, State, and local requirements, and
4. Maintenance of performance bonds or equivalent surety, if required.

These costs are normally a small percentage of a typical operator's total expenses, but for some individual operations, these costs can become economically significant as production declines and profit margins constrict.

Although these administrative and operational costs are a part of the decision to develop wells and/or continue production for existing wells, they are not a major factor. The price of oil and gas, however, is an essential factor. The most important component is the operational and geological risk assessment that exploration and drilling will lead to successful and economical oil and gas production, and if so, at what level.

Local and Regional Economies

Oil and gas exploration and development support jobs and income in nearby communities for drill rig operators, geophysical seismic companies, construction companies, landmen, and oil and gas support companies that complete wells, among others. Oil and gas production supports industry jobs, including inspecting and maintaining equipment and operations, complying with mitigation standards and other on-going production and operational needs. These residential and nonresidential workers spend their wages in local and regional communities, supporting downstream jobs and income. Oil and gas production also provides economic benefits to oil and gas companies, benefiting economies where these companies are headquartered and the nation overall. Many energy-related jobs provide higher wages and earnings than service sector jobs.

During production, the oil and gas value of production is often taxed through severance taxes and ad valorem taxes, although these taxes vary by State. Additionally, local governments often benefit from property and sales and use taxes on oil and gas equipment. These tax receipts typically benefit State and county agencies, providing funding for schools, roads, social services, and other public service and infrastructure.

Purpose and Scope

Currently, the Service applies its regulation to areas within the NWRS where the surface estate is held in fee title. Alternative A would continue that policy. Information collected from refuges indicates that an annual average of 10 seismic surveys and 25 drilling projects have been conducted over the past 10 years on Federal lands and waters within the NWRS. Although the number of permit applications has and will continue to vary widely from year to year, in this analysis, the Service expects the same average level of activity going forward for all alternatives.

Alternative B, the rule, would expand the area of regulatory application to include tracts where the Federal interest is less than fee (e.g., wetland or grassland easements).

Region 6 (primarily in western North Dakota and eastern Montana) contains the vast majority of easement properties in the NWRS that also coincide with occurrence of oil and gas resources and industry activity. The Service estimates that expanding the scope of regulation to include easements could increase the number of operations permit applications for seismic by 1 to 2 and new well drilling by 10 to 20 annually. However, the regulatory requirements of such activities would be limited to the resource (e.g., wetland, grassland) for which the easement was purchased. In most cases, oil and gas operations could be conducted to avoid impacts to the specific resource and also avoid conflict with the terms of the easement agreements. Thus, the cost burden on operators where the Federal interest is less than fee would be substantially less on a permit-by-permit basis than wells drilled on federal fee surface.

There could be some increased costs to operators of pre-existing oil and gas production wells on easements during the reclamation phase, if such operations required action to remedy impacts to the Federal interest.

Overall, expansion of scope under Alternative B could increase costs operators on easements where they could not avoid impacts to the Federal interest resulting in a slightly higher long-term adverse impact compared to Alternative A.

Alternative C would further expand Service jurisdiction to regulate non-Federal oil and gas operations that occur on private surface within the boundary of a refuge (i.e. inholdings). Alternative C would also expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge as described in the next subtopic.

The Service does not keep statistics of wells and operators on inholdings, but estimates the management approach under this alternative would increase the level of non-Federal oil and gas wells by approximately 200 wells. Operators with no wells on refuge lands or waters could be affected by having to incur costs necessary to comply with Service regulation under the Modified Rule.

Accessing Oil and Gas Rights from a Non-Federal Surface Location

Under Alternatives A and B, the incentive for operators to locate their operations outside refuge units would remain in place as described at the beginning of this chapter. The incentive for operators to locate their operations outside refuge units to avoid Service permitting and operational costs would remain in place. Additionally, the incentive for operators to select this method of access would be greater under the rule when compared to current conditions. Since the rule includes provisions for maintaining financial assurance, access fees, and cost recovery, among others, the operators' costs increase as does the incentive to avoid those costs.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge. Directional drilling operations would be subject to the full regulatory requirements of new operations. The Service would impose operational standards on activities outside the refuge to the extent necessary to avoid or minimize impacts on refuge resources and uses.

The historical number of wells being drilled beneath refuge lands to reach non-Federal oil and gas is not maintained by the Service, but is thought to range from 1 to 5 wells per year. With little incentive for operators to choose surface drilling locations outside a refuge, some of the additional operations permit applications would be changed to surface operations inside a refuge. The overall result would be a long-term adverse impact on operators that otherwise could have avoided Service regulation.

An operator's decision to go forward with a drilling project would not be affected by any of the alternatives, and there would be no expected effects on local and regional economies.

Requirement to Obtain a Service Permit to Conduct Operations

Under Alternative A, the Service would continue its policy of securing either an SUP for the large majority of new operations such as seismic surveys or new well drilling.

Operators seeking approval for and conducting new seismic or drilling projects would continue to incur costs for obtaining permits. Permitting costs include collection of information via reconnaissance surveys, which can be the bulk of the permitting cost. Surveys often include several or all of the following: location surveys, biological surveys including threatened and endangered species, cultural surveys, soundscape surveys, soil and water quality measurements, and wetland and floodplain delineations. Depending on resources present in the area of operations and availability of existing resource information, reconnaissance survey costs can range from only several thousand dollars to tens of thousands of dollars. For example, a widespread 3D seismic survey may involve all

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of the surveys listed above over large geographic areas possibly costing up to a high-side scenario of \$100,000. The area of operations for drilling operations is much smaller than a seismic survey and so reconnaissance surveys for drilling proposals will typically add a lower range of \$10,000 to \$30,000 to the overall permitting cost. Of course, some proposed operations may not require any surveys depending on available information and expected impacts from the proposed activity.

Compiling and presenting the operational information and results of reconnaissance surveys in a plan of operations can vary from \$5,000 to \$20,000 depending on the complexity of the operation and whether the plan is prepared in-house or contracted to an environmental consulting firm.

Estimates of an operator's permitting costs thus range from a low of \$5,000 for a straightforward drilling permit prepared in-house, where natural and cultural data is available, to over \$100,000 for a complex 3D seismic survey permit prepared by consultants where the full suite of reconnaissance surveys is necessary.

These costs represent adverse effects on operators and project viability. Though adverse, the costs typically represent a small percentage of overall project costs, and do not materially affect an operator's decision to go forward with a project. Thus, there are no expected impacts on production, and local and regional economies.

Currently, pre-existing operations are not actively managed as a whole, but addressed on a case-by-case basis when substantial and unnecessary impacts to refuge resources and uses occur. Problems such as spills and unauthorized use of Federal surface are addressed through application of other laws and regulations, and cooperation with other permitting agencies and operators. As a result, under Alternative A, operators of pre-existing operations would not incur costs specific with compliance with Service regulation of non-Federal oil and gas rights.

Under Alternatives B, the practice of securing permits for new operations would be codified by a clear requirement for operators to have an approved operations permit prior to conducting new operations. Thus, the impacts on operators proposing new activities would be the same as in Alternative A.

Service statistics show that 115 existing production operations are being conducted under either an SUP. Under Alternative B, existing operations under an SUP may continue producing under the terms of that permit, which invariably include a means to ensure that operational and reclamation standards of the rule can be achieved. Therefore, operators under current Service permits would not be affected.

Under Alternative B, pre-existing operations could continue as they have been as long as they comply with existing Federal, State, and local laws and regulations and the General Terms and Conditions outlined in the rule. The rule requires operators of pre-existing operations to submit documentation demonstrating their right to operate, company contact information, a scaled map of the existing area of operations, and copies of all plans and permits associated with their operations. The Service estimates the information could be developed at cost of about \$300 per well site. Though not required to obtain a Service operations permit during production, the Service would maintain an active management role by assimilation of State laws and regulations into the rule. Thus, operators that are in compliance with applicable laws and regulations would not be affected.

Additionally, the transfer of operatorship of a pre-existing well would result in the new operator having to obtain an operations permit to continue operation during the production phase. The new

operator would experience additional costs in the areas of permit administration, meeting Service operating standards during the production phase, financial assurance, and cost recovery.

The Service does not track operator turnover, but for purposes of this analysis, we use operator turnover rate of 5% of the estimated 4,000 operations each year resulting in permitting actions for up to 200 formally pre-existing wells. These permitting actions would be focused on minimizing or avoiding the ongoing impacts of these pre-existing wells on refuge resources and uses. The Service estimates that operators would incur annual expenses of approximately \$2,400 per well site to obtain an operations permit, improve conditions on site to Service operating standards, maintain financial assurance, and reimburse the Service for its administrative costs.

The number of wells affected by loss of pre-existing status due to a change in operator would decrease over time as more and more wells come under Service permit.

At the end of production operations, operators of pre-existing wells would be required to obtain a permit for plugging and reclamation and comply with all Service reclamation standards. Operators of pre-existing wells would be adversely affected due to costs incurred to obtain an operations permit. The operations permit application process would not involve reconnaissance surveys and the Service would provide site-specific reclamation standards and acceptable methods to achieve them. The Service estimates the adverse effect on operators due to permitting to be approximately \$500 per well site.

Overall, implementation of Alternative B could adversely affect operators of pre-existing wells by creating costs of approximately \$30,000 per well. These cost are described in the related subsections and consist of costs for providing initial information (\$300 per well), obtaining an operations permit for plugging and reclamation (\$500 per well), maintaining a performance bond throughout reclamation (\$1,500 per well site), cost recovery (\$250 per well) and conducting reclamation to Service standards (\$23,000).

Under Alternative C, the requirement to obtain an operations permit would expand to the production phase of pre-existing operations within the scope of the modified rule, which would include wells on federal and private surface estate within refuge acquisition boundaries, as well as those operations accessing oil and gas rights from a surface location outside the refuge boundary.

Approximately 4,000 wells on federal lands and waters operated by perhaps 400 different operators in 107 refuges would fall under the operations permit requirement. As described under Purpose and Scope, another 200 wells could fall under the operations permit requirement.

Many wells could be grouped under a single operations permit by an operator, but the volume of operations permit applications required would likely exceed 1,000. The operators of these pre-existing wells would be adversely affected by permitting costs, cost recovery fees, expenses to maintain financial assurance, and costs to maintain sites to Service standards that are above and beyond other Federal and State requirements. Using cost estimates for the regulatory provisions described in Alternative B, and applying them to 1,000 operations permit applications and 6,500 wells, operators of pre-existing wells could incur costs of nearly \$19 million annually.

Performance-Based Standards

Under current policy, new oil and gas projects are permitted and managed on an individual refuge or refuge complex basis, with protective stipulations developed in a site-specific manner. Current policy

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and training, however, have not established a suite of performance-based standards for protection of refuge resources and uses. As a result, stipulations required in an SUP can vary widely across the NWRs and may be developed on a project-by-project basis. Operators may not be provided flexibility on how they may achieve resource protections. Inconsistencies and lack of flexibility may lead to permitting inefficiencies and implementation of more costly protective measures.

A lack of performance-based standards under Alternative A causes adverse effects on operators seeking and conducting operations under a SUP. There are no expected impacts on production, and local and regional economies.

Under Alternative B, the regulations establish performance-based standards for avoiding or minimizing impacts to refuge resources or visitor uses during operations. The rule also includes standards for achieving successful surface reclamation once operations end.

Compared to Alternative A, this will result in a more consistently high level of resource protection in concert with generally higher costs of implementing actions to meet Service standards for those operators subject to operations permit requirements. These higher operating costs could be partially or wholly offset by permitting efficiencies afforded by a uniform suite of standards and a flexible means for operators to achieve them. Overall, operators implementing new activities would likely experience only slightly higher adverse cost effects compared to Alternative A.

Operators of the 115 wells currently under an SUP would not be impacted by defined performance-based standards in the rule or efficiencies in the permitting process. Operations in Alaska would likewise not be impacted by the performance-based standards in the rule, because the standards would be only used on a case by case basis as guidance and would be no more stringent than the standards already required of operations in Alaska under ANILCA, ANCSA, and the Department's implementing regulations.

Operator of pre-existing operations would need to meet reclamation standards generally not required under Alternative A. During well plugging operations, operators would be required to leave the site in a clean and safe condition in preparation for surface reclamation, which could involve placing liners underneath plugging equipment, using steel tanks instead of earthen pits, catching well fluids and solids in steel tanks and disposing of these materials outside of the refuge, and employing erosion control measures on the access road and well site. These measures could add \$2,000 to \$4,000 per plugging operation.

The rule includes reclaiming the site to standards that many States and individual landowners do not require of operators. Assuming that any surface reclamation standards are above and beyond other Federal, State, and local requirements will provide a high side estimate of costs associated with meeting Service standards. The NPS recently assessed oil and gas site reclamation costs based on operator estimates for reclamation or actual NPS oil and gas site reclamation project costs, and found the weighted average for surface reclamation in the 12 parks with oil and gas operations to be \$23,000 per well site. The Service has a similar range of conditions as NPS (various well site conditions in various types of environments) and can expect operators to incur similar average costs to meet Service reclamation standards.

Thus under Alternative B, operators of pre-existing wells could experience adverse cost effects of \$26,000 per well to meet performance standards at the future time of well plugging and surface reclamation.

Under Alternative B, new operators that take over a pre-existing well would experience costs to bring their operations up to Service standards. In most instances, some initial improvements to their operations would be needed to enable the majority of operators to meet Service standards. Some pre-existing wells already meet Service standards and thus would not experience any increase in operating costs. On the other end of the spectrum, some pre-existing operations may incur costs for a broad range of operating deficiencies. For example, a poorly kept operation near a high visitor use area may incur costs approaching \$4,000 to complete the following work:

- Removal of oil-stained materials and replacement with clean 1-inch gravel (5 cu.yds) is estimated to cost \$730 materials and labor
- Removal of trash/debris/junk equipment/weeds could involve 2 days of 3-person crew ($\$16.87/\text{hour} \times 8 \text{ hour} \times 3 \text{ crew} = \404.88) + ($\$125/\text{day} \times 3 \text{ days} = \375 for dump trailer) = \$780
- Chain-link fencing installation (300 feet x $\$630/100 \text{ feet} = \$1,890$)
- Leveling of pumping unit to reduce noise might involve 4 hours of a welder and helpers time plus equipment and materials ($4 \text{ hours} \times \$26.32/\text{hour} + 4 \text{ hours} \times \$16.87/\text{hour} + \$200$ for welder unit and materials = \$375)

Fencing a site would be one of the more expensive, but less commonly required, site improvements. The majority of pre-existing operations site improvement costs would fall in between the site described above and one already meeting standards. This analysis uses an average cost of \$2000 per site to meet Service operating standards that are above and beyond requirements of other regulatory agencies.

After initial site improvement, maintenance of sites to Service standards after the initial expenditure could add \$0 to \$1,000 in annual operating costs. Vegetation management, maintenance of gates or fencing, or more regular schedules of lubricating pumping units and other machinery for noise control could be common maintenance additions. We used an average of \$500 per well site per year, which is equivalent to 30 hours additional labor (helper-production worker at \$16.87/hour).

Using a \$2,000 one-time cost and \$500 annual cost thereafter results in an average annual costs over 10 years of \$700 per well to meet operating standards.

Under Alternative C, the application of performance-based standards above and beyond other Federal, State, and local requirements would apply to pre-existing operations during the production phase. The Service estimates that most operations on federal surface estate could be improved to meet standards at initial costs between \$0 and \$4,000 initially, and then maintained to those standards for between \$0 and \$500 annually. Using a \$2,000 initial cost and \$500 annual cost thereafter and 4,000 wells results in adverse impacts on operators of \$8 million initially, and \$2 million annually.

Operational standards for the estimated 200 wells on private property within refuge boundaries would be limited to minimizing or avoiding impacts to federal interests. The Service expects that nearly all issues related to indirect effects on federal property can be removed if operations were run in compliance with all other federal, State, and local laws and regulations. Because compliance costs of existing federal, State, and local laws and regulations cannot be attributed to the rule change, it follows that the incremental operational costs of imposing operational standards on private property are expected to be negligible.

Performance Bond (Financial Assurance)

The Service does not typically require financial assurance as a condition of an SUP issued for non-Federal oil and gas operations. Operators in Alaska are permitted using ROW under 43 CFR part 36, which does provide a requirement for financial assurance, but the percentage of ROW issued versus SUP is very low at less than 5 percent. As a consequence, operators only rarely incur costs associated with financial assurance and thus are adversely affected.

The rule would require financial assurance as a condition of approval for operations permits. The financial assurance would be set equal to the estimated cost of reclamation, which includes well plugging. Analogous NPS statistics indicate well plugging and surface reclamation costs vary widely, from \$10,000 to over \$400,000 per well, with an overall weighted average of about \$50,000 per well.

The annual cost for an operator to maintain a performance bond with a surety company varies substantially depending on an operator's credit standing. These costs are not available to the Service and are difficult to estimate. For this analysis, the Service assumes that if annual costs amount to much over 10 percent of the bond amount, operators will use other vehicles, such as an irrevocable line of credit or cash. Using the same 10 percent of bond amount as the "cost" for an operator not having that cash available, it appears reasonable to use 10 percent of the bond amount as a conservative (i.e., high side) estimate of the annual cost of maintaining the bond.

Though subject to a wide range, operators of wells under an operations permits could therefore incur an average of \$1,500 per well ($\$50,000 * 3\%$) annually to maintain financial assurance. Well operators could lower the annual costs by conducting partial reclamation or in-kind reclamation.

Operators conducting geophysical surveys would experience much lower financial assurance costs, perhaps the one-time annual equivalent of \$100 to \$2,000. Geophysical surveys are conducted such that reclamation actions/costs are minimized leading to minimal financial assurance requirements.

As more wells fall under operations permits and financial assurance requirements, adverse effects on operator costs would grow and apply to an increasing number of operators. The long-term adverse effects on operators due to financial assurance requirements are not expected to have noticeable impacts on local and regional economies.

Alternative C would require financial assurance as a condition of approval for an operations permit as described under Alternative B, but would not consider an operator's in-kind reclamation as a means to reduce the bond amount. Pre-existing wells would be subject to operations permits and financial assurances requirements, and those cost estimates are included in the "Requirement to Obtain a Service Permit to Conduct Operations" section for Alternative C. Also, the expansion of scope to regulate operations on private property would not create additional financial assurance burdens on those affected operators since it would be rare for a Service reclamation standard to be imposed on private property to protect the federal interest. No Service reclamation requirements leads to no required performance bond. The effect on long-term adverse costs effects on operators is the same as Alternative B with no reduction for in-kind reclamation.

There are no expected impacts on production, and local and regional economies.

Well Plugging (Maintenance of Idle or Shut-In Wells)

Current regulations and policy do not address procedures for addressing wells that are no longer active, but are not scheduled to be plugged in the near future. Instead, the Service relies on State rules for maintaining wells in shut-in status. As a consequence, operators do not incur costs related to maintenance of idle or shut-in wells under Alternative A. There are no expected impacts on production, and local and regional economies.

Under Alternative B, the preferred alternative, operators wishing to maintain wells in idle or shut-in status would face incremental costs due to this provision.

Service statistics indicate over 2,200 wells in the NWRS are in idle or shut-in status. An important consideration in this analysis is that many operators who have wells that are producing no income may decide to plug and reclaim rather than undertake the expenses necessary to maintain wells to Service standards. The Service believes it to be reasonable to expect perhaps one-half, approximately 1,000, of these wells would be plugged and reclaimed in the initial years following implementation of the rule.

Our analysis does not attribute any incremental cost effects related to permitting or Service reclamation standards due to this regulatory provision. Operators are required to plug wells under State law, and costs to obtain operations permits and comply with Service reclamation standards are described in those sections.

Operators would incur costs to maintain sites to Service standards. Incremental actions/costs specific to this provision that are above and beyond other Federal or State regulatory requirements could include fencing around a facility in a visitor use area, vegetation control, and removal of debris, waste, or equipment no longer needed in operations. These initial improvements might cost operators from \$0 to \$4,000 per well site with negligible incremental maintenance costs after that. Many sites might not meet requirements of other Federal and State requirements (e.g., Spill Prevention Control and Countermeasure, access maintenance, erosion control, signing, and stormwater runoff). Even though the rule change provides the Service a regulatory means to require operators to comply with other Federal, State, and local laws and regulations, the costs are not viewed as incremental.

Overall, operators maintaining wells in idle or shut-in status would be adversely affected by one-time costs incurred to bring sites up to Service standards (\$0-\$4,000 per well) and annual costs of \$5,000 as described under Financial Assurance. The provision is not expected to have effects on local or regional economies.

Also, the expansion of scope to regulate operations on private property would not create additional cost burdens on those affected operators since it would be rare for a Service standard to be imposed on idle wells on private property to protect the federal interest. The effect on long-term adverse costs effects on operators is the same as Alternative B with no reduction for in-kind reclamation.

Permitting Process

Currently, the permitting process is described in policy in general terms and applied in various ways across the Service. The Management of Oil and Gas Activities on National Wildlife Refuge System Lands handbook provides guidance for obtaining an SUP as well as the minimum information contents that should be included in an SUP application. The policy does not specify timelines in which the Service will respond to an operator's submission of information.

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Under Alternative A, operators experience some benefit by the Service's use of guidance on obtaining an SUP, but may be adversely affected by a lack of timelines for processing of permit applications.

The rule establishes a uniform process for obtaining an operations permit and logically only affects those operators seeking an operations permit. The rule establishes the process for taking initial steps in developing a permit application, contents of the application, the Service's review of the application including timelines, the Service's approval standards, and the actions the Service may take on the application including timelines.

Service data indicates we can expect about 40 to 50 operations permit applications annually. These operators will benefit from the efficiencies of a uniform process and greater predictability in the length of time needed to secure approval compared to the no action alternative.

Operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations as a matter of course. The modified rule would establish standards and information requirements relative to downhole operations. The expansion of Service regulation to downhole activities could generally increase operator costs by 10 to 30 percent in cost categories of permitting, cost recovery fees, maintenance of financial assurance, and meeting Service standards that are above and beyond other Federal and State requirements. These adverse cost effects would be long-term.

Cost Recovery

Under Alternative A, the Service does not recover costs for processing proposed plans of operations or monitoring approved operations for regulated operations. There would be no resulting impacts on operators or local and regional economies.

Under Alternative B, the Service may require operators to reimburse the Service for the costs of processing and administering temporary access permits and operations permits. The Service would determine the amount of reimbursement by the actual staff time spent directly processing permit applications and subsequently monitoring the operation for compliance.

The Service costs associated with administering a permit consist of a one-time fee for processing a permit application, and then a recurring annual fee for monitoring operations for compliance with the permit.

The one-time fee for processing permits would vary largely depending on the complexity of the permit, site location, and proximity to sensitive resources (i.e., species habitat, wetlands and water features, cultural resources, etc.). The Service estimates this one-time fee to range from \$200 for simple temporary access permits to over \$5,000 for complex proposals having notable implications on refuge resources and uses.

Annual monitoring costs consist of staff time to visit and document conditions at operations sites, compile information into a monitoring report, and conduct follow up correspondence with operators where conditions of non-compliance exist. These costs will also vary depending on complexity of operations, ease of access, and rates of non-compliance issues. The Service estimates the range to be between \$120 and \$500 with an average cost of \$250 per well per year.

These fees would adversely affect operators proposing and conducting new operations, although the fees would be small relative to the total project and operational costs.

Cost recovery fees under Alternative C would be 10 to 30% higher than described for Alternative B for operations on federal lands and waters due to regulation of downhole activities. For operations on private property, cost recovery fees would trend to the low ranges for processing permits and monitoring since the scope of these permits would be substantially less.

Access Fees

Under Alternative A, there are no provisions for collecting access fees, resulting in no impacts on operators or local and regional economies.

The rule authorizes the Service to charge a fee for commercial vehicles using Service-administered roads and a fee for new access (e.g., roads or gatherings lines) across Federal lands.

The Service does not possess the data to precisely assess how many operations use Federal access beyond their mineral right boundary or how many acres of use are involved. The NPS recently evaluated the same set of conditions for non-Federal oil and gas operations in units of the National Park System. That study found that 75 well operations (of 534 total) currently use about 90 acres of surface disturbance (NPS 2013). Assuming that 10 to 20 percent of the 4,000 operations that could be affected by this provision use about 1 acre per well of surface disturbance provides an estimate ranging from 400 to 800 acres that may be subject to access fees.

The Service would set the fee amount using generally accepted practices. For example, the Service could set fees consistent with Service current regulations regarding fees for access and rights-of-ways (50 CFR 29.21), or calculate fees using BLM's Linear Rights-of-way Fee Schedule. Other methods could be used, such as appraisal or Habitat Equivalency Analysis, which bases compensation on the loss of resource services and the cost to restore those services. The NPS study used BLM's Linear Rights-of-way Fee Schedule and found average annual fees would be about \$80/acre. Similarly, the Service expects that access fees would be minimal on a well-by-well basis and applied to a lower fraction of wells that use Federal access beyond the boundary of the associated mineral rights. Additionally, operators would benefit by privileged use of Federal surface by a fair-market-based amount equivalent to the assessed fee. As a result, the costs to the operator are fully offset by the value of the beneficial use of the Federal surface and the long-term effects on the operator are neutral. The provision fairly compensates the public for such use, but is not expected to have effects on local or regional economies.

Seismic operations are conducted only on lands where permissions from non-Federal mineral rights holders have been granted to the geophysical companies. The large scale 3D seismic surveys that are conducted in today's industry rarely rely upon access across Federal lands in refuges where grants of permission have not been obtained. Therefore, the access fee provisions of the rule will not substantially apply to seismic operations.

Since access fees only apply on federal lands and waters, the fees under Alternative C would be the same as Alternative B.

Third-Party Monitoring

The use of a third party monitor is a common industry practice and has become a common component of seismic surveys currently conducted in refuges pursuant to a special use permit. Based on the Service experiencing 10 surveys per year, a range of 5 to 90 days of monitoring, and a range of monitoring costs of \$500 to \$2,500 per day, third-party monitoring costs could range from as

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low as \$25,000 up to \$2.25 million annually. It is difficult to determine what, if any, additional operators' costs of providing third-party monitors is specifically due to those operations being conducted on a refuge, but it is reasonable to assume that some additional costs are associated with work on refuges, and thus cause adverse impacts on operators under Alternative A.

The provision for third-party monitors under Alternative B and C provides more certainty that refuges would implement the requirement when appropriate, but otherwise has the same impacts on operators described under Alternative A.

Resultant impacts on local and regional economies would be negligible.

Cumulative Impacts of Alternative A: No-Action

Actions inside and outside the refuge units and local trends in oil and gas development can cumulatively affect impacts on local, regional, and national economies. Other past, present and future planned actions within and adjacent to refuges have the potential to impact local and regional economies. Increased development within the refuge boundaries and in adjacent communities generally have beneficial impacts on local and regional economies. Recreation and visitor spending also beneficially affect local communities as visitors stay and spend their income in gateway communities. Actions that induce or discourage visitation and visitor spending can affect local economies.

Generally, economies are subject to business cycles with upturns and downturns affecting economic activity across most regional economies. To the extent that economic activity increases, there would be beneficial effects, and if it decreases there could be adverse effects to regional economies, affecting jobs, income, fiscal receipts, and downstream economic activity.

Oil and gas development and production are also affected by cumulative actions or circumstances, many of which are beyond the operators or Service control, such as oil and natural gas prices, State oil and gas regulation, other development costs, the risks of successful well development, production costs, and many others. Other Federal and State requirements can also cumulatively affect the costs of oil and gas operations within refuge boundaries, which can indirectly affect development and production decisions.

Past, present, and reasonably foreseeable activities that would have beneficial effects on local, regional, and national economies with increases in the activity listed, and conversely, would have adverse effects with decreases in the activity are listed in Table 4-16.

TABLE 4-16. CUMULATIVE IMPACTS ON SOCIOECONOMICS (PROGRAMMATIC LEVEL FOR REFUGE UNITS)

Past, Present, and Reasonably Foreseeable Activity	Impacts on Socioeconomics
Service facility and road construction	Short-term beneficial effects on local and regional economies during construction associated with jobs, income, fiscal receipts, and the workforce spending wages in local economies supporting downstream economic activity. Construction activities can temporarily and adversely affect visitor experience and possibly visitation and visitor spending in local economies.
Vegetation management	Short-term and long-term beneficial effects on local and regional economies during management activities associated with jobs, income, and the workers spending wages in

Past, Present, and Reasonably Foreseeable Activity	Impacts on Socioeconomics
	local economies supporting downstream economic activity. Habitat management activities, if they temporarily disrupt refuge activities, can adversely affect visitor experience and possibly visitation and visitor spending in local economies.
Trails development and maintenance	Short-term and long-term beneficial effects on local and regional economies during development and maintenance activities associated with jobs, income, and the workforce and personnel spending wages in local economies supporting downstream economic activity. Construction activities can temporarily adversely affect visitor experience and possibly visitation and visitor spending in local economies.
ORV use	ORV use can provide short- and long-term beneficial effects from visitor spending on local economies, but could also adversely affect non-motorized visitor experience, possibly decreasing visitation and visitor spending for these types of visitors.
Abandoned mine lands reclamation	Short-term beneficial effects on local and regional economies during reclamation activities associated with jobs, income, and the workforce spending wages in local economies supporting downstream economic activity. Construction or reclamation activities can temporarily and adversely affect visitor experience and possibly visitation and visitor spending in local economies.
Mining and logging activities	Beneficial effects of mining and logging activities associated with jobs, income, fiscal receipts, and the workforce spending wages in local economies supporting downstream economic activity. Mining and logging activities can adversely affect visitor experience and possibly visitation and visitor spending in local economies.
Recreational use	Short- and long-term beneficial effects on jobs, income, and fiscal receipts from visitor spending on local economies.
Ranching, agricultural land uses	Beneficial effects of agricultural production and ranching activities associated with jobs, income, and the households spending wages in local economies supporting downstream economic activity.
Land development: residential and nonresidential (commercial, industrial) land uses, including road construction	Short-term beneficial effects on local and regional economies during construction associated with jobs, income, and the workforce spending wages in local economies supporting downstream economic activity. Construction activities can also temporarily and adversely affect visitor experience and possibly visitation and visitor spending in local economies. Changes in landscapes and views can adversely affect visitor experiences and possibly visitation and visitor spending in local economies.
Current and future oil and gas development and production on adjacent lands	Short- and long-term beneficial effects on local and regional economies during development and production associated with jobs, income, fiscal receipts, and the oil and gas workforce spending wages in local economies supporting downstream economic activity. Changes in landscapes and views can adversely affect visitor experiences and possibly visitation and visitor spending in local economies.
Oil and gas well plugging and reclamation activities inside and outside refuges	Short-term beneficial effects on local and regional economies during plugging and reclamation activities associated with jobs, income, fiscal receipts, and the workers spending wages in local economies supporting downstream economic activity. Construction or reclamation activities can temporarily and adversely affect visitor experience and possibly visitation and visitor spending in local economies, although in the long-term these reclamation activities are expected to benefit visitors.
Other Federal, State, and local requirements and authorities for oil	There are additional Federal, State, and local requirements for oil and gas operations above and beyond those required for Service compliance. Generally, these include State regulations related to erosion control, water discharge, and wildlife. Some Federal permits are also required, such as ESA section 9 and U.S. Army Corps of Engineers 404 Permits

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Past, Present, and Reasonably Foreseeable Activity	Impacts on Socioeconomics
and gas operations	for wetlands. Permitting and requirements for floodplain development are generally administered at the county-level. Although operators' expenditures to comply with these regulations benefit local economies through jobs and income opportunities, the increased permitting and operational costs can have adverse effects on operators and project financial viability.

Cumulative Impacts of Alternative B

Under Alternative B, both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario for these refuge units depending on their effects on jobs, income, visitor spending, and nonmarket environmental values. These are described under Alternative A and would be the same under Alternative B. Additional federal, State, and local requirements for oil and gas operations above and beyond those required to comply with Service regulations (e.g., erosion control, water discharge, wildlife, wetlands, floodplain development) increase permitting and operational costs for operators and can also affect project financial viability.

Alternative B would contribute to cumulative impacts from the continued operations of permitted operations, which would have adverse impacts on operator costs and project financial viability, but would not be expected to have notable effects on the businesses as a whole. These conclusions are based on (1) cost of regulatory compliance being a very small percentage of average annual receipts, and (2) operations in refuges being a small percentage of a business' asset portfolio.

When compared to the existing condition, the economic benefits to local and regional communities associated with oil and gas production could be reduced as 100 previously grandfathered wells are plugged and reclaimed. This adverse effect is expected to be slight since plugging and reclamation activities would have slight benefits on local and regional economies through jobs and incomes. The contribution to the cumulative impacts on local and regional economies of Alternative B would be slight given the considerable oil and gas development and production occurring in adjacent regions and the many other cumulative impacts, both beneficial and adverse, affecting the local and regional economies.

Cumulative Impacts of Alternative C

Cumulative impacts from actions under the cumulative impact scenario would be similar to those described under Alternatives A and B. Under Alternative C, both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario for these refuge units depending on their effects on jobs, income, visitor spending, nonmarket environmental values, and regulatory requirements. These are described under Alternatives A and B and would be the same under Alternative C. As in Alternative B, Alternative C would contribute to cumulative impacts from the continued operations of permitted operations, which would have adverse impacts on operator costs and project financial viability, but would not be expected to have notable effects on the businesses as a whole. These conclusions are based on (1) cost of regulatory compliance being a very small percentage of average annual receipts, and (2) operations in refuges being a small percentage of a business' asset portfolio.

Compared to the existing condition and Alternative B, more new operations are expected to be located within the refuge boundaries under Alternative C, as operators do not have an incentive to

locate wells outside the refuge and directionally drill to access minerals under the refuge boundaries. Due to increased regulatory burdens on pre-existing operations, many more marginally producing and idle wells are assumed to be plugged and reclaimed under Alternative C. Cumulative actions, in combination with Alternative C, could add to project costs to pre-existing wells affecting the viability of marginal and idle wells, resulting in additional plugging and reclamation of wells. Though individual well economics could lead to increased plugging and reclamation costs, the impact on the businesses conducting operations would remain a very small percentage of company revenue.

When compared to the existing condition, the economic benefits to local and regional economies associated with oil and gas production could be reduced as over 1,000 pre-existing wells are plugged and reclaimed. This adverse effect is expected to be slight since marginal producing and idle wells are anticipated to be plugged and reclaimed. Plugging and reclamation activities would have slight benefits on local and regional economies through jobs and incomes. Additionally, Alternative C, and the compliance costs for operations within refuge boundaries as well as for those that are directionally drilled, may encourage new operations to be located within refuge boundaries or could also delay development in the region. When compared to the existing condition and Alternative B, this possible reduction in new development could have adverse impacts on local and regional economies. However, the contribution to cumulative impacts of Alternative C would be minor given the considerable oil and gas development occurring in the regions and the many other cumulative impacts affecting the local and regional economies.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA regulations (40 CFR 1502.16) require an EIS to consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. Special attention should be given to impacts that narrow the range of beneficial uses of the environment or pose a long-term risk to human health or safety.

Common to All Alternatives with Oil and Gas Well Development. For all alternatives in this EIS, many impacts would be relatively short-term and all impacts on refuge resources would be mitigated to both preserve refuge resources and uses and allow the purposes of each refuge and the Service to be achieved. Land disturbed during oil and gas operations would be reclaimed, equipment and contamination or wastes removed, and the ground restored to its natural contours. However, some surface disturbances resulting from oil and gas development may cause long-term effects, if the areas are not totally reclaimed or are reclaimed after a very long period of time. For example, access roads may be used for more than one well pad or for other multiple uses. In such cases, long-term productivity of soils and vegetation would likely decrease and possibly be lost in the areas used for access roads. Also, in the unlikely case that wetlands cannot be avoided and the mitigation required is not successful in compensating for the original productivity of areas lost, there could be a loss in long-term productivity in these areas. This would be the case if certain out-of-kind wetland mitigation is approved for replacement of productive wetland acreage. Finally, short-term use related to oil and gas development could affect land and water resources and associated wildlife in the longer-term if substantial leaks or spills were to occur and require extended time for cleanup and remediation.

Alternative A: No Action—The Service would not make changes to the non-Federal oil and gas regulations. The long-term productivity of refuge resources could decline in certain areas because of the inability to regulate exempt operations. Habitat degradation would continue due to contamination on sites that are not subject to more stringent cleanup requirements.

Alternative B: The Rule (Preferred Alternative)—Implementation of the new regulations is expected to result in long-term increases in the productivity of refuge resources since all operations would either be subject to more stringent environmental standards, or current standards could be more efficiently enforced. Service managers would be able to better manage for habitat, wildlife, and special-status species and this would increase the productivity of refuge resources. Though regulation of pre-existing operations to State standards during the production phase could result in some unnecessary adverse impacts, reclamation to Service standards would assure maintenance and enhancement of long-term productivity.

Alternative C: Modified Rule—This would have the similar impacts as Alternative B with regard to new and existing operations. With regard to directionally drilled wells, the overall effect would be adverse compared to the existing condition and Alternative B. Long-term benefits to productivity would accrue from the application of more stringent standards to any wells that access minerals under refuge surfaces. However, this alternative could result in short-term uses of refuge lands and some loss in refuge resource productivity because of the potential for more wells to be drilled within refuge boundaries.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA regulations (40 CFR 1502.16) require an EIS to address the irreversible and irretrievable commitment of resources caused by the alternatives. An *irreversible* commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources (such as minerals or cultural resources) or resources that are renewable only over long periods (such as soil productivity). It could also apply to the loss of an experience as an indirect effect of a “permanent” change in the nature or character of the land. An *irretrievable* commitment of resources is defined as the loss of production, harvest, or use of natural resources; irretrievable resource commitments may or may not be irreversible. The following identifies commitments of resources that are either irreversible or irretrievable.

For all alternatives, there would be an irreversible commitment of the hydrocarbon resources underlying the refuges, since oil and gas are being depleted at a much faster rate than they are being formed in the subsurface. Another irreversible commitment of resources would occur if any significant cultural resources were destroyed during any phase of oil and gas development. However, the use of the seismic vibration technique instead of shotholes as the source of seismic waves would reduce the chances of irreversible impacts due to earth disturbance and drilling, although some resources could be lost within the wellbores during well drilling or from vibration impacts. Based on the small size of the wellbores and the historic average of new drilling operations of 25 proposals per year, impacts from well drilling would be relatively minimal. If buried cultural resources cannot be avoided, impacts would be mitigated by the recovery of data (excavation) and preservation of recovered materials and associated records, an irreversible adverse impact. Where seismic vibration is proposed, refuge staff would identify areas that require subsurface surveying prior to operations commencing to minimize the chances of impact, although unknown resources could be irreversibly affected.

For all alternatives, there would be an irretrievable loss of undeveloped areas for visitor use where the ground is cleared and disturbed for oil and gas exploration and development, including access roads and well pads. The potential for these lands to produce vegetation or be viewed in an undisturbed State would be irretrievably committed for the duration of the oil and gas development operations, and until the site(s) have been reclaimed. Changes to rare and unique communities and important foraging and nesting habitat could be considered an irretrievable resource commitment if construction activities permanently alter the resource such that it can no longer support special-status species or function as a rare and unique community. However, application of the standard of least damaging methods would prevent irreversible impacts to special-status species.

Because the land used for development of oil and gas wells or other facilities could be converted to another use at a future date if the wells were removed, these effects could be characterized as irretrievable. However, in some cases, the level of restoration effort needed could be intensive and would not restore sites to previous conditions. Therefore, some of the impacts are likely irreversible. For example, wetland impacts resulting from removal of soils and compaction in areas such as Gulf Coast swamps and marshes may not be reversible even if the fill is removed and the site is revegetated. Restored wetland habitats would have different plant species composition, hydrology, and/or different soil characteristics depending on how restoration was completed.

Alternative A: No Action—The Service would not make changes to the non-Federal oil and gas regulations. Continued site degradation and possible contamination at existing operations would continue in limited locations, and reclamation to Service standards would not be assured, which could result in irretrievable losses of wetlands, soils, habitat, and wildlife in the refuges.

Alternative B: The Rule (Preferred Alternative)—Implementation of the new regulations is not expected to result in any irretrievable or irreversible commitments of resources within the refuges except for the continued extraction of the mineral resources. Reclamation of all operations on Federal surface estate would allow the refuges to assure resource protection over the long term. Directionally drilled wells constructed outside refuge boundaries would minimize impacts on refuge resources, but construction of the wells would have similar irretrievable or irreversible impacts on resources located outside the refuges. The type and extent of those impacts would depend on the location of the well pads.

Alternative C: Modified Rule—This would have the same impacts as Alternative B. However, the potential for more wells to be drilled within refuge boundaries could result in more construction-related irreversible or irretrievable effects on refuge resources.

Unavoidable Adverse Impacts

Unavoidable adverse impacts are adverse impacts that cannot be avoided and cannot be mitigated, and, therefore, would remain throughout the duration of the oil and gas operation.

For any of the alternatives, there may be unavoidable adverse impacts if the mitigation proposed for any impacted wetlands or water resources is not successful and/or does not compensate for the original wetland functions and values or loss of water-dependent species. However, all alternatives would require avoidance or no net loss of wetlands as the first mitigation measure, as required by Service policy. In the unlikely case that avoidance or no net loss of wetlands is not possible, it may be difficult to ensure that either the restoration of wetlands required through compensation or the reclamation of the wetlands after operations would have similar functions or values. Water resources would be protected by adherence to regulatory requirements for spill prevention and cleanup, but

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unexpected releases that breach containment could cause unavoidable adverse impacts until response is initiated and completed.

There may also be unavoidable adverse impacts on the refuge, as well as soundscapes and the acoustic environment, if the setbacks and other mitigation measures do not provide enough of a restricted area between oil and gas operations and visitor use areas. There is a possibility that the noise from drilling rigs, compressors, and other oil and gas operations could adversely impact refuge uses, especially on a short-term basis. This would depend on the specific location, intervening topography and vegetation, noise mitigation techniques utilized, and the existing background noise levels in the vicinity of the operation.

Finally, there may be unavoidable adverse impacts related to unplanned releases (blowouts, spills, leaks, and fires). The Service recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills within the boundaries of refuges present a risk of release of contaminants that can adversely impact refuge resources and values, depending on the location of the release. However, the rate of such incidents is low and if such an incident did occur, required mitigation measures such as use of blowout preventers and implementation of spill prevention, control, and countermeasure plans would be expected to result in lessening the potential for spilled substances or a well fire to spread into the refuge, and for timely response and cleanup. Therefore, no matter which type of operation is used for drilling and production (conventional or fracturing), there is a reasonable expectation that long-term adverse impacts would not occur or be limited in intensity, although there could be substantial short-term adverse effects during the release.

Alternative A: No Action—The Service would not make changes to the non-Federal oil and gas regulations. The inability to regulate existing operations and consistently regulate new operations would result in continued adverse effects on refuge natural and cultural resources in some locations. Adverse impacts could result from well construction inside and outside the refuge, even those operations under regulation, and would include changes to hydrological patterns, changes in water quality, soil disturbance, disturbance of wetlands that could not be avoided, changes to natural soundscapes and the acoustic environment due to construction, loss of habitat for wildlife, changes to the visual landscape, and changes in visitor use if the area restricted access.

Alternative B: The Rule (Preferred Alternative)—Implementation of the regulations would result in no new adverse impacts and would have primarily beneficial impacts for natural and cultural resources and refuge uses. Continuing unavoidable adverse impacts would result from ongoing exploration and production operations and construction inside and outside the refuges, and include the same effects as described under Alternative A. Operators would be unavoidably adversely affected by additional costs incurred to comply with the rule.

Alternative C: Modified Rule—This would have the same impacts as Alternative B, with no adverse effects and primarily beneficial effects. However, the potential for more wells to be drilled within refuge boundaries could result in unavoidable adverse effects on refuge resources. Refuge management and operations would be unavoidably adversely impacted by the expanded scope of regulatory application to private surface estate within refuges and to downhole operations for all operations. Operators would be unavoidably adversely affected by additional costs incurred to comply with the rule.

CONCLUSION: ENVIRONMENTAL CONSEQUENCES

This chapter analyzed each alternative for overall impacts to the affected environment, including natural resources, visitor use and experience, cultural resources, refuge management and operations, and socioeconomics. The following is a summary of the beneficial and adverse impacts that would result from implementing any of the alternatives considered in this EIS.

Summary of Impacts of Alternatives on Natural Resources, Visitor Use and Experience, and Cultural Resources

Due to the programmatic nature of this EIS, the general beneficial and adverse impacts of the alternatives on natural resources, visitor use and experience, and cultural resources would be generally the same.

As discussed in further detail in this chapter, natural resources that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS include: geology and soils (including paleontology), air quality, water resources (including surface and groundwater, both quality and quantity), wetlands, floodplains, vegetation (including plant species of special management concern), wildlife and aquatic species (including animal species of special management concern), and natural soundscapes and acoustic environment.

Cultural resources that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS may include: archaeological sites, prehistoric/historic structures, cultural landscapes, and ethnographic resources.

Visitor use and experience that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS may include: human health and safety, visitation patterns, wildlife-dependent recreation opportunities, and scenic views and night sky resources.

Some general conclusions can be drawn about the adverse and beneficial impacts of implementing the various alternatives on these refuge resources and uses.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and result in no change in effects on refuge resources and uses from the existing condition. Occasional seismic surveys would have short-term and generally localized effects on refuge resources and uses, such as disturbance from human and vehicle activity. Also, other longer term impacts, such as habitat fragmentation, could possibly occur depending on species inhabiting the area, habitat, and the number and width of seismic survey lines.

Beneficial effects would continue from Refuge Managers negotiating with oil operators to place new operations under SUPs permits. However, unnecessary, adverse effects may continue to occur from operations not under SUPs permits, or from the inability to secure an operating standard in an SUP that provides adequate protection for refuge resources and uses. Ongoing impacts on refuge resources and uses from pre-existing operations would be expected during the drilling and production phases. Adverse impacts:

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- Natural resources would include: soil compaction, erosion, effects on water quality, noise, impacts from oil and brine spills, spread of invasive species, wildlife displacement, habitat alteration and fragmentation, and potentially wildlife mortality.
- Visitor use and experience would include : visual impacts of sites exacerbated by site erosion and/or abandoned equipment, the risk of exposure to chemical or safety hazards at contaminated or unsecured sites; and noise and visual impacts from equipment and crews due to the lack of setbacks from visitor use and culturally sensitive areas, as well as lack of equipment maintenance or muffling devices.
- Cultural resources would include: the risk of destruction of cultural resources or the degradation of their integrity, as well as visual impacts of sites that may be exacerbated by site erosion and lack of adequate distance between sites and areas of intensive cultural resource presence.

Operations directionally drilling from inholdings or non-Federal surfaces underneath a refuge would continue to be a potential source of indirect, adverse effects on refuge resources and uses when the drilling operations are sited close to refuges as contaminants in soils, water, or air could be transported onto the refuge. Additionally, the lack of adequate distance between these operations and visitor use or culturally sensitive areas could result in erosion of these sites due to runoff from the operations as well as noise and light pollution effects on visitor use areas . However, beneficial effects would continue to result from operators locating new operations off of refuges, avoiding any direct impact to natural resources on refuges.

The lack of consistent requirements or processes to ensure wells are plugged and sites are reclaimed to Service standards would continue to result in long-term, adverse impacts on natural and cultural resources, including ongoing contamination of soil, air, and water from leaking wells, and permanent damage to refuge landscapes and hydrology. Impacts on visitor use and experiences would result from an increased risk of abandoned equipment, debris, and wastes left on the sites.

The lack of requirements under the current regulations for financial assurance, compensation for use of Federal property, and enforcement and penalties would continue to have indirect effects on refuge resources and uses, such as delays in reclamation because of lack of funding or enforcement.

Alternative B: The Rule (Preferred Alternative)

Alternative B, the rule, would result primarily in long-term direct and indirect beneficial impacts on refuge resources and uses, compared to the existing condition. Benefits would accrue primarily from reduced risk to resources and uses due to new operations being subject to a consistent permitting process that includes performance standards that ensure new operations are conducted in the most technologically feasible, least damaging manner. Beneficial impacts to:

- Natural resources would include: improved erosion/sedimentation control, storm water management, reduced air emissions, reduced fire hazards, reduced disturbance to wildlife, reduced impacts to wetlands and floodplains as well as wildlife habitat in general, improved water quality, and improved spill prevention, control, and countermeasure actions compared to the existing condition.
- Visitor use and experience would include: improved site appearance from erosion/sedimentation control, cleanup of spills, removal of wastes and debris, removal of unused equipment, reduced fire hazards, and improved spill prevention, control and countermeasure actions compared to the existing condition.

- Cultural resources would include: improved site appearance from erosion/sedimentation control, protection of cultural resources during site development , and adequate distances between sites and culturally sensitive areas.

Alternative B would extend regulation of oil and gas operations to tracts where the Federal interest is less than fee (e.g., wetland or grassland easements) to the extent necessary to protect Federal interest in those lands. As a result of active regulation by the Service, natural resources associated with interests acquired on easements, such as wetlands or native prairie, would have a consistent and higher level of protection compared to Alternative A.

Additionally, the Service would eliminate many of the ongoing, unnecessary impacts to refuge resources and uses resulting from pre-existing operations by assimilating State laws into the rule and other proposed revisions to enforcement and penalties. For instance, the Service would be able to ensure that operators comply with State laws that would require secondary containment facilities, equipment that meets certain air quality standards, spill reporting and remediation, corrective action for noncompliance, and tank removal and site restoration.

Finally, Alternative B would require that all operations are reclaimed to Service standards, such as plugging all wells, removing all above-ground structures, equipment, roads, well pads, and contaminating substances, re-establishing native vegetation, restoring conditions to predisturbance hydrologic functions, and restoring natural systems using native soil material that would reduce impacts to refuge resources and uses within the refuge units. Eventually, the disturbance associated with the 4,000 pre-existing wells, as well as any new and existing operations under a Service-issued permit would be restored to Service standards, providing a substantial long-term reduction or removal of adverse impacts to refuge resources and uses.

Other regulatory changes would result in an improved process of handling minor acts of noncompliance, accelerated reclamation of sites compared to the existing condition, and funding sources that could indirectly benefit refuges and visitors using and viewing those resources.

Overall, these regulatory improvements would result in long-term direct and indirect beneficial impacts on refuge resources and uses compared to the existing condition, analyzed under Alternative A. Alternative B would result in primarily beneficial effects due to the regulation of new operations and the regulation of the reclamation phase of pre-existing operations, as well as stricter compliance with other Federal and State laws. Additionally, any adverse effects of regulated operations would be very limited when compared to the entire refuge area, and mitigation measures or stipulations would reduce the loss or degradation of natural resources, visitor use and experience, and cultural resources. Therefore, the impacts of this alternative would not be significant.

When combined with the effects of all other actions in the study area, cumulative impacts from the actions under Alternative B would be long term and both adverse and beneficial, with Alternative B contributing mainly beneficial impacts to overall cumulative impacts from the change in regulations. Adverse impacts of oil and gas development would be localized, subject to regulatory review, and limited, and would not be significant.

Alternative C: Modified Rule

Alternative C, when compared to the existing condition, would also result in primarily beneficial impacts. Under Alternative C, the rule would be modified to require that both existing and pre-

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existing operations on refuges obtain an operations permit and operate under the Service's performance based standards. This may result in some direct beneficial impacts to refuge resources and uses because the Service would be able to impose mitigation measures on pre-existing operations for any ongoing, unnecessary adverse impacts to natural resources. However, the additional protections afforded to refuge resources and uses under Alternative C would be minimal as most of the significant impacts occurred when the operation locations were chosen and developed. In most cases, oil and gas wells had already been drilled and the area of operations (access route, well site, production facilities, and routes for gathering lines) were established and impacts to refuge resources occurred prior to the acquisition of a refuge or waterfowl production area. Many of the continuing unnecessary impacts occurring from existing operations (e.g., inadequate containment of spills, improper disposal of refuse and waste, inadequate operation and maintenance of oil and gas infrastructure) without permits can be addressed through stricter adherence to existing Federal (e.g., Oil Pollution Act, 33 U.S.C. 2701-2761, Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.) and State laws.

Under Alternative C, all operations on an inholding or on a non-Federal surface drilling underneath a refuge would also be required to obtain an operations permit and meet all relevant operating and reclamation standards. These modifications to the rule could result in long-term beneficial indirect impacts on refuge resource uses because the Service standards would apply to operations outside the refuge. However, regulating operations on inholdings and non-Federal surfaces drilling underneath a refuge removes the incentive to locate operations outside refuges, and would likely result in a much greater concentration of direct, adverse impacts on refuge resources and uses, as the location of an oil and gas operation on the surface of refuge has the greatest impact to refuge resources and uses, as discussed in the analysis.

Operating standards and the permitting process under Alternative C would be the same as Alternative B except the Service would actively regulate downhole operations, such as well cementing, well casing, and well integrity testing, as a matter of course. The Service's goals in regulating downhole aspects of oil and gas well drilling, production, and plugging are to: 1) prevent escape of fluids to the surface, and 2) isolate and protect usable quality water zones throughout the life cycle of the well. The Service found that these regulatory goals can adequately be met by current state regulatory programs, and that Service regulation would slightly reduce already very low risks to usable quality water zones. Refuge resources and uses, other than usable quality water zones, would only be impacted by accidents associated with well control, and as discussed above, these events are extremely rare. For these other resources and uses, the Service does not expect any reduction of impacts or risks of impacts to refuge resources and uses related to our regulation of downhole operations. The Service believes that State requirements for well control and the expectation that companies will act in their own best interest provide adequate protections.

Similar to Alternative B, other regulatory changes would result in an improved process of handling minor acts of noncompliance, accelerated reclamation of sites compared to the existing condition, and funding sources that could indirectly benefit resources at the refuges.

The regulatory improvements in Alternative C would result mainly in long-term direct and indirect beneficial impacts on refuge resources and uses primarily from bringing previously exempt operations under regulation. However, Alternative C would remove regulatory incentives for operators to locate operations outside refuge units; thus, this alternative would have more direct impacts on resources and uses within refuge boundaries. The impacts of Alternative C would not be significant because it would result in primarily beneficial effects, and any adverse effects of regulated

operations would be limited in extent compared to the entire refuge area with mitigation measures or stipulations reducing the loss or degradation of natural resources, visitor use and experience, and cultural resources.

Overall under Alternative C, both adverse and beneficial cumulative impacts would accrue from projects, plans, and actions considered in the cumulative scenario. When combined with the effects of all other actions in the study area, cumulative impacts would be long term and both adverse and beneficial. Adverse impacts of oil and gas development would be localized and limited, and, subject to regulatory review, and therefore would not be significant.

Overall Impacts of Alternatives on Refuge Management and Operations

As discussed in further detail above, refuge management and operations that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS include: processing permit applications, monitoring operations to ensure that operators are in compliance with all applicable laws, regulations, and Service permits; addressing incidents of noncompliance; maintaining records, providing information to the public and Congress, and addressing legal issues; and preparing guidance and policy documents and participating in training or workshops related to oil and gas management. The following general conclusions can be drawn about possible impacts of implementing the various alternatives on refuge management and operations.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and there would be no change in the administration of currently regulated operations. Alternative A would result in no change to refuge management and operations. The Service estimates it spends approximately \$3.6 million annually, which is less than 1% of the NWRS operating budget, managing activities associated with the exercise of non-Federal oil and gas rights. The costs to the Service in terms of staff and resources of ensuring operational compliance with current requirements would continue under Alternative A, and would result in long-term adverse impacts on refuge management and operations, although these impacts would vary depending on local conditions. For example, exposed well casings and abandoned oilfield equipment and flowlines can limit management options for refuge managers due to safety risks. Tall, dense vegetation can hide flowlines and protruding well casings which can damage refuge equipment and vehicles and potentially injure refuge employees. Therefore, on a refuge-specific level, management of oil and gas operations can have a notable impact on refuge management and operations. However, because Alternative A would not change any impacts to refuge management and operations and impacts are generally manageable and minimal in context of Service-wide refuge management and operations, these impacts would not be significant.

Alternative A would contribute only slightly to adverse cumulative impacts occurring to refuge management and operations as a result of cumulative plans and actions.

Alternative B: The Rule (Preferred Alternative)

Under Alternative B, the administration of the regulations would require the reallocation and addition of refuge staff and resources, but would also benefit from cost recovery provisions, such that the administrative burden of non-Federal oil and gas management would not change materially compared to the existing condition. There would be additional responsibilities involved in addressing

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operations, and these would fall under the existing workload of dedicated refuge staff and the national NWRS Energy Team. Provisions for cost recovery and compensation for access across federally owned lands would result in the potential for a reduced financial and administrative burden, resulting in long-term beneficial impacts on refuge management and operations. Additionally, any additional administrative responsibilities related to implementing the regulations under Alternative B would fall under the existing workload of refuge staff and would not require additional FTE or other administrative or material resources.

Within the broader context of all cumulative plans and actions affecting refuge management and operations, implementation of Alternative B would contribute a small but noticeable amount to adverse and beneficial cumulative impacts. Impacts would likely be greater to refuge operations for those units with a high number of current and/or exempt operations and for those units which exhibit a greater potential for future operations due, for instance, to their proximity to Marcellus shale or the Tuscaloosa shale.

Alternative C: Modified Rule

Under Alternative C, all new and existing operations within the scope of the modified rule would be required to obtain an operations permit and meet all relevant operating and reclamation standards. Operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations as a matter of course. Under Alternative C, similar to Alternative B, the addition of all operations as well as directionally drilled operations that would previously have opted to locate outside refuge boundaries but would now be located within the refuge would further contribute additional responsibilities involved in the oversight and management of new operations, and would increase the existing workload of refuge staff when compared to the existing condition. This would require additional FTE or other administrative or material resources. Additional responsibilities involved in addressing new and existing operations would require expansion of dedicated refuge and the national Energy Team staff. Provisions for cost recovery and compensation for access across federally owned lands would result in the potential for a reduced financial and administrative burden, resulting in long-term beneficial impacts on refuge management and operations. The potential degree of administrative burden would increase under Alternative C, as both new operations and the production phase of pre-existing operations, as well as those operations utilizing directional drilling to access private minerals under the incentive to locate outside the refuge administrative boundaries, would require the regulatory oversight of the Service. Overall, management and administration costs would increase substantially, perhaps to a \$6 to \$7 million range annually, to gain the intended incremental resource protections of the modified rule, resulting in substantial adverse and long-term impacts on refuge operations due to the added cost burdens.

The contribution to cumulative impacts of Alternative C would be notable, but still small given the wider context of cumulative actions affecting refuge management and operations. Adverse impacts of the additional staff and operational need could be significant on a local level, but not on a Service-wide refuge management basis.

Overall Impacts of Alternatives on Socioeconomics

Socioeconomics that may be affected by the Service's proposed action to revise the Service's current regulations for management of oil and gas activities on the NWRS may include: oil and gas operator costs and project financial viability; and local and regional economies. The following general

conclusions can be drawn about possible impacts of implementing the various alternatives on socioeconomics.

Alternative A: No-Action

Under Alternative A, the current regulations and implementation practices would continue and there would be no change in effects on operator costs and local and regional economies from the existing condition. Most new operations would continue to be conducted under an SUP. Current Service regulations and other federal requirements continue to provide incentives for new wells to be directionally drilled from outside refuge boundaries, and this is expected to continue under Alternative A.

Operations are currently benefiting local and regional economies in adjacent communities, although their production is fairly minimal within the local and state context. Additionally, the production supports ad valorem and severance taxes, benefitting communities, counties, and sometimes states, although this is also small within the local and regional context. No compensation for access across federally owned lands would continue to benefit operator access costs. Because Alternative A would not change current level of impacts, impacts to communities are generally beneficial, and adverse impacts to operators are generally manageable and minimal, the impacts of Alternative A would not be significant.

Both adverse and beneficial cumulative impacts would occur from actions considered in the cumulative scenario. However, the contribution to cumulative impacts of Alternative A would be slight given the considerable oil and gas development occurring in the regions outside refuge boundaries, additional federal, state, and local oil and gas permitting and operational requirements, and the many other cumulative impacts affecting operator costs and local and regional economies.

Alternative B: The Rule (Preferred Alternative)

Under Alternative B, operators would incur additional costs to comply with the rule. The additional costs stem primarily from provisions that require operators under an operations permit to maintain financial assurance and reimburse the Service for costs associated with processing and administering the operations permit. Operators of pre-existing wells would incur costs at the time of well plugging and reclamation due to the requirement to conduct reclamation to Service standards under an operations permit. Access fees for use of Federal surface beyond an operator's oil and gas rights boundary would be a small additional expense for all operations. The administrative and operational costs of the rule on operators are typically small relative to the total project costs and revenues. Additionally, the increased expenses are not expected to affect company operations as these expenses are: (1) a fraction of a percentage of company revenue, and (2) the number of wells a company operates in a refuge is typically a small percentage of its business portfolio.

Compared to Alternative A, costs for operators could affect individual well economics. Perhaps up to 1,000 marginally producing and idle wells are likely to be plugged and reclaimed sooner under Alternative B as a result of regulatory costs changing individual well economics. Since these wells currently have little or no associated oil and gas production, wells being plugged and reclaimed would have no noticeable impacts on local and regional economies. The same would apply to royalty revenues to leaseholders.

The rule provides a greater incentive for operators to choose a surface location outside a refuge to explore for and produce non-Federal oil and gas resources inside a refuge. Since it includes

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provisions for maintaining financial assurance, access fees, and cost recovery, among others, the operators' costs increase, as does the incentive to avoid those costs.

SUPs would allow the Service to recover fees for processing permits and for refuge maintenance and other impacts.. Because Alternative B would result in no noticeable impacts on local and regional economies and any adverse effects on individual operators would be limited in extent, the impacts of this alternative would not be significant.

The additional compliance costs associated with Service requirements under Alternative B would have minor cumulative adverse impacts on operators because of the small contribution of these operational costs compared to company revenue and the small percentage of a company's portfolio represented by wells in a refuge unit.

The contribution to cumulative impacts of Alternative B would be slight given the considerable oil and gas development occurring in the regions and the many other cumulative impacts affecting the local and regional economies, and any adverse impacts of the alternative would not be significant.

Alternative C: Modified Rule

Alternative C would impose substantial costs on a larger number of operators compared to Alternative B. Primarily, the modified rule would impose costs for permitting, cost recovery, maintenance of financial assurance, and compliance with Service operating standards on up to existing wells 4,500 wells on both Federal and private surface estate. Using cost estimates for the regulatory provisions described in Alternative B, and applying them to 1,000 operations permit applications and 4,500 wells, operators of pre-existing wells could incur costs over \$20 million initially and \$15 million annually thereafter.

Alternative C would expand Service jurisdiction under the regulations to encompass surface and subsurface directional drilling operations outside the boundary of a refuge, subjecting operators of these wells to the full regulatory requirements of a new operation inside a refuge. With little incentive for operators to choose surface drilling locations outside a refuge, some of the additional operations permit applications would be changed to surface operations inside a refuge.

Compared to Alternative B, the expansion of Service regulation to downhole activities under the modified rule could generally increase operator costs by 10 to 30 percent in cost categories of permitting, cost recovery fees, maintenance of financial assurance, and meeting Service standards that are above and beyond other Federal and State requirements.

The contribution to cumulative impacts of Alternative C would be slight given the considerable oil and gas development occurring in the regions and the many other cumulative impacts affecting the local and regional economies, and any adverse impacts of the alternative would not be significant.

Conclusion: Alternative B is Preferred Alternative

Three general conclusions can be drawn from the analysis about impacts of the alternatives:

1. The action alternatives do not authorize any activities that create additional adverse impacts on natural resources, visitor use and experience, and cultural resources compared to the no-action alternative.
2. Overall beneficial impacts on natural resources, visitor use and experience, and cultural resources are expected from the action alternatives.

3. The beneficial impacts come in conjunction with some increased financial considerations for both the Service and operators

Based on our analysis, we have determined that Alternative B is the *Preferred Alternative*, because it meets the purposes and needs of revising the rule and will provide the maximum protection of refuge resources when balanced with the cost to operators and to the Service for administration.

CHAPTER 5: CONSULTATION AND COORDINATION

The intent of the National Environmental Policy Act (NEPA) is to encourage the participation of Federal and State-involved agencies and affected citizens in the assessment procedure, as appropriate. This section describes the consultation that occurred during development of this environmental impact statement (EIS), including consultation with scientific experts and other agencies. This chapter also includes a description of the public involvement process.

HISTORY OF PUBLIC INVOLVEMENT

The public involvement activities for this EIS fulfill the requirements of NEPA.

THE SCOPING PROCESS

The Service divides the scoping process into two parts: internal scoping and external or public scoping. Taken together, internal and public scoping are essential elements of the NEPA planning process. Internal scoping involves discussions among Service personnel regarding the purpose and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics. Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this planning document and impact statement, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and identify important issues or even other alternatives.

The following sections describe the various ways scoping was conducted for this EIS.

INTERNAL SCOPING

Internal scoping for the proposed rule revisions/EIS began in January 2013 with the establishment of an interdisciplinary team comprising Service subject matter experts, practitioners, and natural and cultural resource management professionals. Initial interdisciplinary team discussions focused on the purpose and need for action, objectives for taking action, identification of preliminary issues, and development of a public involvement plan. The team has continued to meet regularly to provide input to the process, including framing the analysis to focus on the main areas of change in the regulations and identifying impact topics for detailed analysis.

PUBLIC SCOPING

Public Notification and Response

Public participation in the scoping process officially began through publication of an advance notice of proposed rulemaking and the notice of intent to develop an environmental impact statement (ANPR/NOI/EIS) in the Federal Register (79 FR 10080) on February 24, 2014. The purpose of issuing the ANPR was to seek comments and suggestions related to several topics, including regulation of new and pre-existing operations, directional drilling beneath refuges from surface

locations outside refuges, operating standards, operator financial assurance, access fees, and assessments for operator noncompliance with the regulations. Comments were solicited from the public to help the Service determine the need to revise the 50 CFR 29.32 regulations, and how identified needs might be addressed.” The Service also issued an official news release on February 24, 2014, advising the public on publication of the ANPR/NOI/EIS in the Federal Register. The Service received comments from unaffiliated private citizens (36), conservation organizations (14), State agencies (8), counties (2), Alaska Native Corporations (2), a tribal agency, oil and gas owners and operators (6), business associations (5), and a Federal agency, along with almost 80,000 form letter comments from members of two environmental organizations. The majority of commenters were in favor of strengthening and expanding the regulations to better protect refuge resources and values. Some commenters requested that we not revise the existing regulations, while others questioned the legality of regulating non-Federal oil and gas operations on refuges.

The NOI specifically solicited public comment on draft purpose and need statements, objectives, and issues and concerns related to revisions of the Service regulations governing non-Federal oil and gas development on units of the Refuge System. The NOI also requested public comment on possible alternatives the Service should consider in revising the regulations.

Comments received during the public scoping period addressed a number of topics. The majority of comments expressed support for revising the proposed regulations. Several suggested that pre-existing operations should be regulated under the revised rule. One commenter suggested that the revised rule should bring all operators into compliance with the regulations as soon as possible.

The next largest topic discussed in the comments was the various requirements for special use permits and plans of operations. For example, we received opposing views of incorporating a National Park Service-like (NPS) permitting system. Many commenters supported adopting a similar permitting requirement, while others opposed the NPS approach because they believe it duplicates State regulations. One commenter suggested that all operations fall under a permit, while others suggested developing a memorandum of understanding with each State to enforce State rules in lieu of a permit system.

Comments were also received regarding the objectives for taking action. Comments noted that the purpose set forth for the proposed regulations should explicitly state that the regulations are designed to avoid and minimize the adverse effects on fish, wildlife, and associated habitat and to ensure the effective management of species and habitat within refuge boundaries, in addition to other reasons listed.

Commenters made suggestions for carefully outlining reclamation objectives in the EIS and called for reclamation plans that include both interim and final plans using defined benchmarks and comparisons to undisturbed reference sites to measure success. Finally, commenters presented new alternatives or elements to the proposed rule. These included several suggestions for additional standards for oil and gas operators, such as requiring operators to manage their well-sites until the sites have been fully rehabilitated; implementing capture and recapture technologies; prohibiting water withdrawals; requiring full disclosure of the identity and volume of all compounds used in hydraulic fracturing fluids and drilling muds; and avoiding vegetation removal.

Based on internal and public scoping, the Service developed the objectives of revising the 29C regulations and a list of resources and concerns to evaluate in this rule revisions/EIS.

The Service utilized these comments to prepare the proposed rule, which we published on December 11, 2016, and opened, with the associated draft Environmental Impact Statement, a 60-day comment period. The Environmental Protection Agency (USEPA) also issued a Notice of Availability that was published in the Federal Register on December 11, 2015. Members of the public also received notice of the availability of the proposed rule and draft EIS through a press release posted on the Service website at <http://www.fws.gov/refuges/oil-and-gas/rulemaking.html>. The public was encouraged to submit comments regarding the Draft EIS via the www.regulations.gov or by mail.

During this comment period we received approximately 39,600 responses (mostly form letters). Service staff read each one and identified specific comments within each piece of correspondence. Correspondence reviewers derived a total of 53 substantive comments from the correspondences received. A substantial number of commenters expressed support for the proposed rule change, citing existing concerns over the adequacy of the current rule to provide resource protection on refuges. Several commenters suggested the Service include additional elements in the provisions of the rule, as described under Alternative C of the Draft EIS. Other commenters believed the proposed rule is unnecessary as current state and Federal laws and regulation provide the necessary protections for refuge uses and resources. Some commenters expressed concerns over the accuracy of data presented in the Draft EIS and called for additional detail to be incorporated in the analysis of impacts. Commenters also expressed concern over the extent of analysis regarding directionally drilled operations.

All comments received were carefully considered and where appropriate, changes were incorporated in the final rule/EIS. Please see Appendix X for information about where changes were made, and reasons why some comments were not incorporated. This final plan/EIS will be made available for public inspection for a 30-day no-action period, which begins with the publication of the EPA Notice of Availability. After the 30-day no action period, a record of decision (ROD) will be prepared that will document approval of the final rule consistent with the selected alternative. The ROD will be signed by the Chief of the National Wildlife Refuge System will be published in the Federal Register. This publication will complete the NEPA process. Publication of the final rule is the Service's final action.

AGENCY SCOPING AND CONSULTATION

United States Fish and Wildlife Service

We have determined that the rule revisions will have no effect on threatened or endangered species and their associated designated critical habitats since the rule does not specifically authorize ground-disturbing activities. The revisions would also lead to enhanced protections for natural resources, including ESA-listed species. Section 7 consultations will occur at the project-specific level upon implementation of the rule.

State Historic Preservation Offices

The revisions to this rule are not likely to adversely affect cultural resources due to the fact that the revisions are programmatic in nature and no ground-disturbing activities would be authorized. Moreover, the rule changes would provide for additional resource protection and mitigation measures, thus resulting in beneficial impacts on cultural resources. Future actions will be analyzed

separately and will be subject to further site-specific consultation and compliance, including section 106, as amended.

Tribal consultation letters were sent to each of the tribes within all eight regions of the Service. Letters provided information to the tribes concerning the proposed action and inquired as to their desire to consult with the Service. No letters were received from the tribes in response to this initial consultation.

LIST OF RECIPIENTS OF THE RULE REVISION/ ENVIRONMENTAL IMPACT STATEMENT

This programmatic rule revisions/EIS was sent to the following agencies, organizations, and businesses, as well as to other entities and individuals who requested a copy.

FEDERAL DEPARTMENTS AND AGENCIES

- Department of the Interior
 - National Park Service
 - United States Fish and Wildlife Service
- United States Environmental Protection Agency
- Advisory Council on Historic Preservation

TRIBAL GOVERNMENTS

- No tribal governments requests received

STATE GOVERNMENTAL AGENCIES

- Virginia, Department of Environmental Quality

ORGANIZATIONS/OTHERS

- ConocoPhillips, Inc.
- Bjork Lindley Little, PC

LIST OF PREPARERS AND CONSULTANTS

Name	Title	Responsibilities
U.S. Fish and Wildlife Service		
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Erin Carver	Senior Economist Division of Economics	Subject matter expert; writer and reviewer.
Catherine Collins	Environmental Engineer, Air Quality Branch, Natural Resources Program Center	Subject matter expert; writer and reviewer.
Eugene Marino	Service Archeologist Division of Visitor Services and Communication Branch of Visitor Services	Archeology and cultural resources, National Historic Preservation Act compliance subject matter expert.
Linus Chen	Attorney - Advisor Office of the Solicitor	Subject matter expert; writer and reviewer.
Nicole McCarthy	Technical Editor	Editing
Mark Newcastle	Technical Editor/Document Designer	Editing/Document Design



An Assessment of Oil and Gas Wells and Pipelines on National Wildlife Refuge System Lands



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Abstract

In 2003 the U.S. General Accounting Office assessed the extent of oil and gas activities (oil and gas wells, pipelines, seismic exploration) on lands managed by the U.S. Fish and Wildlife Service's (Service) National Wildlife Refuge System (NWRS) and evaluated the Service's management and oversight of these activities. The current increase in oil and gas exploration and production (E&P) prompted the Service to update the information on the number of pipelines and wells associated with oil and gas E&P present in NWRS lands. We obtained geospatial data on oil and gas well locations within NWRS lands (units) acquired as fee simple (i.e., absolute title to the surface lands) as well as wells located within one-half mile of the NWRS unit boundaries. These data indicate that oil and gas activities (5,002 wells and 595 pipelines) occur in 195 of the 599 NWRS units. Of the 195 NWRS units, 87 NWRS units have only pipelines and no wells associated with oil and gas. Almost half (44 percent or 2,196 wells) of the wells are inactive and one-third (33 percent or 1,665 wells) are active. An estimated 595 pipelines cross a total of 1,339 miles of NWRS units. Approximately 6,723 additional wells are located within one-half mile outside of the NWRS unit boundary. Almost half (42 percent) of these wells are inactive (2,741) and 28 percent (1,893 wells) are active. The high level of activities warrants follow-up assessments for wells lacking information on production type or well status with emphasis on identifying abandoned and unplugged wells. The Service should also assess NWRS units for impacts from brine, oil and other hydrocarbon spills, as well as habitat alteration, and other impacts associated with the E&P of oil and gas, including the identification of abandoned oil and gas facilities requiring equipment removal and site restoration.

Background

In 2003 the U.S. General Accounting Office (GAO) found that approximately 25 percent of lands managed by the U.S. Fish and Wildlife Service (Service, FWS) for the primary purpose of the conservation and management of fish, wildlife, and plants and their habitats had past or ongoing oil and gas activities (GAO 2003). Oil and gas activities included seismic exploration, drilling, oil and gas wells, pipelines, tank batteries, and compressor stations. The Service's National Wildlife Refuge System (NWRS) includes 555 national wildlife refuges (NWRs); 38 wetland management districts (WMDs) and 206 waterfowl production areas (WPAs) (Figure 1). The NWRS also includes conservation easements totaling approximately 3.5 million acres acquired for wildlife conservation. For purposes of this report, the term "NWRS unit" includes lands in the NWRS obtained through acquisition as fee simple (i.e., absolute title to the surface land) via purchase or donation of full ownership of the property) or lands withdrawn from public domain and included in NWRS lands (NWRs, WMDs, WPAs, and wildlife ranges). Although the surface lands in NWRS units are federally owned, private individuals, corporations, state or local governments, Indian tribes, or native corporations own the subsurface minerals in many NWRS units. The owners of subsurface minerals, or "mineral rights," have the legal right to explore for and extract oil and gas from their mineral estate. In many NWRS units, oil and gas wells and pipelines were already present when the Service acquired the property.

According to the GAO (2003), 105 refuges contained 4,406 oil and gas wells in 2002. The GAO defined "refuge" as any unit of the NWRS, including national wildlife refuges, wildlife ranges, wildlife management areas, and waterfowl production areas. Over half (59 percent) of the oil and gas wells were inactive and either permanently plugged and abandoned or temporarily shut-in. Actively producing wells comprised 41 percent (1,806 wells) of the total and were located on 36 refuges. Approximately 57 percent of all wells were located on five refuges located in Gulf coast states and Oklahoma (Table 1) in the Service's Regions 2 (Southwest Region) and 4 (Southeast Region) (GAO 2003). The GAO (2003) also reported that 35 refuges contained only pipelines.



Figure 1. National Wildlife Refuges and U.S. Fish and Wildlife Service Regional Boundaries (Pacific Islands – Region 1 and Puerto Rico – Region 4 excluded).

Table 1. Refuges containing the highest number of oil and gas exploration and production wells (GAO 2003).

Refuge	FWS Region	State	Number of Wells
Upper Ouachita NWR	4	Louisiana	1,120
St. Catherine’s Creek NWR	4	Mississippi	465
Deep Fork NWR	2	Oklahoma	362
Delta NWR	4	Louisiana	338
Lower Rio Grande Valley NWR	2	Texas	217
		Total	2,502

The National Wildlife Refuge System Administration Act of 1966 (16 U. S. C. 668dd-668ee) (Refuge Administration Act), and subsequent amendments, authorizes the Service to regulate all activities on refuges. Under the Refuge Administration Act, the Service determines if activities within a refuge are compatible with the purposes of the refuge and the mission of the NWRS. If the Service determines that the activity is not compatible with the refuge purpose and mission,

the activity is not allowed. The Service, by policy, does not apply the compatibility requirement to the exploration and extraction of oil and gas from privately owned mineral rights within NWRS lands (65 FR 62484-62496). The GAO (2003) found “Federal management and oversight of oil and gas activities varies widely among refuges—some refuges take extensive measures, while others exercise little control or enforcement.” The GAO (2003) attributed this variation in oversight and management of oil and gas activities to the lack of guidance, insufficient resources, and little to no training for refuge managers. Additionally, refuges varied in how extensively they identified risks from oil and gas activities and how they managed those risks in order to minimize impacts to the refuges (GAO 2003). Each refuge can issue a Special Use Permit (SUP) to allow the use of any area within NWRS lands for “any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access” whenever the Service “determines that such uses are compatible with the major purposes for which such areas were established” (Refuge Administration Act (16 USC 668dd (d)(1)(A))). The GAO (2003) found that refuge managers differed in the issuance of SUPs with seasonal, vehicle, or other restrictions to oil and gas operators to protect refuge resources such as wildlife habitat, water, soil, and air quality. At the time of the GAO report (GAO 2003), the Service had refuge staff dedicated to the oversight of oil and gas activities on only two refuges within the NWRS.

The GAO made the following recommendations to the Service:

- collect and maintain better data on oil and gas activities on NWRS lands;
- collect and maintain better data on the effects of oil and gas activities on refuge resources;
- determine staffing necessary for adequate oversight of oil and gas activities and seek necessary funding to meet those staffing needs;
- train refuge staff overseeing oil and gas activities; and
- clarify guidance and improve oversight of the land acquisition process to identify all hazardous substances, environmental problems, and potential cleanup costs associated with lands proposed for acquisition into the NWRS.

The GAO also recommended “...*the Secretary of the Interior and the Director of the Fish and Wildlife Service work with the Department of the Interior’s Office of the Solicitor to*

- (1) *determine FWS’s existing authority to issue permits and set reasonable conditions regarding outstanding mineral rights, reporting the results of its determination to Congress, and*
- (2) *seek from Congress, in coordination with appropriate Administration officials, including those within the Executive Office of the President, any necessary additional authority over such rights, and over reserved mineral rights, so that FWS can apply a consistent and reasonable set of regulatory and management*

controls over all oil and gas activities occurring on national wildlife refuges to protect the public's surface interests."

In the 11 years since publication of the GAO report, the Service has developed a guidance manual and trained refuge personnel in the management of oil and gas activities on NWRS lands. The guidance manual *Management of Oil and Gas Activities in National Wildlife Refuge System Lands* includes the following information to assist Service personnel with the management of oil and gas activities in NWRS lands:

- legal authorities, including mineral ownership and implementing regulations;
- negotiation of permits and agreements that protect surface rights;
- environmental compliance requirements;
- physical infrastructure of oil and gas activities;
- minimization of environmental damage; and
- pertinent health and safety issues.

The Service also developed a weeklong training course held at the following locations since 2005: Corpus Christi, Texas (2005); Minot, North Dakota (2006); Sulphur, Louisiana (2007); Pottsboro, Texas (2008); Williston, North Dakota (2009); Shreveport, Louisiana (2011); Fort Collins, Colorado (2012); and Winnie, Texas (2013).

Refuge managers, refuge oil and gas specialists, and realty specialists have attended the week-long course. The training course includes an overview of issues that refuge personnel should consider in managing oil and gas activities on NWRS lands and provides examples of procedures, protocols, and SUP stipulations successfully implemented on refuges. Additionally, the Service currently has six staff dedicated to the oversight of oil and gas activities in NWRS units as well as regional oil and gas specialists in Texas, Louisiana, and Colorado.

Since publication of the GAO report (GAO 2003), oil and gas E&P has increased significantly (EIA 2012). The number of drilling rigs increased by 84 percent, from 1,032 rigs in 2003 to 1,925 rigs in 2011. Annual oil production increased by 55 percent, from 1.87 billion barrels (Bbbls) in 2003 to 2.9 Bbbls in 2010. Annual production of natural gas rose from 19.4 trillion cubic feet (TCF) in 2003 to 33.8 TCF in 2010, an increase of 74 percent. The increase is primarily due to technological advancements in horizontal drilling techniques and hydraulic fracturing, which have allowed the exploration and development of shale for oil and gas (EIA 2011). The expansion of oil and gas E&P necessitates a reexamination of the number of oil and gas wells and pipelines affecting NWRS lands. The purpose of this report is to document the number of oil and gas wells in NWRS lands, the status of the oil and gas wells (active, inactive, shut-in, plugged and abandoned, abandoned, or unknown), and the number of pipelines.

Identification of the location of abandoned oil and gas wells and or equipment associated with those wells will enable the Service to assess the ongoing and potential impacts to NWRS lands from abandoned oil and gas facilities and use the data to prioritize which ones need corrective action. The data will also assist refuge managers with oversight of oil and gas facilities on NWRS lands.

Methods

The Service's Natural Resource Program Center (NRPC) in Fort Collins, Colorado, obtained spatial data on oil and gas wells in NWRS lands in June 2012 from the U.S. Environmental Protection Agency's (EPA) Land-Based Oil and Gas Extraction database (Database) in the Online Tracking Information System (OTIS) administered by the Office of Compliance (EPA 2013). The NRPC obtained data on pipelines crossing NWRS lands in February 2012 from the U.S. Department of Transportation (DOT) Office of Pipeline Safety's National Pipeline Mapping System. The NRPC requested spatial data on wells located within NWRS unit boundaries and within ½ mile outside NWRS unit boundaries. Only NWRS lands obtained through acquisition of fee title (purchase of full ownership of the property, property donated to the Service, or lands withdrawn from public domain and included in NWRS lands) and property where the Service holds a secondary interest to another federal agency (overlay refuge) were included in the analysis of oil and gas well data and pipelines. "Secondary Interest" is defined as property where the Service holds a secondary interest to another federal agency. For example, Hagerman NWR in Texas was established in 1946 on lands originally purchased by the U.S. Department of the Army Corps of Engineers for the Denison Dam Project (Lake Texoma). Conservation easements in the NWRS were not included in this assessment.

EPA obtained the oil and gas well data from HPDI, Inc., now known as DrillingInfo, Inc., a private sector data gathering firm from Austin, Texas (<http://info.drillinginfo.com/>). DrillingInfo, Inc., obtained data on over 3 million oil and gas-associated wells from 30 state regulatory agencies or geological agencies and the Arizona Geological Society in January 2012. Data included all oil and gas-producing states, with the exception of Illinois and Indiana. EPA obtained well data from the Illinois State Geological Survey and Indiana Geological Survey in February 2011.

The EPA oil and gas well database categorizes the wells according to production type and status. The "Production Type" field includes numerous codes depicting the type of fluid or gas that is either produced or injected from or into the well (e.g., oil, gas, oil and gas, coal bed methane, carbon dioxide injection, water injection) (EPA 2013). The "Status" field includes codes depicting the current status or condition of the well (e.g., active, inactive, abandoned, dry hole,

shut-in, plugged and abandoned, or unknown). Active wells are actively producing, injecting, or disposing of fluids. Inactive wells are defined as unplugged wells that have had no reported production of oil and or gas or injection for a period of one year or more. A shut-in well is a well capable of production or injection that can be readily placed into production by activating existing equipment. Plugged and abandoned wells are plugged with cement and heavy mud, and the wellhead removed. Abandoned wells include wells that have been abandoned by oil operators due to lack of production or wells that have “failed beyond repair.” The EPA Database does not specify if wells designated as “abandoned” were plugged and abandoned. If no oil or gas was produced following well completion, the well is categorized as a dry hole.

We analyzed the spatial distribution of wells and pipelines across NWRS lands using geographic information system (GIS) software (ArcGIS 10.1, ESRI, Redlands, CA). For purposes of this study, we grouped wells as follows:

- “Gas” whenever the Production Type listed “Gas” as a type regardless of other Production Type codes listed for that well.
- “Oil” whenever the Production Type listed “Oil” as a type regardless of other Production Type codes listed for that well.
- “Other” whenever the Production Type was something other than “Gas, Oil, or Oil and Gas.”

Wells categorized as “Other” included injection wells for enhanced oil recovery or wastewater disposal, coalbed methane wells, observation wells, stratigraphic wells, and water wells. Wells classified as Status = “Cancelled” or “Cancel” were excluded from the analysis as the permits for these “wells” were cancelled by the operator and not drilled. We calculated the number of wells by production category and status for each NWRS unit and Service region.

In 2013 and 2014, we visited oil and gas facilities at the following NWRs: Anahuac, McFaddin, and Hagerman in Texas; Deep Fork in Oklahoma; Delta, Atchafalaya, Catahoula, Lake Ophelia, and Tensas River in Louisiana; and St. Catherine Creek in Mississippi. During those field visits, we interviewed refuge managers and oil and gas specialists to identify issues with the oversight of oil and gas activities on NWRS units. Refuge managers and oil and gas specialists provided information on environmental effects of oil and gas E&P. We also obtained information on oil and gas E&P environmental compliance incidents from reports provided by refuge managers and oil and gas specialists. Using GIS, we measured the sizes of a subset of well pads from the following NWRs: Deep Fork (n=14), Hagerman (n=20), Tensas River (n=15), Catahoula (n=11), St. Catherine Creek (n=13), Anahuac (n=12), and McFaddin (n=15). We selected no more than 10 well sites and 10 tank battery sites at each of the 7 NWRs.

Results

Oil and Gas Wells

Approximately 195 NWRS units (38 percent) of the 599 (561 NWRs and 38 WMDs) NWRS units have oil and gas activities (wells and pipelines) and 107 NWRS units (18 percent) have wells associated with oil and gas E&P (wells) (Table 2) (Figures 2 and 3). The Southeast Region (Region 4) has the most NWRS lands with oil and gas activities (55 NWRS units) followed by the Southwest Region (Region 2) (31 NWRS units). The Southeast Region has the most number of NWRS units (43 NWRS units) with pipelines followed by the Mountain-Prairie Region (28 NWRS units), the Southwest Region (26 NWRS units), and Midwest Region (21 NWRS units).

The Southwest, Southeast, and Mountain-Prairie Regions have the most number of NWRS units with active wells, 16, 14, and 9 NWRS units respectively (Table 3). The Southeast, Southwest, Pacific, and Mountain-Prairie Regions have the most number of NWRS units with inactive wells, 35, 23, 18, and 17, respectively. The Pacific Region has the most NWRS units with plugged and abandoned, dry, and shut-in wells (Table 4).

Table 2. Number of NWRS units, listed by FWS region, with oil and gas activities within fee interest boundaries.

FWS Region	Oil & Gas wells	Other wells	Total # NWRS units with Wells	# of NWRS units with Pipelines	Total # NWRS units with Wells and or Pipelines
1 (Pacific)	0	0	0	6	6
2 (Southwest)	20	16	23	26	31
3 (Midwest)	2	4	5	21	24
4 (Southeast)	20	31	35	43	55
5 (Northeast)	3	3	4	12	12
6 (Mountain-Prairie)	11	14	18	28	39
7 (Alaska)	1	4	4	1	4
8 (Pacific Southwest)	6	18	18	12	24
Totals	63	90	107	149	195

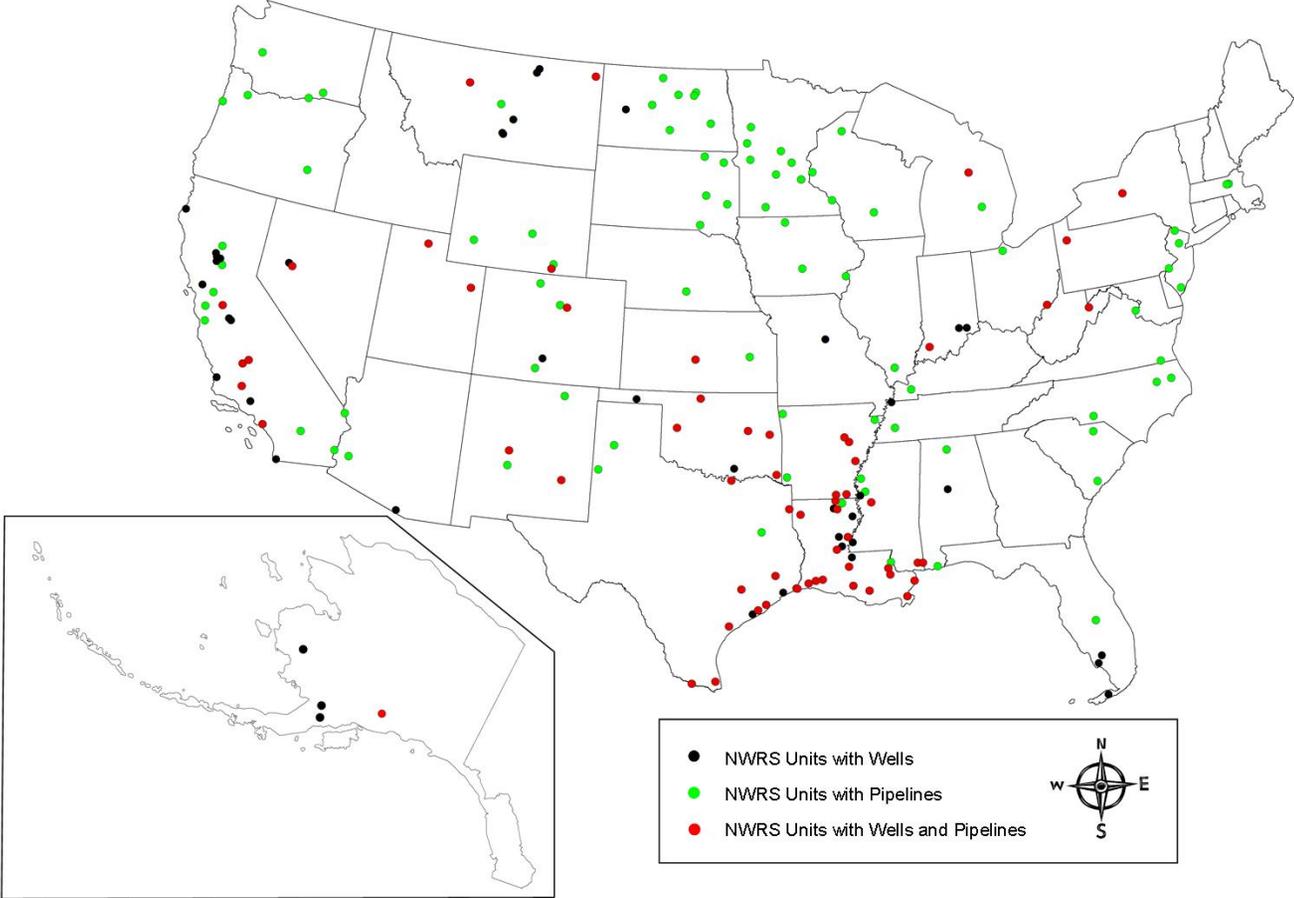


Figure 2. NWRS units with pipelines and oil and gas exploration and production wells.

Table 3. Number of NWRS units with active and inactive wells by region.

FWS Region	Active ¹ Wells			Inactive ² Wells		
	Oil & Gas wells	Other ³ wells	Total # NWRS units	Oil & Gas wells	Other wells	Total # NWRS units
1 (Pacific)	0	0	0	0	0	0
2 (Southwest)	15	6	16	16	15	23
3 (Midwest)	2	2	2	1	4	5
4 (Southeast)	14	1	14	20	31	35
5 (Northeast)	0	0	0	3	3	4
6 (Mountain-Prairie)	9	0	9	8	14	18
7 (Alaska)	1	1	1	1	4	4
8 (Pacific Southwest)	3	1	3	6	18	18
Totals	44	11	45	55	89	107

¹Active wells = includes oil & gas wells that are producing oil and gas and other wells that are injecting gas or fluids underground.

²Inactive wells = includes all wells with a status \neq active (e.g., inactive, plugged and abandoned, shut-in, dry hole, unknown, etc.).

³Other wells = includes wells other than oil and gas: injection, saltwater disposal, enhanced oil recovery, dry, observation, stratigraphic, other, and production type data not available (N/A).

Table 4. Number of NWRS units with non-producing oil and gas wells.

FWS Region	Number of NWRS units by well status category			
	Abandoned ¹	Plugged & Abandoned ²	Dry ³	Shut-in ⁴
1 (Pacific)	0	0	0	0
2 (Southwest)	1	8	1	0
3 (Midwest)	1	0	3	0
4 (Southeast)	0	5	6	1
5 (Northeast)	0	2	3	0
6 (Mountain-Prairie)	0	3	0	1
7 (Alaska)	0	4	0	1
8 (Pacific Southwest)	0	16	16	4
Totals	2	38	29	7

¹Abandoned = well no longer in use, whether dry, inoperable or no longer productive, and operators have intentionally relinquished interest in the well.

²Plugged & Abandoned = well that has been plugged with cement & mud and wellhead removed.

³Dry = well with no economically producible oil and/or gas.

⁴Shut-in = a well capable of production or injection by opening valves or powering equipment.

The production type in 1,771 (36 percent) of the 5,002 wells present in NWRS units is grouped as “Other” and one percent (75 wells) have other status codes, including application for permit to drill, drilling active, drilling suspended, dry, dry hole, other, suspended, temporarily abandoned, unknown, and “blank” or no data present in that field.

Table 5. Number of wells by Production Type and Status within NWRS unit boundaries.

Well Status	Gas	Oil	Oil & Gas	Other	Total
Active	1,282	257	8	118	1,665
Inactive	779	446	37	934	2,196
P&A ¹	81	129	9	499	718
Shut-in	3	26	0	1	30
N/A ²	53	106	3	156	318
Other ³	3	7	2	63	75
Grand Total	2,201	971	59	1,771	5,002

¹P&A = plugged and abandoned

²N/A = status data not available

³Other = includes other status codes not listed in table, such as dry hole, suspended, temporarily abandoned, unknown, or “blank” (i.e. no data)

Active and inactive wells comprise 33 and 44 percent, respectively, of all wells on NWRS lands, and only 14 percent of the wells are plugged and abandoned. Oil and gas wells make up 65 percent of all wells on NWRS lands. Other wells include wells with Production Type listed as abandoned, injection, coalbed methane, observation, stratigraphic, dry hole, suspended, temporarily abandoned, unknown, or blank (i.e., no data). Most of the wells (93 percent or 776 wells) designated as production type = N/A and status = inactive, N/A, unknown, or blank are in the Southeast Region in 21 NWRS units with half of the wells in the following NWRs: Upper Ouachita (128 wells); D’Arbonne (100); Delta (86); and Tensas (75) (Table 6).

Injection wells make up 5 percent (206 wells) of all wells on NWRS units (Table 7) with half (51 percent or 121 wells) designated as active. The Southwest Region has the most NWRS units (11) with injection wells. Deep Fork and Hagerman NWRs have the highest number of injection wells in the NWRS, 82 and 68, respectively. Almost all (78) of the injection wells at Deep Fork NWR are designated as active. Only 21 of the 68 injection wells at Hagerman NWR are active. Of the 21 active injection wells at Hagerman NWR, one is used for saltwater (oilfield brine) disposal and the remainder are used for secondary recovery (water flood) of oil.

Table 6. NWRS units with wells with production type = not available (N/A) and status = inactive, N/A, unknown, or blank.

Region / State / NWRS unit	Number of Wells
<i>Region 2</i>	
New Mexico	
Sevilleta National Wildlife Refuge	2
Oklahoma	
Deep Fork National Wildlife Refuge	120
Tishomingo National Wildlife Refuge	8
Sequoyah National Wildlife Refuge	4
Little River National Wildlife Refuge	1
<i>Region 3</i>	
Missouri	
Big Muddy National Fish And Wildlife Refuge	1
<i>Region 4</i>	
Florida	
Florida Panther National Wildlife Refuge	2
National Key Deer Refuge	1
Ten Thousand Islands National Wildlife Refuge	1
Louisiana	
Upper Ouachita National Wildlife Refuge	128
D'Arbonne National Wildlife Refuge	100
Delta National Wildlife Refuge	86
Tensas River National Wildlife Refuge	75
Catahoula National Wildlife Refuge	54
Lake Ophelia National Wildlife Refuge	51
Sabine National Wildlife Refuge	51
Bayou Cocodrie National Wildlife Refuge	49
Lacassine National Wildlife Refuge	42
Red River National Wildlife Refuge	27

Table 6. Continued

Region / State / NWRS unit	Number of Wells
Louisiana	
Mandalay National Wildlife Refuge	25
Atchafalaya National Wildlife Refuge	23
Bayou Teche National Wildlife Refuge	18
Cameron Prairie National Wildlife Refuge	14
Black Bayou Lake National Wildlife Refuge	7
St. Catherine Creek National Wildlife Refuge	6
Big Branch Marsh National Wildlife Refuge	4
Breton National Wildlife Refuge	3
Cat Island National Wildlife Refuge	3
Grand Cote National Wildlife Refuge	2
 Region 5	
West Virginia	
Ohio River Islands National Wildlife Refuge	15
 Region 6	
Colorado	
Baca National Wildlife Refuge	2
Rocky Mountain Arsenal National Wildlife Refuge	1
 Montana	
Northeast Montana Wetland Management District	9
Benton Lake Wetland Management District	7
Halfbreed Lake National Wildlife Refuge	4
Medicine Lake National Wildlife Refuge	3
Benton Lake National Wildlife Refuge	2
Bowdoin Wetland Management District	2
Lake Mason National Wildlife Refuge	2
Bowdoin National Wildlife Refuge	1
Hailstone National Wildlife Refuge	1
Hewitt Lake National Wildlife Refuge	1

Table 6. Continued

Region / State / NWRS Unit	Number of Wells
Alaska	
Kenai National Wildlife Refuge	7
Region 8	
Nevada	
Stillwater National Wildlife Refuge	4
Fallon National Wildlife Refuge	1
Total	974

Five NWRS units contain 42 percent of all oil and gas wells in the NWRS with three of the top five NWRS units located in the Southeast Region (Table 8). The status of 93 percent of the wells at Delta NWR is either inactive, N/A, unknown, or blank. Seventy percent of the wells at Deep Fork NWR are designated as either inactive, N/A, unknown, or blank. One hundred wells at Deep Fork NWR have no data on well status or production type. Within the NWRS, Deep Fork NWR has the highest number of active oil wells (68) and Upper Ouachita NWR has the highest number of active gas wells (928) in the NWRS. Gas wells comprise 77 percent of all active oil and gas wells with 86 percent of these wells located in NWRS units in Louisiana.

Table 7. Number of injection wells on NWRS lands.

FWS Region	# of NWRS units	Number of Wells	Active	Inactive	Plugged & Abandoned	Other Status ¹
1 (Pacific)	0	0	0	0	0	0
2 (Southwest)	11	161	112	21	15	13
3 (Midwest)	1	5	1	4	0	0
4 (Southeast)	2	33	5	1	20	7
5 (Northeast)	0	0	0	0	0	0
6 (Mountain-Prairie)	1	2	0	2	0	0
7 (Alaska)	1	2	2	0	0	0
8 (Pacific Southwest)	1	3	1	1	0	1
Totals	17	206	121	29	35	21

¹Other Status - temporarily abandoned, drilling, well status not available, or shut-in.

Table 8. NWRS units with the highest number of oil and gas wells (excluding other wells such as injection wells).

NWRS unit	State	Number of Wells						Total
		Oil Wells		Gas Wells		Oil & Gas Wells		
		Active	Inactive	Active	Inactive	Active	Inactive	
Upper Ouachita	LA	0	2	928	352	0	0	1,282
Delta	LA	18	196	3	49	0	11	277
D'Arbonne	LA	0	0	100	83	0	0	183
Deep Fork	OK	68	79	2	24	0	0	173
Lower Rio Grande Valley	TX	4	19	60	79	2	8	172
	Total	90	296	1,093	587	2	19	2,087

Approximately 6,723 oil and gas E&P wells, all wells related to oil and gas production, occur within one-half mile outside of NWRS unit boundaries (Table 9). Twenty-eight percent (1,890) of these wells are active wells and 48 percent (2,741) are inactive.

Table 9. Number of wells by Production Type and Status located within ½ mile of the NWRS unit boundaries.

Well Status	Number of Wells by Production Type				
	Gas	Oil	Oil & Gas	Other	Total
Active	977	419	399	95	1,893
Inactive	829	520	70	1,322	2,741
P&A ¹	110	83	166	509	868
Shut-in	42	45	0	46	87
N/A ²	107	177	65	358	707
Other ³	41	20	218	151	427
Grand Total	2,106	1,264	918	2,481	6,723

¹P&A = plugged and abandoned

²N/A = status data not available

³Other = includes other status codes not listed in table, such as cancelled, dry hole, suspended, temporarily abandoned, unknown, or "blank" (i.e. no data)

Pipelines

There are 595 pipelines totaling approximately 1,339 miles cross 149 NWRS units (Table 10). Seven percent (87 NWRS units) of the 599 NWRS units have only pipelines crossing NWRS units and no wells associated with oil and gas production. Some of the pipelines were constructed before the Service acquired the property. The Southeast Region (Region 4) contains the most number of NWRS units (43) with pipelines followed by Regions 2, 3, and 6. Over half (68 percent) of the pipelines transport gas products (Table 11). The pipelines transport a variety of petroleum products including crude oil, refined petroleum products, and natural gas.

Table 10. Number of pipelines crossing NWRS units.

FWS Region	Total # Pipelines	# NWRS units with Pipelines	# NWRS units with Pipelines Only	Miles of Pipeline
1 (Pacific)	8	6	6	26
2 (Southwest)	182	26	8	463
3 (Midwest)	98	21	19	147
4 (Southeast)	190	43	19	450
5 (Northeast)	25	12	8	33
6 (Mountain-Prairie)	60	28	21	98
7 (Alaska)	7	1	0	101
8 (Pacific Southwest)	25	12	6	20
Totals	595	149	87	1,338

Table 11. Number of pipelines by type crossing NWRS units.

FWS Region	Liquids Pipelines ¹	Gas Pipelines ²
1 (Pacific)	3	5
2 (Southwest)	76	106
3 (Midwest)	28	70
4 (Southeast)	34	156
5 (Northeast)	4	21
6 (Mountain-Prairie)	23	37
7 (Alaska)	2	5
8 (Pacific Southwest)	1	24
Totals	194	424

¹Liquids pipelines transport crude oil, and refined products such as gasoline, diesel, and jet fuel.

²Gas pipelines transport natural gas and other gases such as carbon dioxide.

³Liquids & gas pipelines transport liquefied natural gas, liquefied petroleum gas, and anhydrous ammonia (in liquid state in pipeline but vaporize into gas when released from pipe).

Almost three-quarters (72 percent) of the pipelines traversing NWRS units transport natural gas. Over half of the natural gas pipelines in NWRS units occur in Regions 2 (Southwest) and 4 (Southeast). Almost all of the gas pipelines (96 percent) transport natural gas and the remainder convey carbon dioxide, hydrogen, or other gases. Liquids pipelines transport crude oil, anhydrous ammonia, liquefied petroleum gas, natural gas liquids, highly volatile liquids, and non-highly volatile liquid products. Most pipelines are buried underground and range in size from 2 to 42 inches in diameter. The larger pipelines (diameter > 25 inches) typically convey either natural gas or crude oil. Six percent (23 pipelines) are idle, abandoned, or retired.

Environmental Effects of Oil and Gas on NWRS Units

Environmental impacts associated with oil and gas E&P on NWRS units range from small, chronic leaks and trash at production sites to larger and significant incidents such as removal of vegetation, spills resulting in soil and vegetation damage, leaking abandoned wells, and abandoned oilfield equipment. Hagerman NWR reported six brine spills in 2010 caused by flowline leaks due primarily to corrosion. A corroded flowline discharged 75 bbls of oilfield brine at Hagerman NWR in February 29, 2012, and affected 2 acres of habitat. The brine killed 84 hardwood trees, 2 of which were over 150 years old, and caused an estimated \$154,000 in damages (M. Maddux, pers. comm.). In March 2013, a drilling operation spilled 25 bbls of oil-based drilling mud at a drilling rig at the Lower Rio Grande Valley NWR. The drilling mud spill contaminated soil and vegetation next to the well pad (M. Maddux, pers. comm.).

Refuge staff documented soil and water contamination from improperly plugged and abandoned wells. An oil well plugged and abandoned in 1983 at St. Catherine Creek NWR leaked in April 2012, necessitating replugging the well and restoring the site at a cost exceeding \$260,000 (M. Cupit, pers. comm.). At the Lower Rio Grande Valley NWR, leaking abandoned oil wells threatened East Lake, a saline lake of critical importance to migrating shorebirds. The state oil and gas regulatory agency (Texas Railroad Commission) spent \$1.2 million to plug the wells and remove the abandoned oilfield equipment.

Oil spills due to stream flooding and hurricane storm tides have also occurred on NWRS units. Hurricane storm tides in Texas and Louisiana resulted in extensive damage to oil and gas production sites. The storm tides damaged oil storage tanks causing oil releases onto wetlands on NWRS. Storm tides also moved storage tanks from the well pads inland into sensitive areas of the NWRS. E&P wells located in floodplains could cause releases of oil and brine during flood events. Catahoula, Deep Fork, Patoka River, St. Catherine Creek, Tensas River, and Upper Ouachita NWRS have wells located within floodplains subject to seasonal flooding. The total number of spills associated with oil and gas E&P on NWRS units is unknown.

Well pad sizes at Anahuac, McFaddin, and Hagerman NWRs in Texas; Deep Fork NWR in Oklahoma; Atchafalaya, Catahoula, and Tensas River NWRs in Louisiana; and St. Catherine Creek NWR averaged 0.4 acres for well sites and 1 acre for well pads with tank batteries. We documented abandoned oilfield equipment including pump jacks, pipes, separators, flowlines, and storage tanks in the following NWRs: Atchafalaya, Delta, and Tensas River in Louisiana; Deep Fork in Oklahoma; and Anahuac, Brazoria, Hagerman, McFaddin, and San Bernard in Texas. NWRS unit managers and oil and gas specialists reported improvement in working with oil and gas operators to achieve resource protection; however, they added that unnecessary impacts on NWRS units still occur.

Discussion

In the 11 years since the publication of the GAO findings (GAO 2003), the NWRS has increased from 575 to 599 NWRS units. We cannot attribute this increase to an expansion in the number of NWRS units as none of the 24 NWRS units acquired since 2003 have any wells within the fee interest boundaries. The increase may be due to the acquisition of additional land for existing NWRS units or the drilling of additional wells. We cannot directly compare the well numbers reported by the GAO (2003) to our data, as we do not have specific information on the actual NWRS unit fee interest boundaries used in the 2003 analysis nor how GAO imported the well data from the data sources. In addition, well data vary as the production type and the status of wells change as the wells age. For the purposes of assessing trends, however, we offer some general contrasts with the GAO findings.

Data on oil and gas-related wells in and adjacent to NWRS units reflect the history and trends of oil and gas E&P in the United States. Regions 2 and 4 encompass the Gulf coast states, which historically and currently have extensive oil and gas E&P. Most of the oil and gas development on NWRS units occurred prior to the acquisition of these lands by the Service. The Southeast Region (Region 4) has the largest number of pipelines and wells and the largest number of actively producing oil and gas wells followed by the Southwest Region (Region 2). This is similar to the GAO findings in 2003 (GAO 2003). The Southeast and Southwest regions encompass the Gulf of Mexico coast, which historically has been a major oil and gas-producing region for the United States (Advanced Resources International 2006). Texas and Oklahoma (Southwest Region) account for 32 and 10 percent, respectively, of all oil and gas wells in the United States (EIA 2011). Historically, the oil-producing states of Texas, Oklahoma, and Louisiana in the Southeast and Southwest regions have led the United States in the production of crude oil and natural gas (Boyd 2002, Kim and Ruppel 2005). Oil production in Texas and Louisiana dates back to 1901 with the discovery of oil at Beaumont, Texas, near McFaddin and Texas Point NWRs, and Jennings, Louisiana, near Laccasine NWR (Louisiana Geological

Survey 2001). Oil and gas wells on some NWR units in Texas and Louisiana were completed during the 1920s and 1930s.

As oil and gas production in the well declines, its status changes from active to shut-in, abandoned, or plugged and abandoned. Changes in well status may explain the eight percent decline in active wells from 1,806 wells in 2003 to 1,665 wells in 2011. The percentage of inactive wells and plugged and abandoned wells did not change considerably from 2003. Active wells can adversely affect NWRS units because of disturbance from routine operations and facility maintenance in addition to oil and brine spills. Although inactive, shut-in, or abandoned wells are not producing or injecting fluids, the risk of leakage onto the surface or contamination of aquifers due to the loss of wellbore integrity still exists. Delaying the plugging and abandonment of inactive wells increases the risk of well integrity failure. Oil operators can abandon inactive wells and place the burden of plugging and abandonment and site reclamation on the taxpayer.

Three of the five refuges with the highest number of wells are located in the Southeast Region (Region 4): Upper Ouachita, Delta, and D'Arbonne National Wildlife Refuges. This is also similar to the findings of the GAO (2003). Upper Ouachita and D'Arbonne NWRs are located in north-central Louisiana in the Ouachita River Basin. The wells in these NWRs produce natural gas from the Monroe gas field, Louisiana's largest gas field at approximately 365 sq. miles producing 7.3 TCF of natural gas since its discovery in 1917 (Williams 2005). The Upper Ouachita NWR in Louisiana has the highest number of active gas wells (928 wells) in the NWRS and comprises 56 percent of all active wells in the NWRS. Some of the gas wells in the Upper Ouachita NWR have been in production since the 1920s. Approximately 781 wells in Upper Ouachita NWR were completed between 1970 and 1989 with over half of those wells completed between 1970 and 1978 prior to the acquisition of the NWR. Prior to the 1970s, gas wells in the Upper Ouachita NWR were restricted by state regulations to one well per 40 acres. However, changes in the regulation of natural gas prices (Natural Gas Supply Association 2011) and the resultant increase in natural gas prices led to an increase in drilling in the NWR during the 1970's with some wells drilled within 600 feet of other wells (FWS 2008a). Twenty-three wells were drilled 83 to 93 years ago and 468 wells are from 41 to 78 years old. Forty-two percent of the wells older than 40 years are designated as inactive. The EPA dataset does not specify if these wells are plugged and abandoned. The impacts of gas development at Upper Ouachita NWR include brine spills, improperly closed reserve pits, abandoned or poorly maintained wells and equipment, and mercury contamination from manometers used to measure gas production (FWS 2008a). Black Bayou Lake and D'Arbonne NWRs are also located in the Monroe Gas Field and have a large number of active gas wells, 60 and 100 gas wells, respectively. Over half of the gas wells at D'Arbonne NWR were completed after 1980.

St. Catherine Creek NWR, located in Adams and Wilkinson Counties, in southwestern Mississippi, has 514 wells and 90 percent of the wells (464) have been plugged and abandoned. Sixty-seven percent of the wells (338 wells) at the NWR were dry and 25 percent (130 wells) are oil wells. The NWR has eight active oil wells and five active saltwater disposal wells. The NWR staff has worked with the Mississippi Oil and Gas Board in coordinating the removal of inoperable and abandoned oil production equipment (FWS 2006).

Delta NWR, located in Plaquemines Parish at the mouth of the Mississippi River in southeast Louisiana, has a total of 363 wells of which 71 percent are designated as inactive. Over half of the wells are oil wells (62 percent or 196 wells) with 18 producing or active oil wells and 3 active gas wells. Oil and gas development in Delta NWR began in 1942, 7 years after the refuge was established in 1935 (FWS 2008b). Over half (65 percent or 237) of the wells at Delta NWR were completed prior to 1980. Of the wells with data on the last production date, 166 wells apparently stopped producing prior to the year 2000. Seven oil wells have been active for over 50 years. Seven oil wells and two gas wells have been in production for less than 20 years.

Deep Fork NWR, located in Okmulgee County, Oklahoma, has a total of 400 wells with 68 active oil wells and 2 active gas wells. Most of the well completions at Deep Fork NWR occurred in the 1920s and between 1950 and 1969. Some of the oil wells at Deep Fork NWR have been in production since the early 1900s. Twenty-eight percent of all wells have data on the last production date; of those, 68 percent (77 wells) ceased production between 1979 and 1999. The status of 41 percent of the wells is unknown. The refuge also has 78 active injection wells. Fifty-one percent (35 wells) of the active injection wells in the refuge were completed during the 1950s.

Deep Fork NWR in Oklahoma and Hagerman NWR in Texas have the highest number of injection wells, 82 and 68, respectively. The Southwest Region (Region 2) has the highest number of NWRS units with injection wells (11 NWRS units) and the highest total number of injection wells (161 wells). As wells become less productive in other regions, dry holes or unproductive oil and gas wells could be converted into injection wells for enhanced oil recovery or wastewater disposal.

The GAO (2003) reported 59 percent of wells in NWRS units as “inactive with an unknown number of these wells abandoned but not plugged,” but did not provide the number of abandoned wells. Unplugged and improperly plugged wells are a potential source of groundwater contamination and can serve as a pathway for oil and other hydrocarbons and brine to reach the surface and contaminate soils, vegetation, and surface waters. Nearby hydraulic fracturing operations at new or existing well sites can force oil, brine, and fracturing fluids into aquifers or the surface through unplugged and improperly plugged wells. The Interstate Oil and Gas

Compact Commission (IOGCC) defines an inactive or abandoned well as “orphan” if the well is not producing or injecting fluids, does not have approval from the appropriate state regulatory agency to remain inactive, and if the operator is unknown or insolvent (IOGCC 2008). Vegetation can obscure orphan wells with no surface markers or visible equipment such as pump jacks. Well casing extending above the surface presents a safety risk to refuge staff and the public and can impede or damage equipment such as vehicles or mowers. Additionally, unplugged orphan wells can increase the risk and intensity of wildfires (IOGCC 2008). The IOGCC states that “many wells pre-dating 1952 were probably plugged improperly” as cement plugs from that time period “were not always effective as their compounds lacked the chemical components to withstand down-hole temperatures and pressure” and thus, probably failed to harden and seal the wells properly (IOGCC 2008). The number of orphan wells on NWRS units remains unknown.

Environmental effects of oil and gas E&P activities remain unchanged as those reported in 2003 (GAO 2003). The frequency of oil operator noncompliance with state oil and gas regulations as well as the number of oil and brine spills in NWRS units remains unknown. Oilfield brine spills generally cause long-term impacts to soils and groundwater and are difficult to remediate (Preston et. al. 2013). Existing vegetation in areas subjected to a brine spill will die as the saline conditions in the contaminated soil inhibit water uptake by plant roots. A brine spill onto clay soils alters the soil structure by clogging soil pores, thus, creating an impermeable hard pan (Harris et. al. 2005). Erosion eventually results from the brine-impacted soil’s inability to support vegetation and absorb water from precipitation. These conditions are slower to recover than impacts by E&P oil spills because unlike E&P oil spills, microbial decomposition, leaching, and volatilization will not restore the soil to conditions that will support vegetation (Jager et. al. 2005). These areas, also known as “salt scald,” remain as permanent scars on the landscape.

The rate of E&P oil and brine spill incidents ranges from 1 spill for every 53 active wells to 1 spill for every 76 active wells (Fisher and Sublette 2005) (NDDH 2014). Fisher and Sublette (2005) reviewed E&P spill incident reports in Oklahoma and found the average size of E&P-associated spills ranged from 34 to 46 bbl of oil and 89 to 158 bbl of brine per spill. On average, E&P operations resulted in the release of 62,000 bbl of oil and 146,000 bbl of brine. Fisher and Sublette (2005) found that crude oil and brine made up 76 percent of all fluids released from E&P facilities, with 34 percent of the spills causing injury to surface water, soil, crops, livestock, fish, or wildlife. Although states like Oklahoma and North Dakota maintain records on the number of E&P-associated spills, not all states track the smaller oil and brine spills that do not result in some impact on surface waters.

Advances in oil and gas exploration and production technology have made previously uneconomical oil and gas plays, such as shale oil and shale gas, economically viable to extract.

Consequently, the development of shale oil and shale gas plays, in particular the Bakken in North Dakota and Eastern Montana and the Marcellus in Ohio, West Virginia, Pennsylvania, and New York, could impact NWRS lands in these states. Oil and gas exploration and drilling in prospective shale plays like the Tuscaloosa marine shale in central Louisiana could also impact several NWRs. Bogue Chitto, Cat Island, Catahoula, Grand Cote, Lake Ophelia, and St. Catherine's Creek NWRs are located in the Tuscaloosa marine shale play. The development of these shale plays will most likely involve the use of horizontal drilling and hydraulic fracturing, requiring large well pads and large quantities of water. The construction of new well pads and compaction of the sites can increase precipitation runoff and can cause erosion and siltation of streams and wetlands (McBroom et. al. 2012). Intensive water use and the risk of hydraulic fracturing flowback fluid spills would also pose a risk to NWRS resources.

Conclusions and Management Recommendations

The updated data obtained on oil and gas wells and pipelines in and adjacent to NWRS lands will assist the Service in determining follow-up assessments on the status of these wells and impacts to individual NWRS units. Although the updated data is useful, errors are inherent in the collection of data on thousands of wells due to inaccurate data transcription, typing errors, errors made during the data collection process, programming errors, unclear definitions for data items, or not adhering to the data collection protocol. Given the likelihood of errors, the Service should, at a minimum, conduct follow-up assessments on NWRS units with oil and gas wells with no data on well status (status = N/A). Deep Fork NWR, Felsenthal NWR (Arkansas), and Ohio River Islands NWR (West Virginia) have the most wells with no data on status, 252, 57, and 23 wells, respectively. The Service should also follow-up on wells designated as inactive. Sixty-nine percent of wells designated as inactive are located in NWRS units in Louisiana with one-quarter of those wells in the Upper Ouachita NWR. It is not known if inactive wells and wells with no data on well status are plugged. The Interstate Oil and Gas Compact Commission (IOGCC) states that "*many wells pre-dating 1952 were probably plugged improperly*" as cement plugs from that time period "*were not always effective as their compounds lacked the chemical components to withstand down-hole temperatures and pressure*" and thus, probably failed to harden and seal the wells properly (IOGCC 2008). Unplugged wells and improperly plugged wells can provide a pathway for oil and other hydrocarbons, well stimulation chemicals, and oilfield brine to aquifers or to the surface and contaminate ground water, water wells, soils, vegetation, and surface waters. In addition to the environmental risks, unplugged and improperly plugged wells pose a risk to public safety as surface seeps can increase risk and intensity of wildfires (IOGCC 2008). Updated information on well status should be obtained from the pertinent state oil and gas regulatory agencies.

The Service should conduct onsite ecological assessments on NWRS units with oil and gas activities to determine impacts from brine, oil, and other hydrocarbon spills, as well as habitat

alteration, and other impacts associated with the exploration and production of oil and gas. The onsite ecological assessments should also identify abandoned oil and gas facilities necessitating equipment removal and site restoration. Several states have programs for the removal of abandoned oil and gas equipment and site restoration. The onsite ecological assessments should determine the nature and extent of contamination, the sources, and causes of spills and releases, injury to NWRS resources, and corrective measures to prevent continued or potential harm to NWRS units. Refuge managers should forward information on abandoned oil and gas facilities requiring removal and site restoration to the appropriate state regulatory agencies and oil operators and request removal of equipment and site restoration.

Refuge managers should also work with oil operators to develop operation and maintenance plans for existing oil and gas production facilities with the goal of protecting NWRS resources. The operation and maintenance plans should include, at a minimum, spill prevention, control, and countermeasures (SPCC); waste management and disposal; procedures for reporting spills or releases to the refuge manager; and procedures for routine maintenance of the facilities and for maintenance of the well using workover rigs or other heavy equipment. The Service should work with pipeline operators to ensure that they develop spill contingency plans for pipelines traversing NWRS units or for pipelines crossing waterways upstream of NWRS unit boundaries.

The NWRS's mission is to "administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Wildlife conservation, the primary purpose of the NWRS, is challenging at best and severely diminished at worst with oil and gas exploration and production activities on NWRS units. The Service has made much progress in training refuge staff in the oversight of oil and gas activities with the goal of avoiding or minimizing impacts to NWRS resources. However, given the increase in oil and gas development, the need for Service authority to "*require reasonable permit conditions and oversee oil and gas activities*" as recommended by the GAO (2003) to "*strengthen and provide greater consistency*" in management and oversight and "*to protect the public's surface interests*" is justified.

Literature Cited

- Advanced Resources International. 2006. Basin Oriented Strategies for CO2 Enhanced Oil Recovery: Onshore Gulf Coast. Prepared for U.S. Dept of Energy, Office of Fossil Energy – Office of Oil and Natural Gas. Available: http://www.adv-res.com/pdf/Basin%20Oriented%20Strategies%20-%20Onshore_Gulf_Coast.pdf
- [AOPL] Association of Oil Pipe Lines. 2007. Pipeline 101, Overview. Available: <http://www.pipeline101.com/Overview/energy-pl.html>
- Boyd, D.T. 2002. Oklahoma oil: past, present, and future. Oklahoma Geology Notes 62 (3):97-106. Available: <http://www.ogs.ou.edu/fossilfuels/pdf/OKOilNotesPDF.pdf>
- [EIA] U.S. Energy Information Administration. 2011. Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays. Available: <http://www.eia.gov/analysis/studies/usshalegas/>
- [EIA] U.S. Energy Information Administration. 2012. Distribution and production of oil and gas wells by state. Available: http://www.eia.gov/pub/oil_gas/petrosystem/petrosysog.html.
- [EPA] U.S. Environmental Protection Agency. 2013. Land-based oil and gas extraction – data dictionary. Online Tracking Information System, Office of Enforcement and Compliance, Washington, DC. Available: http://www.epa-otis.gov/knowledge_base/oilandgas/data_dictionary_oil_gas.html
- Fisher J.B., K.L Sublette. (2005) Environmental releases from exploration and production operations in Oklahoma: Type, volume, causes, and prevention. Environmental Geosciences 12: 89-99.
- [FWS] U.S. Fish and Wildlife Service. 2006. Comprehensive Conservation Plan, St. Catherine Creek National Wildlife Refuge, Adams and Wilkinson Counties, Mississippi. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 156 pp.
- [FWS] U.S. Fish and Wildlife Service. 2008a. Comprehensive Conservation Plan, Upper Ouachita and Handy Brake National Wildlife Refuges, Including Farm Service Agency Tracts. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 207 pp.
- [FWS] U.S. Fish and Wildlife Service. 2008b. Comprehensive Conservation Plan, Delta and Breton National Wildlife Refuges, St. Bernard and Plaquemines Parishes, Louisiana. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 140 pp.
- [GAO] U.S. General Accounting Office. 2003. National Wildlife Refuges – Opportunities to Improve the Management and Oversight of Oil and Gas Activities on Federal Lands. GAO-03-517, Washington, DC. 73 pp.

- Harris T.M., J.B. Tapp, and K.L. Sublette. 2005. Remediation of oil-field brine-impacted soil using a subsurface drainage system and hay. *Environmental Geosciences* 12(2):101-113.
- [IOGCC] Interstate Oil and Gas Compact Commission. 2008. Protecting Our Country's Resources: The State's Case. Interstate Oil and Gas Compact Commission Oklahoma City, OK 62 pp. Available: <http://iogcc.publishpath.com/Websites/iogcc/pdfs/2008-Protecting-Our-Country's-Resources-The-States'-Case.pdf>
- Jager H.I., R.A. Efroymsen, K.L. Sublette, T.L. Ashwood. (2005). Unnatural landscapes in ecology: generating the spatial distribution of brine spills. *Environmetrics* 16:687-698
- Kim, E.M. and S.C. Ruppel. 2005. Oil and gas production in Texas. Bureau of Economic Geology, Univ. Texas, Austin, TX. Available: <http://www.beg.utexas.edu/UTopia/images/pagesizemaps/oilgas.pdf>
- Louisiana Geological Survey. 2001. Jennings Field – the birthplace of Louisiana's Oil Industry. Public Information Series No. 9. 27 pp. Available: <http://www.lgs.lsu.edu/deploy/uploads/9jennings.pdf>
- McBroom M., T. Thomas and Y. Zhang. Soil erosion and surface water quality impacts of natural gas development in East Texas, USA. *Water* 4: 944-958.
- Natural Gas Supply Association. 2011. Natural Gas Regulations, The History of Regulation. Available: <http://naturalgas.org/regulation/history/>
- NDDH (North Dakota Department of Health) (2014) Environmental incident reports. North Dakota Dept of Health, Bismarck, ND. <http://www.ndhealth.gov/ehs/spills/>. Accessed 4 March 2014
- Preston T.M., T.L. Chesley-Preston, and J.N. Thamke. 2013. A GIS-based vulnerability assessment of brine contamination to aquatic resources from oil and gas development in eastern Sheridan County, Montana. *Science of the Total Environment*. Available: <http://pubs.er.usgs.gov/publication/70048186>
- Williams, P. 2005. Prolific and Proud: A Century of E&P in Louisiana. Louisiana Proud Past; Promising Future. A Supplement to Oil and Gas Investor. Hart Energy Publishing, Houston, TX. 2 pp. Available: <http://www.oilandgasinvestor.com/pdf/LASupplement.pdf>

Appendix 1

Number of oil and gas exploration and production wells and interstate pipelines on National Wildlife Refuge System fee simple lands (i.e., absolute title to the surface land).

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
Northwest Region (1)	0	0	0	0	0	8
<i>Oregon</i>						4
Malheur National Wildlife Refuge						1
McNary National Wildlife Refuge						1
Siletz Bay National Wildlife Refuge						1
Tualatin River National Wildlife Refuge						1
<i>Washington</i>						4
McNary National Wildlife Refuge						2
Nisqually National Wildlife Refuge						1
Umatilla National Wildlife Refuge						1
Southwest Region (2)	358	282	26	308	974	182
<i>Arizona</i>				1	1	14
Buenos Aires National Wildlife Refuge				1	1	
Havas National Wildlife Refuge						10
Kofa National Wildlife Refuge						4
<i>New Mexico</i>	5	10		2	17	6
Bitter Lake National Wildlife Refuge	5	10			15	2
Bosque Del Apache National Wildlife Refuge						1
Maxwell National Wildlife Refuge						1
Sevilleta National Wildlife Refuge				2	2	2
<i>Oklahoma</i>	62	149		255	466	9
Deep Fork National Wildlife Refuge	26	147		227	400	4
Little River National Wildlife Refuge		1		7	8	1
Optima National Wildlife Refuge	13			2	15	
Salt Plains National Wildlife Refuge	11	1		1	13	2
Sequoyah National Wildlife Refuge				4	4	1
Tishomingo National Wildlife Refuge	2			12	14	
Washita National Wildlife Refuge	10			2	12	1
<i>Texas</i>	291	123	26	50	490	153
Anahuac National Wildlife Refuge	5	7		3	15	
Aransas National Wildlife Refuge	58	8	4	2	72	2
Atwater Prairie Chicken National Wildlife Refuge	19	1			20	5
Big Boggy National Wildlife Refuge	1				1	
Brazoria National Wildlife Refuge	12	4	3		19	29
Buffalo Lake National Wildlife Refuge						1
Caddo Lake National Wildlife Refuge	2	2		1	5	2
Hagerman National Wildlife Refuge	3	71	4	38	116	1
Laguna Atascosa National Wildlife Refuge	11				11	1
Lower Rio Grande Valley National Wildlife Refuge	139	23	10	3	175	23

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
McFaddin National Wildlife Refuge	14	4		2	20	3
Muleshoe National Wildlife Refuge						1
Neches River National Wildlife Refuge						3
San Bernard National Wildlife Refuge	24	3	2	1	30	58
Texas Point National Wildlife Refuge			2		2	4
Trinity River National Wildlife Refuge	3		1		4	20
Midwest Region (3)	2	7		93	102	98
Illinois						8
Crab Orchard National Wildlife Refuge						2
Port Louisa National Wildlife Refuge						2
Upper Mississippi River National Wildlife And Fish Refuge						4
Indiana		7		89	96	7
Big Oaks National Wildlife Refuge				5	5	
Muscatatuck National Wildlife Refuge				1	1	
Patoka River National Wildlife Refuge		7		83	90	7
Iowa						20
Iowa Wetland Management District						14
Neal Smith National Wildlife Refuge						1
Port Louisa National Wildlife Refuge						2
Upper Mississippi River National Wildlife And Fish Refuge						3
Michigan	2				2	18
Kirtlands Warbler Wildlife Management Area	2				2	17
Shiawassee National Wildlife Refuge						1
Minnesota						33
Crane Meadows National Wildlife Refuge						1
Detroit Lakes Wetland Management District						1
Fergus Falls Wetland Management District						7
Litchfield Wetland Management District						2
Minnesota Valley National Wildlife Refuge						5
Minnesota Valley Wetland Management District						2
Morris Wetland Management District						5
Sherburne National Wildlife Refuge						1
Upper Mississippi River National Wildlife And Fish Refuge						1
Windom Wetland Management District						8
Missouri				4	4	
Big Muddy National Fish And Wildlife Refuge				4	4	
Ohio						1
Ottawa National Wildlife Refuge						1

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
Wisconsin						11
Leopold Wetland Management District						7
St. Croix Wetland Management District						2
Upper Mississippi River National Wildlife And Fish Refuge						1
Whittlesey Creek National Wildlife Refuge						1
Southeast Region (4)	1709	530	16	1172	3427	190
Alabama				14	14	4
Cahaba River National Wildlife Refuge				14	14	
Grand Bay National Wildlife Refuge						2
Wheeler National Wildlife Refuge						2
Arkansas	8	51		6	65	25
Bald Knob National Wildlife Refuge	3				3	13
Big Lake National Wildlife Refuge						1
Cache River National Wildlife Refuge	2				2	3
Felsenthal National Wildlife Refuge	3	48		6	57	1
Logan Cave National Wildlife Refuge						2
Overflow National Wildlife Refuge		1			1	1
Pond Creek National Wildlife Refuge						1
White River National Wildlife Refuge		2			2	3
Florida				4	4	1
Florida Panther National Wildlife Refuge				2	2	
Lake Wales Ridge National Wildlife Refuge						1
National Key Deer Refuge				1	1	
Ten Thousand Islands National Wildlife Refuge				1	1	
Georgia						1
Savannah National Wildlife Refuge						1
Kentucky				1	1	3
Clarks River National Wildlife Refuge						3
Reelfoot National Wildlife Refuge				1	1	
Louisiana	1693	349	16	772	2830	130
Atchafalaya National Wildlife Refuge	9	12	2	23	46	8
Bayou Cocodrie National Wildlife Refuge				49	49	1
Bayou Sauvage National Wildlife Refuge				4	4	10
Bayou Teche National Wildlife Refuge	14	3		18	35	26
Big Branch Marsh National Wildlife Refuge				4	4	5
Black Bayou Lake National Wildlife Refuge	78			7	85	7
Bogue Chitto National Wildlife Refuge						1
Breton National Wildlife Refuge				3	3	2
Cameron Prairie National Wildlife Refuge				14	14	3

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
Cat Island National Wildlife Refuge	2			3	5	
Catahoula National Wildlife Refuge	1	20		54	75	
D'Arbonne National Wildlife Refuge	183			100	283	8
Delta National Wildlife Refuge	52	214	11	86	363	14
Grand Cote National Wildlife Refuge				2	2	1
Handy Brake National Wildlife Refuge						6
Lacassine National Wildlife Refuge	32	5	1	42	80	14
Lake Ophelia National Wildlife Refuge		5		51	56	
Mandalay National Wildlife Refuge	13	5		25	43	4
Red River National Wildlife Refuge	6	24		27	57	8
Sabine National Wildlife Refuge	22	23	2	51	98	10
St. Catherine Creek National Wildlife Refuge				6	6	
Tensas River National Wildlife Refuge	1	36		75	112	
Upper Ouachita National Wildlife Refuge	1280	2		128	1410	2
Mississippi	8	130		375	513	16
Dahomey National Wildlife Refuge						4
Grand Bay National Wildlife Refuge				1	1	2
Holt Collier National Wildlife Refuge						1
Mississippi Sandhill Crane National Wildlife Refuge				1	1	2
Panther Swamp National Wildlife Refuge				2	2	4
St. Catherine Creek National Wildlife Refuge	8	130		370	508	
Sam D. Hamilton Noxubee National Wildlife Refuge						3
Yazoo National Wildlife Refuge				1	1	
North Carolina						6
Pee Dee National Wildlife Refuge						3
Pocosin Lakes National Wildlife Refuge						2
Roanoke River National Wildlife Refuge						1
South Carolina						3
Carolina Sandhills National Wildlife Refuge						1
Ernest F. Hollings Ace Basin National Wildlife Refuge						1
Savannah National Wildlife Refuge						1
Tennessee						1
Hatchie National Wildlife Refuge						1
Northeast Region (5)	7	4	11	28	50	25
Massachusetts						2
Assabet River National Wildlife Refuge						1
Great Meadows National Wildlife Refuge						1

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
New Jersey						6
Cape May National Wildlife Refuge						1
Great Swamp National Wildlife Refuge						4
Wallkill River National Wildlife Refuge						1
New York				1	1	5
Montezuma National Wildlife Refuge				1	1	5
Pennsylvania	2				2	8
Erie National Wildlife Refuge	2				2	1
John Heinz National Wildlife Refuge At Tinicum						7
Virginia						2
Featherstone National Wildlife Refuge						1
Great Dismal Swamp National Wildlife Refuge						1
West Virginia	5	4	11	27	47	2
Canaan Valley National Wildlife Refuge	4			3	7	1
Ohio River Islands National Wildlife Refuge	1	4	11	24	40	1
Mountain - Prairie Region (6)	42	37	2	41	122	60
Colorado				3	3	7
Arapaho National Wildlife Refuge						1
Baca National Wildlife Refuge				2	2	
Monte Vista National Wildlife Refuge						1
Rocky Flats National Wildlife Refuge						2
Rocky Mountain Arsenal National Wildlife Refuge				1	1	3
Kansas	1	25	1		27	9
Flint Hills National Wildlife Refuge						7
Quivira National Wildlife Refuge	1	25	1		27	2
Montana	40	9		34	83	4
Benton Lake National Wildlife Refuge				2	2	
Benton Lake Wetland Management District	4			7	11	1
Bowdoin National Wildlife Refuge	1			1	2	
Bowdoin Wetland Management District	21			2	23	
Charles M. Russell National Wildlife Refuge						2
Hailstone National Wildlife Refuge				1	1	
Halfbreed Lake National Wildlife Refuge	1			4	5	
Hewitt Lake National Wildlife Refuge	13			1	14	
Lake Mason National Wildlife Refuge				2	2	
Medicine Lake National Wildlife Refuge		2		3	5	
Northeast Montana Wetland Management District		7		11	18	1
Nebraska						6
Rainwater Basin Wetland Management District						6

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
North Dakota			1		1	16
Audubon Wetland Management District						2
Chase Lake Wetland Management District						2
Devils Lake Wetland Management District						5
J. Clark Salyer Wetland Management District						2
Lake Ilo National Wildlife Refuge			1		1	
Long Lake Wetland Management District						1
Sullys Hill National Game Preserve						1
Valley City Wetland Management District						3
South Dakota						10
Huron Wetland Management District						2
Lake Andes Wetland Management District						1
Madison Wetland Management District						4
Sand Lake Wetland Management District						2
Waubay Wetland Management District						1
Utah	1	3		3	7	2
Bear River Migratory Bird Refuge				3	3	1
Colorado River Wildlife Management Area	1	2			3	
Ouray National Wildlife Refuge		1			1	1
Wyoming				1	1	6
Bamforth National Wildlife Refuge						1
Mortenson Lake National Wildlife Refuge				1	1	1
Pathfinder National Wildlife Refuge						3
Seedskaadee National Wildlife Refuge						1
Alaska Region (7)	75	66	4	54	199	7
Alaska	75	66	4	54	199	7
Alaska Peninsula National Wildlife Refuge				5	5	
Becharof National Wildlife Refuge				2	2	
Kenai National Wildlife Refuge	75	66	4	46	191	7
Yukon Delta National Wildlife Refuge				1	1	
Pacific Southwest Region (8)	8	45		75	128	25
California	8	45		70	123	24
Antioch Dunes National Wildlife Refuge						1
Bitter Creek National Wildlife Refuge				12	12	1
Butte Sink Wildlife Management Area				1	1	
Cibola National Wildlife Refuge						1
Coachella Valley National Wildlife Refuge						1
Colusa National Wildlife Refuge	1			3	4	

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total	Pipelines
Delevan National Wildlife Refuge	1			7	8	
Don Edwards San Francisco Bay National Wildlife Refuge						1
Ellicott Slough National Wildlife Refuge						1
Grasslands Wildlife Management Area				6	6	
Guadalupe-Nipomo Dunes National Wildlife Refuge		2		1	3	
Havasu National Wildlife Refuge						11
Hopper Mountain National Wildlife Refuge		17		2	19	
Humboldt Bay National Wildlife Refuge				1	1	
Kern National Wildlife Refuge				2	2	1
Merced National Wildlife Refuge				1	1	
North Central Valley Wildlife Management Area	6			22	28	
Pixley National Wildlife Refuge				1	1	1
Sacramento River National Wildlife Refuge						1
San Joaquin River National Wildlife Refuge				5	5	1
San Pablo Bay National Wildlife Refuge				1	1	
Seal Beach National Wildlife Refuge		26		4	30	1
Sutter National Wildlife Refuge						2
Tijuana Slough National Wildlife Refuge				1	1	
Nevada				5	5	1
Fallon National Wildlife Refuge				1	1	
Stillwater National Wildlife Refuge				4	4	1
Grand Total	2201	971	59	1771	5002	595

Appendix 2

Photographs of oil and gas exploration and production facilities on National Wildlife Refuge System fee simple lands fee simple lands (i.e., absolute title to the surface land).



Figure A2-1. Open-topped tank at oil production facility on Deep Fork NWR, OK. *P Ramirez/FWS Photo*



Figure A2-2. Abandoned wellhead at Deep Fork NWR, OK. *P Ramirez/FWS Photo*



Figure A2-3. Abandoned pump jack at Deep Fork NWR, OK. *P Ramirez /FWS Photo*



Figure A2-3. Inactive well at Hagerman NWR, TX. *P Ramirez /FWS Photo*



Figure A2-4. Inactive well at Tensas River NWR, LA. *P Ramirez/FWS Photo*



Figure A2-5. Saltwater disposal well (injection well) inundated by floodwaters at St. Catherine Creek NWR, MS. *P Ramirez/FWS Photo*



Figure A2-6. Oil production facility elevated above floodplain at Catahoula NWR, LA. *P Ramirez /FWS Photo*



Figure A2-7. Two-acre well pad at Atchafalaya NWR, LA. *P Ramirez /FWS Photo*



Figure A2-8. Gas well at Delta NWR, LA. *P Ramirez/FWS Photo*



Figure A2-9. Inactive oil and gas production infrastructure at Delta NWR, LA. *P Ramirez/FWS Photo*

An Assessment of State Oil and Gas Regulations

U.S. Fish and Wildlife Service
August 2013

Introduction

State oil and gas regulations vary extensively, but can be used to limit impacts on wildlife resources, in some cases. This report summarizes State oil and gas regulations, which (if available) were analyzed for specific criteria, and compared among each state.

Several sources were accessed for this report in addition to each State agency's oil and gas regulations. These include:

1. Interstate Oil and Gas Compact Commission (IOGCC);
2. State Review of Oil and Natural Gas Environmental Regulations (STRONGER); and
3. American Petroleum Institute (API).

Methods

The data used in this research were taken primarily from each State's oil and gas regulations. This included extracting information directly from either the State's administrative code or State statute, depending on which was available or more inclusive/detailed. For some States, both the administrative code and the State statute were used to supplement each other. The administrative code includes the rules written by the State's oil and gas agency, while State statutes are produced by the State legislature. Additionally, the oil and gas regulations for the U.S. territories of Puerto Rico, Guam, U.S. Virgin Islands, Marianas Islands, and American Samoa were researched and included in the States regulations matrix. Sources for State and territory regulations are cited in the States regulations matrix.

The second major source of information was the IOGCC, which is a "multi-State government agency...that works to ensure our nation's oil and natural gas resources are conserved and maximized" (IOGCC 2013). The IOGCC produced a summary of State statutes and regulations for its 38 member States. Information was taken directly from this summary and included in the State regulations matrix in this report. The summary did not include every State or every element to be researched, so it was used in conjunction with the data taken directly from State regulations to complete the matrix.

In order to clarify in the State regulations matrix whether the data came directly from State regulations or the IOGCC summary, the citations are color-coded: citations in black are from the IOGCC summary and citations in red are from the State regulation itself. The IOGCC summary did not provide citations for some of the elements. In such instances, if the same information was found directly in the regulation, then it is cited in the matrix as being taken from the regulation (red) instead of from the IOGCC report.

The data collected from the IOGCC report and the State regulations were compiled into an excel spreadsheet (referred to in this report as the "State regulations matrix"). The spreadsheet includes 35 elements divided into 9 different categories (Table 1). These elements were chosen based on recommendations from the Service's oil and gas team and include a selection of elements from the IOGCC summary and the *Resources for the Future* report. They were determined to be the most

appropriate oil and gas elements relevant for management of oil and gas. These elements were used as the foundation to evaluate State regulations by drawing comparisons, identifying similarities among States, and determining areas in which State regulations are generally lacking.

The *Resources for the Future* report was also used as a source for four of the elements included in the State regulations matrix. While this report is primarily concerned with shale gas development, several of the regulatory elements evaluated relate to oil and gas drilling. The elements taken from this report include pit liner requirements, water withdrawal regulations for hydraulic fracturing, maximum time a well can remain idle, and whether temporary well abandonment is allowed. The report examined 31 States; information for the remaining States, when available in the State regulation, was added to the matrix.

Drilling Requirements	Drilling Site Completion
License Required	Completion Requirements
Permit Required/Fees	Site Reclamation/Restoration/Remediation
Bond Purpose/Type	Reclamation Fees
Bond Amounts	Removal of Abandoned Equipment
Land Leasing Information	Maximum Time a Well Can Remain Idle ¹
Site Selection/Preparation	Temporary Well Abandonment ¹
Setback Requirements	Well Plugging Requirements
Spacing Requirements	Plugging/Abandonment Costs
Production Activities	Noncompliance
Oil Production	Penalty/Fees/Violations
Gas Production	Noncompliance Procedures
Pit Liner Requirements ¹	Well Shut-in from Repeated Noncompliance
Pit Use (Reserve Pits)	Surface Owner Impacts
Pit Closure (Reserve Pits)	Addresses Impacts to Surface Owner
Pit Use (Produced Water)	Requires Surface Owner's Permission/Notification
Pit Closure (Produced Water)	Access Fees
Oil and Gas Transportation Method	Wildlife Impacts
Hydraulic Fracturing	Addresses Impacts to Wildlife Resources/Wildlife Protection Requirements
Hydraulic Fracturing Requirements	Emergency Reporting
Water Source for Fracking Requirements	Brine Spill Reporting/Cleanup Requirements
Water Withdrawal Regulations ¹	Oil Spill Reporting/Cleanup Requirements

¹These categories were taken from the *Resources for the Future* report (Richardson et al. 2013).

Table 1. These 35 elements were used to assess the States' regulations and are included in the State regulations matrix.

In addition to State regulations, oil and gas regulations for the Federal land management agencies within the Department of the Interior (DOI) and several other Federal agencies were examined. The DOI agencies used in this report include the Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and Bureau of Reclamation (BOR). Other agencies include the Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), U.S. Forest Service (USFS), and the U.S. Army Corps of Engineers (USACE). Similar to the State regulations, the Federal agencies' regulations are assembled in a matrix and include the same elements as the State regulations matrix, in addition to several others.

Finally, the State regulations were compared to the State Review of Oil and Natural Gas Environmental Regulations (STRONGER) guidelines. STRONGER is "a non-profit, multi-stakeholder organization whose purpose is to assist states in documenting the environmental regulations associated with the exploration, development and production of crude oil and natural gas" (STRONGER 2013). STRONGER has produced several versions of guidelines for State regulatory programs, and has done its own review of 22 States' regulations to determine whether they meet their guidelines. Of these

States, 10 have done follow-up reviews, which determine if they have met the recommendations made in the initial STRONGER report. When available, the follow-up reports were used in this evaluation, while the initial reviews were used for the remaining States. For this report, the State reviews were examined (Table 4), which indicate the degree to which each guideline was met (fully met/partially met/not met). The actual guidelines were not used in this evaluation; rather, the State reviews that STRONGER did were used as they have already determined if the regulations have met the guidelines. STRONGER also did reviews for six States' hydraulic fracturing regulations, which are also included in this report.

Results

Forty-three States have oil and gas regulations¹. Most States have an oil and gas commission/minerals division, or their oil and gas activities are regulated by the State natural resources/environment department. Twenty-six States have hydraulic fracturing regulations, with 5 States currently developing regulations. The States' regulations vary greatly. Table 2 represents the number of States that have each element included in their oil and gas regulations, demonstrating the inconsistency in the regulatory elements in State oil and gas regulations.

The assessment of STRONGER guidelines revealed whether State regulations have met specific standards developed by STRONGER. Twenty-two States' regulations were compared to the guidelines (Table 4), in addition to six States' hydraulic fracturing regulations (Table 5). While not every standard was a part of all the States' regulations, this assessment gives a general idea of which regulations generally meet STRONGER guidelines. The results vary among categories (administrative, technical, abandoned sites, wildlife/environmental impacts, naturally occurring radioactive material, and stormwater management) and whether the States met the standards on a scale of 1–3 (met/partially met/not met). For a standard to have been met, either STRONGER directly Stated in their report that it was met or did not provide any recommendations; partially met standards included those that have parts that both met and did not meet STRONGER standards; and a standard was determined not to have been met if it was directly Stated by STRONGER or none of the parts to the standard had been met. For example, of the 18 States whose permitting regulations were mentioned in STRONGER's review, 4 had met the permitting standard, 7 had partially met it, and 7 had not met the standard. Refer to Table 5 for the total numbers of States that met the guidelines for each category.

¹ The States for which oil and gas regulations could not be identified include Hawaii, Maine, Massachusetts, Minnesota, New Hampshire, New Jersey, and Rhode Island. Minnesota does have a statute that allows the State natural resources department to create oil and gas regulations, and Rhode Island has a statute for oil spills, both of which are included in the States regulations matrix, but are considered in this report to not have regulations.

Number of States with Each Regulatory Element

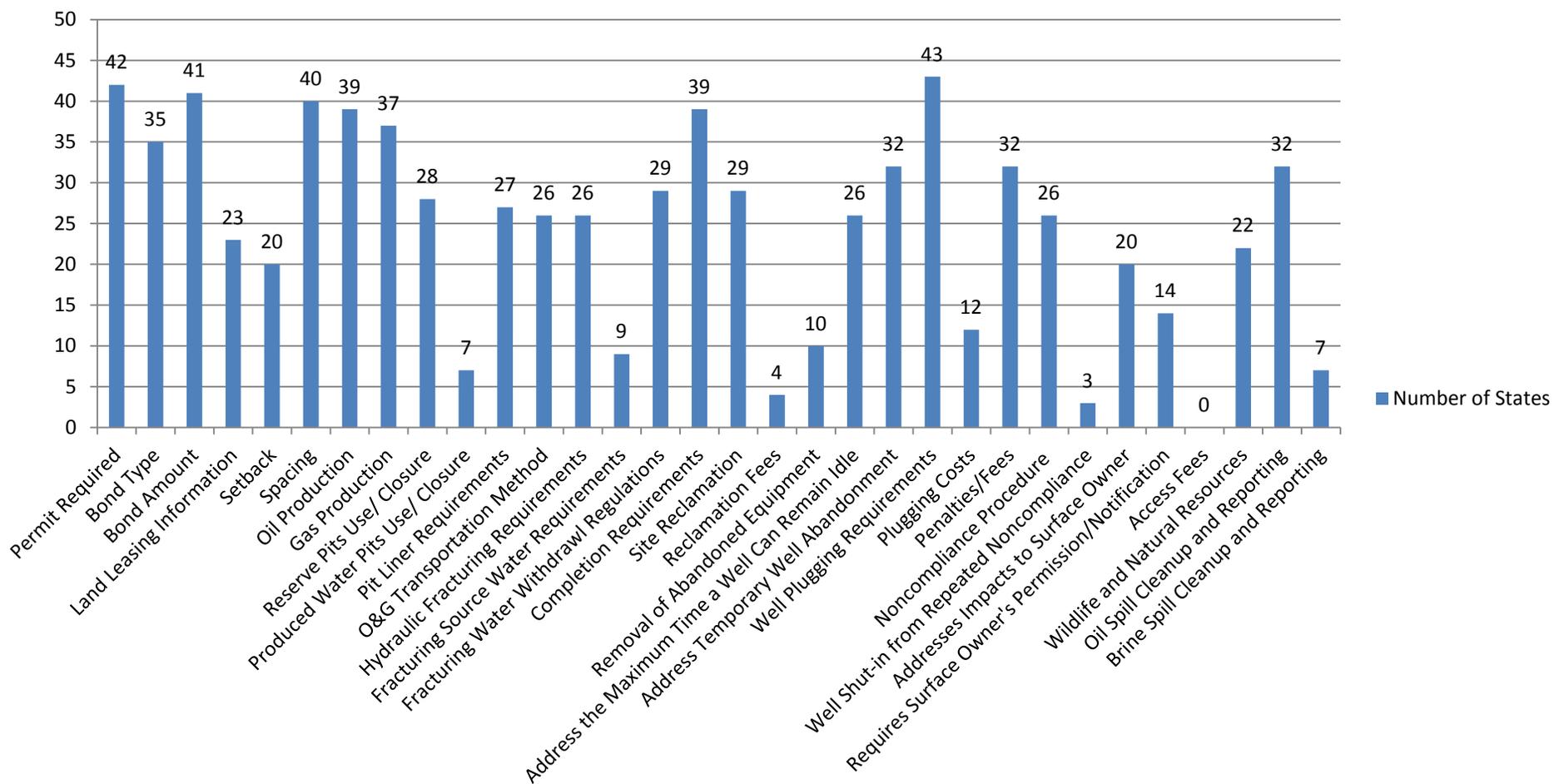


Table 2. This table shows the number of State regulations that were assessed using the 35 elements.

Number of Federal Agencies with Each Regulatory Element

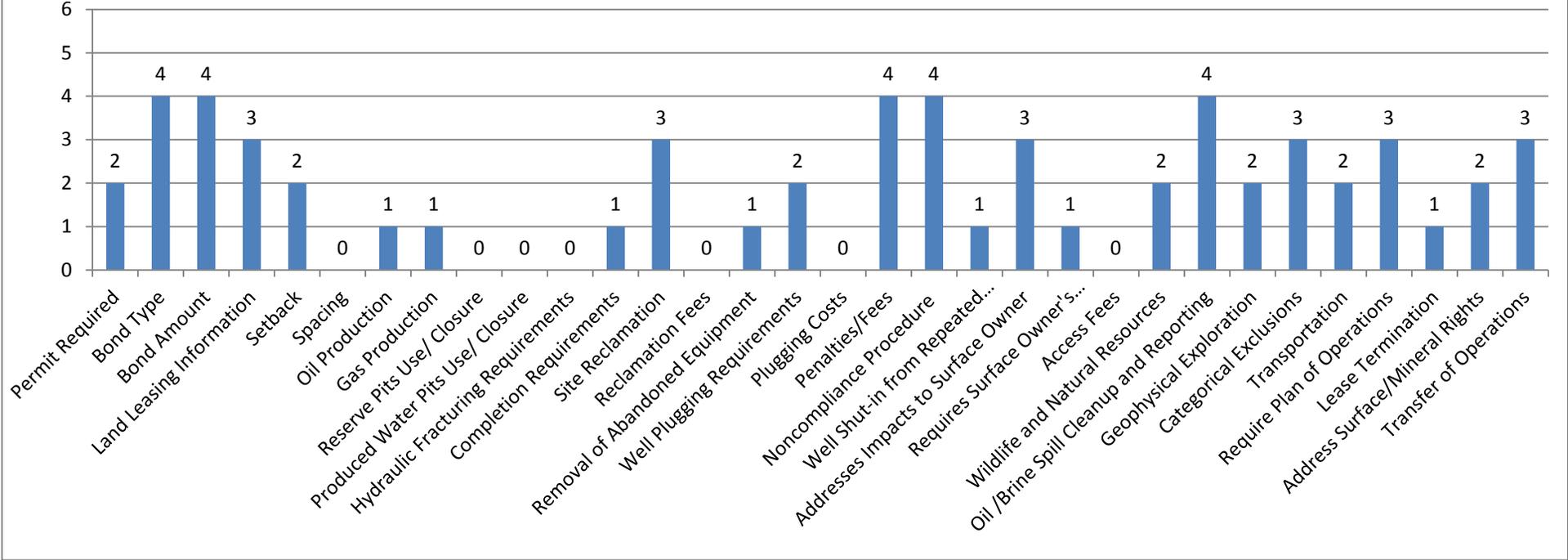


Table 3. This table shows the number of federal agency regulations that were assess for each element. The elements used for the federal agencies differ slightly from those used for the State regulations.

	Alaska	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	New Mexico
Source	Alaska State Initial Review; 1992 (no follow-up review was done)	Arkansas Initial Review; 1992	CA Follow-up State Review; 2002	Colorado State Review; 1996	Illinois State Review; 1996	Indiana State Review; 2005	Kansas State Review; 1993	Kentucky State Follow-Up Review; 2006	Louisiana State Follow-up Review; 2004	Michigan Initial State Review, 2003	New Mexico Follow-up and Supplemental Review, 2001
Version of STRONGER guidelines used for comparison	1990	1990	2000	1994	1994	2000	1990	2000	2000	2000	2000
Administrative											
Permitting	3	2	1	2	2	3	2	1			1
Bond Standards	1	2	1	2	2	1	3		2		1
Bond/Surety Amounts		2	1	1		1	3				
Operating Plan Required											
Brine Spill Reporting/Cleanup Requirements											
Oil Spill Reporting/Cleanup Requirements	2	3	1	2			3	1	2		1
Noncompliance-Penalty/Fees/Violations	3	3	3	1	3		3	3	2		3
Noncompliance Procedures Requires Surface Owner's Permission/Notification	3	3		1	2	1	2				2
								3			
Technical											
Pit Use (Reserve Pits)/standards	2	2	3	2	3	3	2	3	2	1	2
Pit Closure (Reserve Pits)	1	1	1	2		3	2	3			3
Landspreading	1	2		3	2	3	3	3	3		1
Roadspreading	1	1		3	3		3				
Burial/Landfilling		3		3	2	3	2	3			3
Site Reclamation/Restoration Requirements/Remediation											
Removal of Abandoned Equipment											
Well Plugging Requirements											2
Plugging/Abandonment Costs			1					3			
Pollution prevention/prohibition	2										1
Waste disposal/E&P waste regulations	2	2	2	2	2		2	2		2	1
Abandoned Sites											
Abandoned Sites				3	3	1		3	3	1	1
Wildlife/Environmental Impacts											
Addresses Impacts to Wildlife Resources/Wildlife Protection Requirements	3	2						3	3		
General environmental impacts	1			2				1	1	1	3
Naturally Occurring Radioactive Material											
Naturally Occurring Radioactive Material	3		2		2	1		3	1	2	1
Stormwater Management											
Stormwater Management								2			

	New York	North Carolina	North Dakota	Ohio	Oklahoma	Pennsylvania	Tennessee	Texas	Virginia	West Virginia	Wyoming
Source	New York State Initial Review, 1994	North Carolina State Review, 2012	North Dakota Initial State Review, 1997	Ohio Follow-up and Supplemental Review, 2005	Oklahoma Follow-up and Supplemental Review, 2005	Pennsylvania Follow-up State Review, 2004	Tennessee Initial State Review, 2007	Texas State Review Follow Up, 2003	Virginia Initial State Review, 2004	West Virginia Follow-Up State Review; 2003	Wyoming Follow-up State Review, 1994
Version of STRONGER guidelines used for comparison	1990	2010	1994	2000	2000	2000	2000	2000	2000	2000	1994
Administrative											
Permitting	3	2	3	1	3		2	3	3	2	
Bond Standards	3			2	2			1			1
Bond/Surety Amounts		2	1				2	1			
Operating Plan Required								2			
Brine Spill Reporting/Cleanup Requirements				1			3				
Oil Spill Reporting/Cleanup Requirements	1	2	2	2	1			3	2	1	1
Noncompliance-Penalty/Fees/Violations	2		3	1	1		3	1	3		3
Noncompliance Procedures Requires Surface Owner's Permission/Notification	1				3		3		1	1	2
					1			3			
Technical											
Pit Use (Reserve Pits)/standards	2	3	2	1	1	2	2	3	1	1	1
Pit Closure (Reserve Pits)	2				1			3	2		1
Landspreading	2	2	3		3			2	2	1	
Roadspreading	3		3		2			3	2	1	
Burial/Landfilling	1	3						3		1	
Site Reclamation/Restoration Requirements/Remediation			3		1				1		
Removal of Abandoned Equipment					1						
Well Plugging Requirements											
Plugging/Abandonment Costs											
Pollution prevention/prohibition								1			
Waste disposal/E&P waste regulations	3	2		1	2		3	1	1	3	3
Abandoned Sites											
Abandoned Sites		3		1	2	2	2	2	3	2	
Wildlife/Environmental Impacts											
Addresses Impacts to Wildlife Resources/Wildlife Protection Requirements					3						
General environmental impacts	3				2		3			1	
Naturally Occurring Radioactive Material											
Naturally Occurring Radioactive Material	3	3	2	3	3	1	3	2	2	3	
Stormwater Management											
Stormwater Management		2					1		1		

Table 4 (page 7&8). This table (divided into two parts) illustrates which States have met STRONGER oil and gas standards. The values 1–3 indicate the degree to which the regulation has met STRONGER standards:

- 1= The standard was determined to be met through initial review, and no recommendation was needed
- 2= At least one standard was met for a category (some categories have multiple regulations, some of the regulations might not meet the standard)
- 3= None of the standards were met for a category, or it was expressly Stated that the standard has not yet been met

	Arkansas	Colorado	Louisiana	Ohio	Oklahoma	Pennsylvania
Source	Arkansas Hydraulic Fracturing Review, 2012	Colorado Hydraulic Fracturing State Review, 2011	Louisiana Hydraulic Fracturing State Review, 2011	Ohio Hydraulic Fracturing State Review, 2011	Oklahoma Hydraulic Fracturing State Review, 2011	Pennsylvania Hydraulic Fracturing State Review, 2010
Version of STRONGER guidelines used for comparison	2010	2010	2010	2010	2010	2010
Standards						
Depth to surface casing		3	2			
Inventory well site chemicals/provide to gov't officials		1				
Cememt used in well construction			3			
Reporting						
Public disclosure of chemicals used in fracturing	1					
Notification prior to fracturing	3	2	1	1	1	3
Report well completion		2		1	2	
Public Information						
Provide information to public via website	1	2	1	1	1	1
Maintain database of complaints	3		1			2
Water/Waste Management						
Gather information used to protect streams/water quality testing	1					2
Manage the potential risk of induced/triggered seismicity	1					
Evaluation of NORM in hydraulic fracturing wastes		3		2		
Recycling of flowback water				1	1	
Use surface water for fracturing			1	2		

Table 5. This table represents which States have met, partially met, or not met STRONGER *hydraulic fracturing* guidelines.

1= The standard was determined to be met through initial review, and no recommendation was needed

2= At least one standard was met for a category (some categories have multiple regulations, some of the regulations might not meet the standard)

3= None of the standards were met for a category, or it was expressly Stated that the standard has not yet been met

Number of States- Oil and Gas Regulations			
	The standard has been met (#1)	The standard has been partially met (#2)	The standard has NOT been met (#3)
Administrative			
Permitting	4	7	7
Bond Standards	6	6	2
Bond/Surety Amounts	5	3	1
Operating Plan Required	-	1	-
Brine Spill Reporting/Cleanup Requirements	1	-	1
Oil Spill Reporting/Cleanup Requirements	7	7	3
Noncompliance-Penalty/Fees/Violations	4	2	11
Noncompliance Procedures	5	4	4
Requires Surface Owner's Permission/Notification	1	-	2
Technical			
Pit Use (Reserve Pits)/standards	6	10	6
Pit Closure (Reserve Pits)	5	4	4
Landspreading	3	6	7
Roadspreading	3	2	6
Burial/Landfilling	2	2	7
Site Reclamation Requirements	2	-	1
Removal of Abandoned Equipment	1	-	-
Well Plugging Requirements	-	1	-
Plugging/Abandonment Costs	1	-	1
Pollution prevention/prohibition	2	1	-
Waste disposal/E&P waste regulations	4	10	4
Abandoned Sites			
Abandoned Sites	3	5	6
Wildlife/Environmental Impacts			
Addresses Impacts to Wildlife	-	1	4
General environmental impacts	5	2	3
Naturally Occurring Radioactive Material			
Naturally Occurring Radioactive Material	4	6	8
Stormwater Management			
Stormwater Management	2	2	-

Table 6. This table shows the number of States that have regulations for the given categories, and whose regulations meet the STRONGER standards. This analysis is based on a review of the State initial and follow-up review reports that STRONGER conducted on each of the States' oil and gas regulations. For example, only five

States had regulations relating to impacts to wildlife, only one of which had only partially met STRONGER standards.

Number of States- Hydraulic Fracturing Regulations			
	The standard has been met (#1)	The standard has been partially met (#2)	The standard has NOT been met (#3)
Standards			
Depth to surface casing		1	1
Inventory well site chemicals/provide to gov't officials	1		
Cement used in well construction			1
Reporting			
Public disclosure of chemicals used in fracturing	1		
Notification prior to fracturing	3	1	2
Report well completion	1	2	
Public Information			
Provide information to public via website	5	1	
Maintain database of complaints	1	1	1
Water/Waste Management			
Gather information used to protect streams/water quality testing	1	1	
Manage the potential risk of induced/triggered seismicity	1		
Evaluation of NORM in hydraulic fracturing wastes		1	1
Recycling of flowback water	2		
Use surface water for fracturing	1	1	

Table 7. This table shows the number of States that have regulations for the given categories, and whose regulations meet the STRONGER standards. This analysis is based on a review of the State initial and follow-up review reports that STRONGER conducted on six States’ hydraulic fracturing regulations. For example, five States provide information to the public via their website, meeting STRONGER standards, while one State has partially met that standard.

The bond type and amount was researched for each State’s oil and gas regulation, in addition to three federal agencies for which bond amounts were found. The bond is important financial assurance for both the oil and gas operator and the surface owner. Table 8 shows the bond types and amounts for each State and NPS, BLM, and BIA.

State/Agency	Type of Bond								Other Financial Assurances		
	Single Well Bond (\$)	Blanket Bond (\$)	Performance	Surety, Indemnity, Compliance	Plugging	Restoration	Personal	Collateral Bond	Letter of Credit	Certificate of Deposit	Cash
Alabama ¹	5,000-50,000	100,000		X							
Alaska	>100,000	>200,000		X			X		X	X	
Arizona	10,000-20,000	25,000-250,000	X	X	X					X	
Arkansas	3,000	25,000-100,000		X					X	X	X
California	15,000 - 30,000	100,000 - 1 million		X	X						
Colorado	10,000-20,000	60,000-100,000			X	X					
Connecticut	25,000		X	X							
Delaware											
Florida	50,000-100,000	1 million		X	X				X		
Georgia	10,000-40,000	50,000		X							
Hawaii											
Idaho ⁷	10,000	50,000-150,000		X							
Illinois ⁸⁻⁹	1,500-3,000	25,000-100,000			X	X			X	X	
Indiana	2,500	45,000			X	X				X	X
Iowa	15,000	30,000									
Kansas	\$0.75x well	15,000-45,000	X						X		
Kentucky	500-5,000	10,000-100,000							X	X	X
Louisiana ⁶	1.00-3.00/ft	25,000-250,000	X						X		
Maine											
Maryland	100,000 max	500,000 max		X					X	X	X
Massachusetts											
Michigan	10,000 - 30,000	100,000 - 250,000		X					X	X	X
Minnesota											
Mississippi	10,000	100,000		X	X						
Missouri	1,000-5,000	20,000-30,000		X			X			X	
Montana	1,500-10,000	50,000		X	X	X			X	X	
Nebraska	10,000	25,000		X	10,000					X	X
Nevada	10,000	50,000		X	X						
New Hampshire											
New Jersey											
New Mexico	10,000	50,000		X	X				X		
New York	2,500-5,000	2,500-150,000		X			X				
North Carolina	500-5,000	500,000									
North Dakota	50,000	100,000		X	X	X					
Ohio	5,000	15,000	X	X					X	X	X
Oklahoma ⁵	25,000	25,000	X						X	X	X
Oregon	25,000-50,000	150,000									
Pennsylvania	2,500	25,000		X				equal to surety bond amount	X	X	
Rhode Island											
South Carolina ³	20,000-50,000	100,000	X								
South Dakota	10,000-50,000	30,000-100,000			X	X					
Tennessee	2,000-3,000	20,000-30,000		X		1,500/well			X	X	X
Texas ²	25,000	50,000-250,000	X	X					X	X	X
Utah	1,500-60,000	15,000-120,000		X				X	X		
Vermont			X								
Virginia	10,000	25,000-100,000		X						X	
Washington	50,000	250,000		X					X	X	X
West Virginia	5,000-50,000	50,000-250,000	X	X				X			X
Wisconsin	50,000			X							
Wyoming ⁴⁻⁷	10,000-20,000	75,000		X					X	X	
NPS	up to 200,000		X						X		X
BLM	\$10,000	25,000 (statewide) 50,000(nationwide)							X	X	X
BIA	75,000	150,000		X			X				

Table 8. State and Federal agencies' bond types and amounts.

¹Alabama also requires a \$2,000 bond for wells used for fresh water

²Texas also requires a bond for bay wells for \$60,000 plus the regular bond amount

³South Carolina also requires a bond for drilling an underground injection well

⁴Wyoming also requires a bond for produced water/pit performance

⁵Oklahoma also requires a \$50,000 bond for the land application of deleterious substances

⁶Louisiana also requires a \$125,000–\$1.25 million bond for water wells (inland lakes/bays)

⁷Idaho and Wyoming also require a bond for an inactive/idle well (\$10,000 and \$10.00/ft. (depth), respectively)

⁸Illinois also requires a \$10,000 bond for operating a Liquid Oilfield Waste Transportation System

⁹Illinois also requires a \$2,500–25,000 bond for drilling a test hole

Table 9 shows a sample of violation types and associated fees. This table does not include every violation for all of the States. The violations here include many of those in the State regulations matrix. Most States have a long list of violations, some with appendices devoted to the violations. Therefore, the violations included here and in the State regulations matrix are only a sample and not all-inclusive. The goal of this table is to demonstrate the variation among the States in the amount of fees required for each type of violation.

Enforcement Background Research

Earthworks, a nonprofit organization that seeks to protect people from the impacts of oil and gas drilling and change State drilling regulations by working with STRONGER, produced a report on six States' enforcement policies. The States are Colorado, New Mexico, New York, Ohio, Pennsylvania, and Texas. The report found that these States' enforcement policies are not always carried out, and that some of the main factors inhibiting proper enforcement include budgets, not having enough staff, and that other aspects of drilling, such as permitting, generally receive more resources than enforcement (Earthworks 2012).

Earthworks' report describes all of the States' inspection capacities as "egregiously lacking." All of the States have a large number of wells that are not inspected each year. For example, in Pennsylvania in 2010, 91 percent of the State's active wells had not been inspected. None of the States require periodic inspection of wells. Additionally, the States have been slow to respond to oil and gas complaints from citizens and follow up with them. For all the States, it was found that it is often very difficult for a State oil and gas agency to get drilling companies to come into compliance, and that the same rules are often violated. The penalty fees are generally too low to deter operators from noncompliance, and many of the States have outdated penalty schedules. Earthworks believe that the States' lack of strong enforcement has created a feeling of betrayal among the public, and that the public's confidence in the States' ability to regulate oil and gas drilling is low (Earthworks 2012).

Violation Type	Fees
Violation of Permit	\$100,000
	\$10,000
	\$5,000
	\$2,000
	\$1000 (2)
Violation of any O&G Regulation	\$25,000
	\$10,000 (6)
	\$5,000
	\$4,000
	\$1,000 (4)
	\$500
Operating Violation	\$2,500
	\$100-2,500
Sell illegal O&G	\$12,500
Purposely Waste Gas	\$1,000
Administrative Violation	\$50-500
Discharge oil into environment	\$25,000
Damage to water/wildlife	\$1,000 (2)
Falsify Records	\$1,000
	\$5,000
Failure to Plug Well	\$15,000
	\$1,000 (3)
Drilling and/or fracking without permit	\$25,000
	\$1,000
Violating Reclamation Procedure	\$15,000
Failure to Remove Equipment	\$1,000
	\$10,000

Table 9. This table includes a sampling of violations and associated fees. The numbers in parentheses indicate the number of States with that fee amount.

Questions	Total Number of States
Requires mitigation for any surface disturbance and lost use of the surface?	28
Allow use of open pits (Reserve Pits, Mud Pits, etc.) for any phase of operations?	28
Prescribe operating standards specifically to geophysical, drilling and production, construction, operation, or abandonment of a pipeline, reclamation/restoration? (oil and gas production/reclamation)	41
Require operators to submit a plan of operations for proposals to drill/produce a well? (mostly required to obtain drilling permits, usually a plat)	29
Require operators to provide financial assurance to the State? (<i>bond/surety</i>)	42
Adjust operators' financial assurance if their plans or permits are revised?	5
Prescribe when will the State release an operators' financial assurance?	28
Describe what the previous operator's responsibilities are after transfer of operations?	21
Describe what the new operator must do after a transfer of operations?	24
Describe what an operator must do if they acquire operations that do not have an approved permit?	0
Describe what operators do if they want to temporarily suspend operations? (temporary abandonment)	16
Describe plugging/abandoning procedures/ who is responsible for well plugging and abandonment?	43
Describe under what conditions will the State require operators to plug and abandon a well? (well plugging requirements)	43
Describe how operators get an exception to a plugging determination?	5
Describe what will the State do if operators fail to comply with regulations? (includes penalties/violation fees)	37
Describe when the State can require an operator to suspend their operation?	9
Describe when the State can revoke an operator's permit?	27
Describe what assessments may an operator be subject to if they commit one or more of the prohibited acts? (penalties/fees)	32
Describe if an operator can obtain a permit if they are in or have been in violation of State regulations or in violation of a permit?	2

Table 10. Questions that should be addressed in the State regulations.

The Service oil and gas team recommended several questions to extract relevant information from each State's regulations. The questions and answers (in yes/no form) are shown in Tables 11 and 12. For a few of the questions, answers were taken directly from information in the State regulations matrix. To answer the remaining questions, the State regulations had to be searched again for the specific information.

	Alabama	Alaska	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	Florida	Georgia	Hawaii	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Louisiana	Maine	Maryland	Massachusetts	Michigan	Minnesota	Mississippi	Missouri
Requires mitigation for any surface disturbance and lost use of the surface?	yes	no	no	yes	no	yes	no	no	yes	no		yes	yes	yes	no	yes	yes	yes		yes		yes		no	no
Allow use of open pits (Reserve Pits, Mud Pits, etc.) for any phase of operations?	yes	yes	yes	yes	no	yes	no	no	no	yes		yes	yes	no	no	yes	no	yes		no		yes		yes	no
Prescribe operating standards specifically to geophysical, drilling and production, construction, operation, or abandonment of a pipeline, reclamation/restoration? (oil and gas production/reclamation)	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		yes	yes	yes	no	yes	yes	yes		yes		yes		yes	yes
Require operators to submit a plan of operations for proposals to drill/produce a well? (mostly required to obtain drilling permits, usually a plat)	yes	yes	yes	yes	yes	yes	yes	no	yes	yes		yes	yes	no	yes	no	yes	yes		yes		yes		no	yes
Require operators to provide financial assurance to the State? (bond/surety)	yes	yes	yes	yes	yes	yes	yes	no	yes	yes		yes	yes	yes	yes	yes	yes	yes		yes		yes		yes	yes
Adjust operators' financial assurance if their plans or permits are revised?	no	no	yes	no	no	no	no	no	no	no		yes	no	no	no	no	no	no		no		no		no	no
Prescribe when will the State release an operators' financial assurance?	yes	yes	no	yes	yes	no	no	no	no	no		yes	yes	yes	yes	no	yes	yes		yes		yes		no	yes
Describe what the previous operator's responsibilities are after transfer of operations?	yes	no	no	no	no	no	no	no	no	no		yes	yes	no	yes	yes	no	yes		yes		no		yes	no
Describe what the new operator must do after a transfer of operations?	yes	yes	no	yes	no	no	no	no	no	yes		yes	yes	no	yes	yes	no	yes		yes		no		yes	no
Describe what an operator must do if they acquire operations that do not have an approved permit?	no	no	no	no	no	no	no	no	no	no		no	no	no	no	no	no	no		no		no		no	no
Describe what operators do if they want to temporarily suspend operations? (temporary abandonment)	yes	yes	yes	yes	no	yes	no	no	no	no		no	yes	yes	no	no	no	yes		no		yes		no	no
Describe plugging/abandoning procedures/ who is responsible for well plugging and abandonment?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes	yes	yes	yes	yes	yes	yes		yes		yes		yes	yes
Describe under what conditions will the State require operators to plug and abandon a well? (well plugging requirements)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes	yes	yes	yes	yes	yes	yes		yes		yes		yes	yes
Describe how operators get an exception to a plugging determination?	no	no	no	no	no	no	no	no	no	no		no	no	yes	no	no	no	yes		no		yes		no	no
Describe what will the State do if operators fail to comply with regulations? (includes penalties/violation fees)	yes	yes	no	yes	yes	yes	no	no	yes	yes		yes	yes	yes	no	yes	yes	yes		yes		yes		yes	yes
Describe when the State can require an operator to suspend their operation?	yes	yes	no	no	no	no	no	no	no	no		no	yes	no	no	no	no	no		no		yes		no	no
Describe when the State can revoke an operator's permit?	yes	yes	no	yes	no	yes	no	no	no	yes		no	yes	yes	no	no	no	yes		yes		yes		yes	yes
Describe what assessments may an operator be subject to if they commit one or more of the prohibited acts? (penalties/fees)	yes	yes	no	yes	yes	yes	no	no	yes	yes		yes	yes	yes	no	yes	yes	yes		yes		yes		yes	yes
Describe if an operator can obtain a permit if they are in or have been in violation of State regulations or in violation of a permit?	no	no	no	no	no	no	no	no	no	no		no	no	yes	no	no	no	no		no		no		no	no

Table 11. This table indicates the first 25 States and whether their regulations address the 19 questions listed on the left.

	Montana	Nebraska	Nevada	New Hampshire	New Jersey	New Mexico	New York	North Carolina	North Dakota	Ohio	Oklahoma	Oregon	Pennsylvania	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Wyoming
Require mitigation for any surface disturbance and lost use of the surface?	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	yes	yes	no	no	no	yes	no	yes	no	yes	yes	yes	no	yes
Allow use of open pits (Reserve Pits, Mud Pits, etc.) for any phase of operations?	yes	yes	yes	no	no	yes	no	no	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	no	yes
Prescribe operating standards specifically to geophysical, drilling and production, construction, operation, or abandonment of a pipeline, reclamation/restoration? (oil and gas production/reclamation)	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Require operators to submit a plan of operations for proposals to drill/produce a well? (mostly required to obtain drilling permits, usually a plat)	no	no	no	no	no	no	yes	no	yes	yes	yes	no	no	no	yes	yes	yes	yes	no	yes	no	yes	yes	no	yes
Require operators to provide financial assurance to the State? (bond/surety)	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adjust operators' financial assurance if their plans or permits are revised?	no	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	yes	yes	no
Prescribe when will the State release an operators' financial assurance?	no	yes	yes	no	no	yes	yes	no	yes	yes	yes	yes	yes	no	yes	no	no	no	yes	no	no	yes	yes	yes	yes
Describe what are the previous operator's responsibilities after transfer of operations?	yes	no	yes	no	no	yes	no	no	yes	yes	yes	yes	yes	no	yes	yes	no	no	no	no	no	yes	yes	no	yes
Describe what must the new operator do after a transfer of operations?	no	yes	yes	no	no	yes	no	no	yes	yes	yes	yes	yes	no	yes	yes	no	no	no	no	no	yes	yes	no	yes
Describe what an operator must do if they acquire operations that do not have an approved permit?	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Describe what operators do if they want to temporarily suspend operations? (temporary abandonment)	no	no	no	no	no	yes	yes	no	yes	no	no	no	no	no	no	no	yes	no	yes	no	no	no	no	yes	yes
Describe plugging/abandoning procedures/ who is responsible for well plugging and abandonment?	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Describe under what conditions will the State require operators to plug and abandon a well? (well plugging requirements)	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Describe how operators get an exception to a plugging determination?	no	no	no	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	yes	no	no	no	no	no	no	no
Describe what will the State do if operators fail to comply with regulations? (includes penalties/violation fees)	no	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes
Describe when can the State require an operator to suspend their operation?	no	no	yes	no	no	yes	no	no	no	no	no	yes	no	no	no	no	no	no	yes	no	no	yes	no	no	no
Describe when the State can revoke an operator's permit?	no	no	no	no	no	no	no	no	yes	yes	yes	yes	no	no	yes	no	no	no	yes	no	yes	yes	yes	yes	yes
Describe what assessments may an operator be subject to if they commit one or more of the prohibited acts? (penalties/fees)	no	yes	yes	no	no	no	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	no	yes	yes	no	yes	yes	no
Describe if an operator can obtain a permit if they are in or have been in violation of State regulations or in violation of a permit?	no	no	no	no	no	no	no	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no

Table 12. This table indicates the remaining 25 States and whether their regulations address the 19 questions listed on the left.

Discussion

U.S. Territories and Federal Agency Regulations

In addition to the State oil and gas regulations, the regulations for U.S. territories and several Federal agencies were researched and included in the State regulations matrix. No regulations could be found for the Northern Marianas, while only water well regulations were found for both Guam and American Samoa. Puerto Rico and the U.S. Virgin Islands have some regulations, although they are not extensive. There are oil spill regulations for Puerto Rico, Guam, and the U.S. Virgin Islands.

Eight Federal agencies' regulations were researched. BLM, NPS, BIA, USFS, and BOR all have regulations related to oil and gas drilling. EPA has oil spill regulations; there were no relevant regulations found for USGS. The Army Corps of Engineers has regulations, which were not available in time to complete this analysis.

Bond Requirements

There was extensive variation among the States in the bond amounts required for drilling activities. The majority of States required a surety/compliance bond to ensure operators comply with drilling regulations. This type of bond was usually the first bond mentioned in the regulations, as it was often one of the requirements for operators to begin oil and gas operations. Almost all States with bonding requirements stated amounts for both individual well bonds and blanket bonds. Other common forms of bonds that were either required in addition to surety bonds, or as the main type of bond, were plugging and restoration bonds. Other types of financial assurances required by most States, in addition to a bond, include a letter of credit, certificate of deposit, or cash assurance. In order to show the differences in bond amounts, a table was created which summarizes the range of bond amounts and the number of States that fall into each range (Table 13).

There are three categories for bond amounts for both individual and blanket bonds (low, medium, high). For both bond types, there are overwhelmingly more States that have bonds with medium-range amounts. For individual well bonds, the majority of States required bonds between \$10,000 and \$50,000 (with exceptions), while the majority of blanket bonds fall into the \$25,000 to \$100,000 range (with exceptions). Because blanket bonds include multiple wells, they are generally much more expensive, as much as \$1 million. The highest individual well bond is \$100,000. It is surprising that several States have very large ranges for individual bond amounts (e.g., Utah \$1,500–\$60,000, Alaska <\$100,000), implying that bonds may be set on a case- by-case basis. The blanket bond ranges are also generally large; however, the amount depends on the number of wells included in the bond.

The States with the lowest individual well bonding requirements include Kentucky, with a minimum of \$500, and Missouri, with a minimum of \$1,000. The highest bond amounts for individual well bonds include Florida and Alaska, both of which have \$100,000 maximum amounts. Likewise, the States with the lowest blanket bond requirements include New York (\$2,500) and Kentucky (\$10,000). States with the highest blanket bonds include Florida and California, both at \$1 million. Kentucky has the

lowest bonding requirements of any State, while Florida has the highest (both individual and blanket bonds).

Questions to consider further:

1. Do high or low bond amounts correlate with the level of stringency in State oil and gas regulations?
2. What other factors would influence high or low bonding requirements (i.e., cost of living, land values, number of operators statewide)?

Summary of General Drilling Bond Amounts			
	Amount Range (\$)	Number of States	Exceptions
Individual Well Bond¹	500–9,999	14	Includes: Montana (\$1,500–10,000) Utah (\$1,500–60,000) Alabama (\$5,000–50,000) West Virginia (\$5,000–50,000)
	10,000–50,000	26	Includes: Utah (\$1,500–60,000) Alabama (\$5,000–50,000) West Virginia (\$5,000–50,000)
	Less than 100,000	3	Includes: Florida (\$50,000–100,000)
Blanket Bond	2,500–25,000	10	Includes: Kansas (\$15,000–45,000) Kentucky (\$10,000–100,000) New York (\$2,500–150,000) Utah (\$15,000–120,000)
	25,000–100,000	25	Includes: Kansas (\$15,000–45,000) Kentucky (\$10,000–100,000) New York (\$2,500–150,000) Utah (\$15,000–120,000) Arizona (\$25,000–250,000) Idaho (\$50,000–150,000) Louisiana (\$25,000–250,000) Texas (\$50,000–250,000) West Virginia (50,000–250,000)
	Greater than 100,000	15	Includes: New York (\$2,500–150,000) Utah (\$15,000–120,000) Arizona (\$25,000–250,000) Idaho (\$50,000–150,000) Louisiana (\$25,000–250,000) Texas (\$50,000–250,000) West Virginia (\$50,000–250,000)

Table 13. Because of the variation in the range of bond amounts, it was difficult to divide the amounts into clean categories in which every State would fit. Therefore, some States are included more than once because they fit into multiple categories, and are noted as exceptions in the right hand column.

¹Two States (Kansas and Louisiana) do not have fixed bond amounts and instead measure the amount by foot. These States are not included in the table for the individual well bond.

STRONGER Interpretation

STRONGER has reviewed 22 States' oil and gas regulations, which represents 94 percent of oil and gas production in the United States. Therefore, the States reviewed are generally representative of oil and gas operations in the U.S. Approximately 76 percent of STRONGER's recommendations for States' regulations have been implemented, indicating progress and responsiveness on the part of the States (STRONGER 2013). The STRONGER analysis in this report is based on the State reviews that STRONGER conducted, and is therefore not based on this report's reported review of how each State's regulations compare to the STRONGER guidelines. The review of every State did not always include the same elements. Because STRONGER produced several versions of their guidelines, the State review reports varied as to what was included in them. Therefore, not all of the States had the same main elements included in their State review reports.

To summarize the six categories used for State oil and gas regulations (administrative, technical, abandoned sites, wildlife/environmental impacts, naturally occurring radioactive material, and stormwater management), the percentage of States which had either met, partially met, or not met the standards within the six categories was determined (Table 14). For the administrative and technical categories, percentages were generally fairly even on the spectrum of meeting to not meeting the standards. However, many States did not meet the wildlife/environmental impacts or the naturally occurring radioactive material standards. Overall, none of the standards have been completely met for every State.

Based on Table 3, which gives an overview of the standards each State met or did not meet, some conclusions can be drawn that show which States might have more lenient regulations or regulations that are not comprehensive enough when compared to STRONGER's standards. It is important to keep in mind, however, that in some instances the State was developing a specific regulation at the time of the STRONGER review, so at that time that standard would not have been met. Some of the States that stood out as not meeting many of STRONGER's standards include Illinois, Kentucky, North Dakota, and Tennessee. For instance, Kentucky did not meet 10 of the standards; it only met 3 standards. Similarly, Illinois did not fully meet any of the standards. On the other hand, there were several States that did meet many of the standards. For example, of the categories found in each State's regulations, both New Mexico and West Virginia met the majority of STRONGER standards.

Table 14. Percentages of States whose oil and gas regulations either met, partially met, or did not meet STRONGER guidelines for each category.

	The standard has been met (#1)	The standard has been partially met (#2)	The standard has NOT been met (#3)
Administrative	35	32	33
Technical	29	36	36
Abandoned Sites	21	36	43
Wildlife/Environmental Impacts	33	20	47
Naturally Occurring Radioactive Material	22	33	44
Stormwater Management	50	50	-

STRONGER also reviewed six State’s hydraulic fracturing regulations to see if they met their 2010 guidelines (STRONGER is currently revising and updating the hydraulic fracturing guidelines). Four categories were used (standards, reporting, public information, and water/waste management). The same review was completed for hydraulic fracturing regulations as for oil and gas regulations, and the percentages of States that met the standards within each category were determined. The majority of States (although not by much) had met the standards for public information and water/waste management, while half of the States had not met the standards requirements.

Table 5 presents an overview of the standards each State met or did not meet for hydraulic fracturing, and some conclusions can be drawn that show which States might have more lenient regulations or regulations that are not comprehensive when compared to STRONGER’s standards. Overall, the hydraulic fracturing regulations for all six States largely met STRONGER standards. For Ohio and Oklahoma, all of their regulations either fully or partially met STRONGER standards, while Arkansas, Louisiana, and Pennsylvania each had only one regulation that was not up to standard.

After conducting a search of the most stringent hydraulic fracturing regulations in the country, Illinois’s newly created regulation (June 2013) appears to be the strictest of all the States. Illinois’s regulation has the best protection against water pollution from fracking activities, including the requirement of closed tanks to store wastewater. It also has the strictest chemical disclosure policy in the country, requiring chemical disclosure before and after fracking (Environmental Law and Policy Center 2013).

Table 15. Percentage of States whose hydraulic fracturing regulations either met, partially met, or did not meet STRONGER guidelines for each category.

	The standard has been met (%)	The standard has been partially met (%)	The standard has NOT been met (%)
Standards	25	25	50
Reporting	50	30	20
Public Information	67	22	11
Water/Waste Management	56	33	11

The review of State oil and gas/hydraulic fracturing regulations by STRONGER is valuable because it offers an outside/unbiased analysis of State regulations. However, very few States have volunteered to have STRONGER review their regulations, therefore lessening the validity of STRONGER reviews (Gilmer 2012). API has said it “supports and works closely with” STRONGER and other organizations such as FracFocus.org (Porter 2012).

Questions to further consider:

1. How do State regulations compare to API standards (which must be purchased)?
2. Most of the State reviews that STRONGER did are outdated (from the 1990’s/early 2000’s). How would the State regulations compare to STRONGER’s 2013 standards?

Regional Comparison

In addition to the data on the State regulations, the oil and gas regulations were examined at the regional level. In order to show the presence of the 35 elements in State regulations by region, the percentage of States per region that regulate each element was determined (Table 1 in appendix). This information might be useful for interpreting which States/regions have the strictest regulations and which States are most lenient based on which elements are included in the regulations.

The regions that consistently had the highest percentages of the regulatory elements included were regions 2, 3, 6, and 7. The elements under the “drilling requirements” and “production activities” categories were included the most in State regulations. Regions 2, 3, 7, and 8 had the highest percentages of States that have each drilling regulation, and regions 2, 3, 4, and 6 have the most production activity regulations.

One-hundred percent of States in regions 2, 4, 6, 7, and 8 have well spacing requirements. All States in region 6 have oil spill reporting and site reclamation requirements, the highest of all regions. There is no region where all States have regulations for surface owner impacts or address impacts to wildlife. These two categories seem to be the most lacking across all States.

Two of the regulatory elements were chosen to show their inclusion in State regulations regionally. Hydraulic fracturing regulations and impacts to wildlife were used to show the number of States in each region that have addressed both elements in their oil and gas regulations. Chart 1 indicates that all States within region 6 have hydraulic fracturing requirements or address it, while there are only three

States in region 5. Hydraulic fracturing occurs more in some regions, so geography is important to consider when looking at the fracking regulations. Chart 2 shows that of all the regions, regions 2 and 6 have the most States with regulations that address impacts to wildlife from oil and gas drilling. Based on this and some of the other elements mentioned above, regions 2 and 6 seem to regulate the most of all the elements (35 total) included in this assessment.

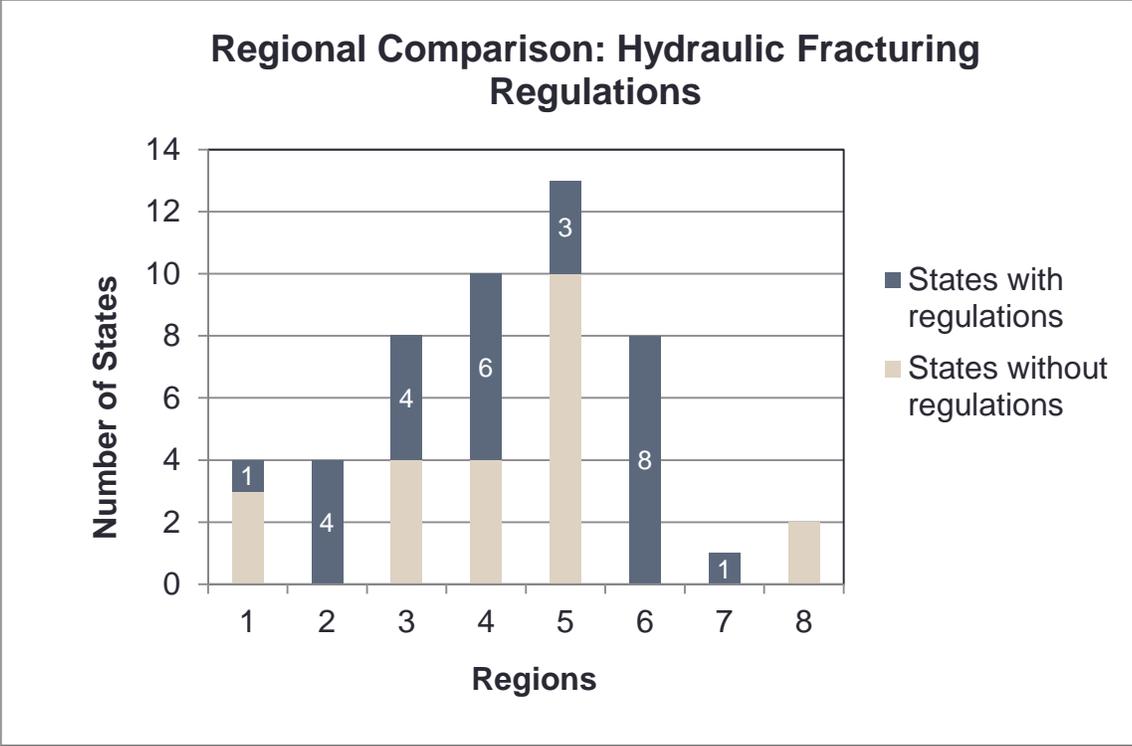


Chart 1. Hydraulic fracturing regulations across regions.

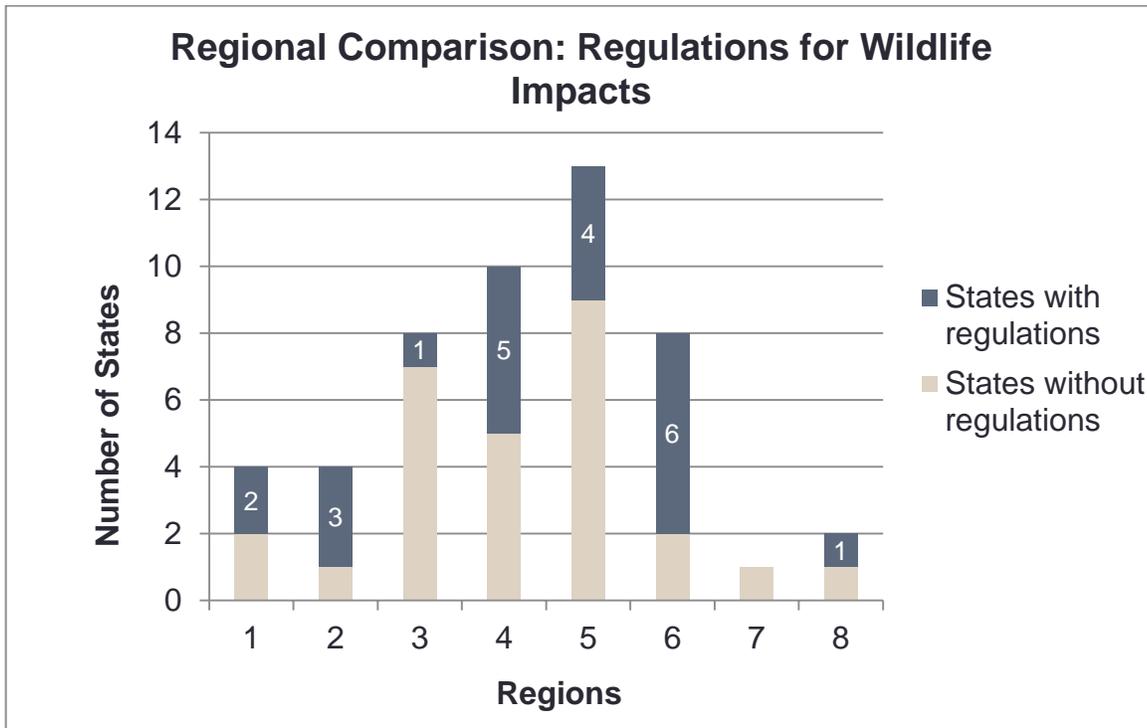


Chart 2. Impacts to wildlife across regions.

Questions that State Regulations Should Address

The majority of the States’ regulations addressed many of the main questions posed by Service staff (Table 10). The goal of these questions was to show to what extent the State regulations addressed topics that the Service thought were important. They are used as a supplement to the State regulations matrix.

The majority of the States addressed the following questions:

1. Is mitigation required for any surface disturbance or lost use of the surface?
2. Is the use of open pits allowed for any phase of operations?
3. Are operating standards for drilling production and operation prescribed?
4. Are operators required to submit a plan of operations for proposals to drill/produce a well?
5. Are operators required to provide financial assurance to the State?
6. Do the regulations prescribe when the State will release an operator’s financial assurance?
7. Are plugging/abandoning procedures described?
8. Do the regulations describe under what conditions the State will require operators to plug/abandon a well?
9. Does it describe what the State will do if operators fail to comply with regulations?

10. Do the regulations describe when the State can revoke an operator's permit?
11. Do the regulations describe what assessments an operator may be subject to if they commit one or more prohibited acts?

Five or fewer States addressed the following questions:

1. Is the operator's financial assurance adjusted if their plans/permits are revised?
2. What should an operator do if they acquire operations that don't have an approved permit?
3. Can an operator get an exception to a plugging determination?
4. Can an operator obtain a permit if they are or have been in violation of State regulations or a permit?

The questions that most State regulations fail to answer are related to the Service's need to address its statutory mission to protect wildlife and their habitat. Many State regulations are not intended to address such specific issues. This indicates that some State regulations may help reduce oil and gas impacts, but not as specific as regulations tailored to address this need. These responses spotlight the gap in protection of state oil and gas resources and the wildlife resources managed by refuges.

Conclusion

State oil and gas regulations vary extensively in the regulatory elements they address. The regulations also differ regionally, with regions 2 and 6 having the most detailed and stringent regulations. The differences in State regulations are important for bringing to light the uneven oil and gas regulating practices throughout the country. This will hopefully add to the justification for the Service's need to re-establish its oil and gas drilling rule for refuges.

It is recommended that information on State regulations be added to regional sharepoint sites so Service employees who are confronted with oil and gas drilling issues will have an additional resource. The State regulations matrix is a good resource for this type of use (there is also a spreadsheet that has the matrix broken down into regions). Other sources might be useful as well, such as the *Resources for the Future* report or the OIGCC summary of oil and gas regulations.

Bibliography

- Earthworks 2012. Breaking All the Rules: The Crisis in Oil and Gas Regulatory Enforcement. Earthworks Oil and Gas Accountability Project. Accessed August 2013 at <http://www.earthworksaction.org/files/publications/FINAL-US-enforcement-sm.pdf>
- Environmental Law and Policy Center. 2013. Understanding the Illinois Hydraulic Fracturing Regulatory Act (HB 2615). Accessed August 2013 at <http://elpc.org/illinoisfrackingbill>
- Gilmer, Ellen M. 2012. Few States Submitting Oil and Gas Rules for Review. EnergyWire, E&E Publishing. Accessed August 2013 at <http://www.eenews.net/stories/1059969654>
- InterState Oil and Gas Compact Commission (IOGCC). 2013. Accessed June 2013 at <http://iogcc.publishpath.com/>
- Porter, Reid. 2012. API: New Interior Hydraulic Fracturing Rules Must Not Ignore Effective State Efforts. American Petroleum Institute. Accessed August 2013 at <http://www.api.org/news-and-media/news/newsitems/2012/may-2012/api-new-interior-hydraulic-fracturing-rules-must-not-ignore-effective-State-efforts.aspx>
- Richardson, Nathan et. al 2013. The State of State Shale Gas Regulation. *Resources for the Future*. Accessed August 2013 at http://www.rff.org/rff/documents/RFF-Rpt-StateofStateRegs_Report.pdf
- Southern States Energy Board. A Guide to State Oil & Gas Regulatory Entities in the South. Accessed August 2013 at <http://www.sseb.org>
- State Review of Oil and Natural Gas Environmental Regulations (STRONGER). 2013. Accessed July 2013 at <http://strongerinc.org>

Appendix- additional tables

Table 1.

Percentage of States By Region that Regulate each Element								
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7 (1 State)	Region 8 (2 States)
Drilling Requirements								
License Required	0	75	25	20	15	38	100	50
Permit Required/Fees	75	100	88	100	54	100	100	100
Bond Purpose/Type	75	100	63	80	46	88	100	100
Bond Amounts	75	100	88	100	46	8	100	100
Land Leasing Information	75	100	38	40	23	50	100	50
Site selection/preparation								
Setback Requirements	0	25	50	50	38	0.25	100	50
Spacing Requirements	75	100	75	100	46	100	100	100
Production Activities								
Oil Production	75	100	75	90	62	88	100	100
Gas Production	75	100	63	90	54	88	100	100
Pit Liner Requirements (from RFF report)	0	75	38	70	38	100	0	0
Pit Use (Reserve Pits)	75	100	38	60	15	88	100	50
Pit Closure (Reserve Pits)	50	75	25	50	15	88	100	0
Pit Use (Produced Water)	0	0	13	30	0	50	0	0
Pit Closure (Produced Water)	0	0	0	20	0	38	0	0
O&G Transportation Method	25	75	50	60	23	88	0	100
Hydraulic Fracturing								
Hydraulic Fracturing Requirements	25	100	50	60	23	100	100	100
Water Source for Fracking Requirements	25	75	13	30	23	37	100	0
Water withdrawal Regulations (Yes/No) (from RFF Report)	0	50	50	70	46	100	0	50
Emergency Reporting								
Brine Spill Reporting/Cleanup Requirements	0	25	25	10	8	25	0	0
Oil Spill Reporting/Cleanup Requirements	75	75	63	70	31	100	0	50

Drilling Site Completion								
Completion Requirements	75	100	88	90	46	88	100	100
Site Reclamation/Restoration Requirements /Remediation	75	50	50	60	31	100	0	50
Reclamation Fees	0	50	0	30	0	0	0	0
Removal of Abandoned Equipment	25	75	13	20	0	38	0	0
Maximum time a well can remain idle (from RFF report)	0	75	50	60	38	75	0	50
Temporary Well Abandonment (from RFF report)	0	75	50	60	31	88	0	0
Well Plugging Requirements	75	100	88	100	62	100	100	100
Plugging/Abandonment Costs	0	0	25	20	15	63	0	50
Noncompliance								
Noncompliance-Penalty/ Fees/Violations	25	50	75	90	46	63	100	100
Noncompliance Procedures	75	75	50	60	15	63	100	100
Well Shut-in from Repeated Noncompliance	0	25	0	0	0	13	0	0
Surface Owner Impacts								
Addresses Impacts to Surface Owner	50	75	13	50	31	50	0	50
Requires Surface Owner's Permission	25	50	25	50	15	25	0	0
Measures protecting the surface owner from the subsurface mineral owner (ie. Financial liability)	0	0	0	10	0	1	0	0
Access Fees	25	0	0	0	0	0	0	0
Wildlife Impacts								
Addresses Impacts to Wildlife Resources/Wildlife Protection Requirements	50	75	13	50	31	75	0	50

* States without regulations are included

* It's important to keep in mind for the percentages that each region has a different number of States (i.e., regions 7 and 8)

APPENDIX C: TYPES OF NON-FEDERAL OIL AND GAS DEVELOPMENT CONDUCTED BY THE NATIONAL WILDLIFE REFUGE SYSTEM

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INTRODUCTION

The petroleum industry is a continuous cycle of searching for new oil and gas reservoirs, developing and producing them, and finally abandoning the property once the hydrocarbons are depleted.

There are four general phases of petroleum development. The phases are (1) exploration, (2) drilling, (3) production, and (4) abandonment/reclamation. Surface uses vary for each phase in terms of intensity and duration. Also, operations related to one or all of the phases may be occurring in the same area at any given time. In Lower Rio Grande National Wildlife Refuge and Upper Ouachita National Wildlife Refuge, most oil and gas activities will likely be part of the production and abandonment/reclamation phases. Drilling is expected to occur on a less frequent basis. Although described below, exploration work such as geophysical surveys is not expected because zones of interest in the area are shallow (economics of seismic survey versus just drilling an explorations well) and there is a good number of wells that provide information for interpreting the subsurface.

To be of interest to the petroleum industry, petroleum deposits must be commercially valuable. There must be a reasonable chance of making a profit on the eventual sale of the oil and gas. Factors such as the market price of oil and gas, the amount of recoverable petroleum, the expected production rates, and the cost of drilling wells, producing, and transporting the product to market all determine the economic viability of developing a deposit once it is discovered.

The following sections are meant to provide the reader with a general understanding of common activities associated with each phase of oil and gas development.

EXPLORATION OPERATIONS

OCCURRENCE OF PETROLEUM

Petroleum deposits are not large underground caverns filled with oil and gas as the term reservoir might suggest. Rather, petroleum accumulates in tiny spaces within the buried rock layers. Most scientists today agree that petroleum was formed from large amounts of very small plant and animal life. These organic materials accumulated in ancient seas, which, over great periods of time, have covered much of the present land area. As time passed, sediments rich in organic matter were buried deeper and deeper. The increased pressure and temperature caused these organic remains to change into oil and natural gas. Once formed, the oil and gas migrated upward until certain forms and shapes of underground rocks halted the upward movement, trapping the hydrocarbons in large quantities. The search for these traps is the focus of the first phase of oil and gas development and exploration.

GEOLOGICAL EXPLORATION

The search for oil and gas often begins with geological exploration. The exploration geologist is looking for clues on the surface that would suggest the possibility of petroleum deposits below. Surface studies comprise the first stage of exploratory fieldwork. Geological surveys of the land surface are made using aerial photographs, satellite photographs, maps of surface outcrops of specific formations or rock types, and geochemical analyses. Field crews map surface attributes and collect surface samples of rock for analysis.

Creating maps of surface outcrops and geochemical analyses requires fieldwork. Little equipment is needed other than surveying gear and rock and soil sampling supplies. These activities require a small field party of two to four persons who can work out of a single vehicle or on foot. Access to remote areas can be gained by a four-wheel-drive vehicle, small all-terrain vehicles, helicopter, pack animals, or by walking. A small boat may be used where navigable water occurs near the area being studied. Constructing roads or channels in shallow water areas is not required at this early stage.

Geochemical analysis often requires subsurface samples to be taken from a ditch or a shallow corehole. The coreholes are usually shallow, but may generate some cuttings.

GEOFYSICAL EXPLORATION

Geological exploration can narrow the area being searched, but subsurface geology may or may not be accurately indicated by surface outcrops. Geophysical prospecting extends the search beneath the earth's surface. The surveys identify and map characteristics favorable to oil and gas accumulation deep underground. Geophysical operations include gravitational, magnetic, and seismic surveys. Of these, the seismic survey is most common.

Gravitational and Magnetic Surveys—Gravitational and magnetic field studies yield regional or reconnaissance-type data. These surveys detect variation in gravitational attractions and magnetic fields of the various types of rock below the surface.

Gravity surveys are generally done with small, portable instruments called gravity meters or gravimeters. The number and placement of measurement points in a gravity survey depend on the site's characteristics. These include feasibility of access and the spacing pattern necessary to detail the features selected for mapping. The field party required is not large, usually 3 to 6 people. Travel on foot is possible with the smaller portable gravimeters. Progress, however, is slow, so most surveys use four-wheel-drive vehicles. In marshy areas, the use of special swamp or marsh buggies is quite common with gravity survey crews. Airborne survey operations are not yet practical due to present instrument limitations and the relatively large and rapid changes in altitude and acceleration characteristic to aircraft.

The objective of most surveys can be achieved when gravity stations are confined to existing roads or waterways. Where roads or waterways do not exist, a large level of latitude in positioning stations is possible to account for logistical or environmental constraints. Disturbance of the land surface is minimal when established access is already available. Methods of access to roadless areas are similar to those required for geological explorations described above. The surveying technique itself does not require any physical disturbance of the surface.

Magnetic surveys are often used in place of or to supplement gravity surveys. These surveys are done with relatively small airborne or portable ground instruments called magnetometers. Flight patterns usually consist of a series of parallel lines at 1- to 2-mile intervals.

Airborne surveys require geodetic and ground control points. These must be installed on the ground before the survey can take place, if not already present. A majority of the lower 48 states have been surveyed, so these points are already in place. If not, however, the area must be accessed by overland vehicles or helicopters. The size of the field party required is not large. The access to roadless areas is similar to that required for geological exploration described above. The surveying technique itself does not require any physical disturbance of the surface.

Seismic Surveys—Whereas gravity and magnetic surveys provide regional information, seismic survey can provide enough subsurface detail to locate potential oil and gas traps.

A seismic survey gathers subsurface geological information by recording impulses from an artificially generated shock wave. The energy waves travel downward toward underground formations. A series of sensitive instruments, called geophones, set out at surveyed points on the ground, record the energy waves as they are reflected off the subsurface formations and back to the surface. Cables or radio transmitters transfer information from the geophones to a recorder truck that receives and records the reflected seismic energy. Sophisticated computers analyze the data and generate a “picture” of the rocks underground. Each survey line provides a cross-section of the rock formations beneath it, and many lines may be run to create a complete picture.

In remote areas where there is little known subsurface data, a series of short seismic lines may be required to determine the attitude of the subsurface formations. After this, the pattern of seismic lines or grids is designed to make the final data more accurate and valuable. Although alignment is fairly critical, some source and recording stations may be moved or skipped for environmental or logistical reasons without seriously affecting the results of the investigation.

A more recent technique called 3-D Seismic works on the same principle as conventional seismic, but energy and recording stations are placed at a much denser spaced grid. There may be up to 150 energy source locations and 200 recording stations per square mile on a 3-D seismic project. Surveys commonly exceed a 25-square-mile-area. The 3D-Seismic surveys can provide enough detail to locate traps that have been “missed” by conventional geophysical methods and exploratory drilling. Even in areas that have been heavily explored and developed, 3D-Seismic is helping to optimize new field development and find new targets within producing fields. New life is being brought to areas thought to have been played out.

Seismic methods are usually referred to by the various methods of generating the shock wave. These include weight drop, vibrators, dinoseis (combustible gas expansion), and explosives. No matter what method of generating energy is used, the procedures for preparing the line and recording the data are relatively similar. The procedure typically consists of first surveying and flagging the locations for the geophones and the positions of the energy sources. Second, the geophones and the connecting cable are laid down. The cable is either connected with more cable to the recording truck or to a radio transmitter to send the data to the recording truck. Normally the recording truck will be within a short distance of the transmitter or within line of sight. Once the geophones and ground cable are in place, the energy source is put in place. The initiation of the energy source, whether by a “vibroseis” truck or by explosive, is controlled by the recording truck. The shock wave is set off, and the seismic signal recorded by multiple geophones. Once the signal is recorded, the ‘shooting crew travels to the next source point, and the process is repeated.

The most common energy source in seismic work is explosives placed in holes drilled to depths of several feet up to 200 feet. Explosives may range from ½- to 50-pound charges and typically increase in size with increased setting depths. Drills can be mounted on trucks, boats, or specially designed airboats or all-terrain vehicles, depending on the type of access required. In rugged topography, or to reduce surface disturbance associated with access, portable drills are sometimes carried by helicopter or by hand. Other

field equipment can include vehicles to carry water for drilling operations, personnel, surveying equipment, recording equipment, and computers.

Existing roads are used if possible, but reaching some lines may require clearing vegetation and loose rock to improve access for the crews and the trucks. Each mile of seismic line cleared to a width of 8 to 15 feet represents disturbance of about an acre of land. A network of low-standard temporary roads and trails can result from these operations. The alignment of these trails usually consists of straight lines dictated by the grid, often with little regard for steep slopes or rough terrain. Level topography with few trees and shrubs would require little or no trail construction. An area with rugged topography or larger vegetative types such as trees and large shrubs would require more trail preparations. Temporary roads and trails are usually constructed with bulldozers.

Seismic crews consist of several surveying people, people for laying and retrieving the cable and geophones, the truck drivers and drillers for the energy source, personnel in the recording truck and miscellaneous water truck drivers, cleanup people, and field crew managers. The size of the seismic crews varies from 15 to 80 people. On most seismic jobs, the people and equipment are transported in trucks or four-wheel-drive vehicles. However, the surveying, cable laying, and sometimes the drilling can be done on foot in some situations.

Under normal conditions, 3 to 5 miles of line can be surveyed each day using the explosive methods. Crews may be in the field for 1 to 4 weeks for an average conventional survey. An average 3-D survey may take several months to complete.

DRILLING AND PRODUCTION OPERATIONS

OIL AND GAS WELL DRILLING

Classification of Wells—Wells drilled for oil and gas are classified as either exploratory or development wells. An exploratory well is drilled either in search of an as-yet-undiscovered pool of oil or gas (a wildcat well) or to extend greatly the limits of a known pool. Exploratory wells may be classified as (1) wildcat, drilled in an unproven area; (2) field extension or step-out, drilled in an unproven area to extend the proved limits of a field; or (3) deep test, drilled within a field area but to unproven deeper zones. Development wells are wells drilled in proven territory in a field to complete a pattern of production.

Similar to geophysical surveys, drilling operations are relatively short-term. However the intensity of impacts is much higher due to the equipment and materials needed to drill a well and the potential duration of the operation. At a common height of 180 feet, the rig stands as tall as a 12-story building. An average drilling rig needs a level location of about 3 acres. The drilling pad and access road must be capable of supporting thousands of tons of equipment. Existing access roads may need to be widened and upgraded to accommodate heavy loads. Rigs commonly used in Louisiana are somewhat smaller and locations perhaps 1 to 2 acres in size.

Choosing the Site—Once exploration activities have narrowed the search to specific drilling targets, the operator must select an exact spot on the surface to drill the well. The industry prefers to drill vertically, and usually chooses a drill site directly above the desired bottomhole location. When topographical, geological, or environmental constraints prevent a drill site from being located directly above the bottomhole location, the use of direction drilling can achieve the objective. Reaches of over a mile are common for 10,000-foot-deep wells, and extended reach wells have been drilled with over 2 miles of horizontal departure.

Directional drilling involves deviating a wellbore from its vertical along a predetermined course to a target located at some depth and some horizontal distance away. It is a common practice in the industry today, with a number of uses. Directional drilling techniques can be applied if the target zone lies underneath an inaccessible location such as a heavily urbanized area, mountain, or water body, and the drill rig must be located elsewhere. The technique is most often used in offshore applications to allow many wells to be drilled from one location. It can be used to drill around or through fault planes, salt domes, or obstructions in the hole, and to provide relief to a nearby well that has blown out. More recently, the technique has been used to move surface locations as an environmental protection measure.

While directional drilling allows flexibility in the selection of the drill site, there are technical, physical, and economic constraints on its use. Geological factors such as target depths, formation properties (stability, type, dip angle, etc.), and contemplated horizontal departures physically complicate and restrict the opportunities for using directional drilling. Sophisticated equipment and specialized personnel are needed to monitor and guide the direction of the well as it is being drilled. The cost of using this technique typically ranges from 10 percent to 50 percent higher than the cost of a vertical well. While directional drilling can be applied in a wide variety of situations, project specific conditions must always be taken into account.

Accessing the Site—Wildcat drilling often takes place in remote areas. Preliminary exploration work will not have contributed any new roads to an area, although there may be some cross-country trails. Temporary access roads will have to be constructed. Existing roads may need upgrading to accommodate the heavier loads associated with truck traffic. One lane is usually adequate, but turnouts and/or traffic control are necessary to accommodate two-way traffic on longer routes. Installation of culverts or other engineering structures will be needed in steep terrain or when crossing stream channels. Soil texture, topography, and moisture conditions might dictate that roads be surfaced with material such as gravel, oyster shells, caliche, or ground limestone. Heavy equipment such as graders, bulldozers, front-end loaders, and dump trucks are commonly used in constructing roads. In marshy areas, a roadbed may be laid with heavy boards.

Preparing the Drill Site—To accommodate the rig and equipment, the drill site must be prepared. Site preparation may include extensive clearing, grading, cutting, filling, and leveling of the drill pad using heavy construction equipment. Soil material suitable for plant growth is often removed first and stockpiled for later use in reclamation. The operator may also dig reserve pits to hold large volumes of drilling mud and drill cuttings. In environmentally sensitive areas, a large effort is made not to alter the surface area comprising the drill site more than is necessary. For example, reserve pits may not be dug. Instead, large steel bins are placed on the site to receive the cuttings and other materials that are normally dumped into the reserve pits. These bins can then be trucked away from the site and the material inside them disposed of properly. Also, even in areas where reserve pits are excavated, they are often lined with thick plastic sheeting to prevent any contaminated water or other materials from seeping into the ground. The drill pad typically occupies about 2 to 3 acres.

Directional drilling may require a larger-sized rig and additional support facilities that may lead to larger pad sizes. For inland water sites, drilling barges that sit on the bottom may be used as a foundation for the drill rig. Some dredging may be done on these sites to create a slip, and protective skirts or pilings may be installed around the barge to prevent erosion by currents and tidal flow. In deeper water, jack-up, submersible and semi-submersible, rigs and drill ships may be used to drill wildcat wells. An offshore platform is typically used to drill development wells in deep water.

Since a source of freshwater is required for the drilling mud and for other purposes, a water well is sometimes drilled prior to moving the rig onto the location. If other sources are available, the water may be piped or trucked to the site.

At the exact spot on the surface where the hole is to be drilled, a rectangular pit called a cellar is dug, or culvert-like pipe is driven into the ground. If the cellar is dug, it may be lined with boards, or forms may be built and concrete poured to make walls for the cellar. The cellar is needed to accommodate drilling accessories that will be installed under the rig later.

In the middle of the cellar, the top of the well is started, sometimes with a small truck-mounted rig. The conductor hole is large in diameter, perhaps as large as 36 inches or more; is about 20 to 100 feet deep; and is lined with conductor casing, which is also called conductor pipe. If the topsoil is soft, the conductor pipe may be driven into the ground with a pile driver. In either case, the conductor casing keeps the ground near the surface from caving in. Also, it conducts drilling mud back to the surface from the bottom when drilling begins, thus the name conductor pipe.

Usually, another hole considerably smaller in diameter than the conductor hole is dug beside the cellar and also lined with pipe. Called the rathole, it is used as a place to store the kelly (a square or hexagonal rod used in drilling) when it is temporarily out of the borehole during certain operations. Sometimes on small rigs, a third hole, called the mousehole, is dug. On large rigs, it is not necessary to dig a mousehole because of the rig floor's height above the ground. In either case, the mousehole is lined with pipe and extends upward through the rig floor and is used to hold a joint of pipe ready for makeup.

Rigging Up—With the site prepared, the contractor moves in the rig and related equipment. The process, known as rigging up, begins by centering the base of the rig, called the substructure, over the conductor pipe in the cellar. The substructure supports the derrick or mast, pipe, drawworks, and sometimes the engines. If a mast is used, it is placed into the substructure in a horizontal position and hoisted upright. A standard derrick is assembled piece by piece on the substructure. Meanwhile, other drilling equipment such as the mud pumps are moved into place and readied for drilling.

Other rigging-up operations include erecting stairways, handrails, and guardrails; installing auxiliary equipment to supply electricity, compressed air, and water; and setting up storage facilities and living quarters for the toolpusher and company man. Further, drill pipe, drill collars bits, mud supplies, and many other pieces of equipment and supplies must be brought to the site before the rig can make hole.

Mobilizing the drill rig to the location requires moving 10 to 25 large truckloads of equipment over public highways and smaller roads. In very remote locations, entire drilling crews and service personnel may be temporarily housed onsite. A typical drilling crew consists of five people. Drilling operations are continuous, 24 hours a day and 7 days a week. The crews usually work two 12-hour shifts. With the drilling crew, geologists, engineers, supervisors, and specialized service providers, there may be anywhere from 5 to over 20 people on a drilling location at any given time. An irregular stream of traffic to and from the rig occurs day and night.

Drilling the Surface Hole—Rotary drilling is used almost universally in modern-day drilling. Drilling is accomplished by rotating special bits under pressure. Starting to drill is called “spudding in” the well. To spud in, a large bit, say 17 ½ inches in diameter as an example, is attached to the first drill collar and is lowered into the conductor pipe by adding drill collars and drill pipe one joint at a time until the bit reaches the bottom. While drilling, the rig derrick and associated hoisting equipment support the drill string’s weight. The combination of rotary motion and weight on the bit causes rock to be chipped away at the bottom of the hole.

The rotary motion is created by a square or hexagonal rod, called a kelly, which fits through a square or hexagonal hole in a large turntable, called a rotary table. The rotary table sits on the drilling rig floor and as the hole advances, the kelly slides down through it. With the kelly attached to the top joint of pipe, the pump is started to circulate mud, the rotary table is engaged to rotate the drill stem and bit, and weight is

set down on the bit to begin making hole. When the kelly has gone as deep as it can, it is raised, and a joint of drill pipe about 30 feet long is attached in its place. The drill pipe is then lowered, the kelly is attached to the top of it, and drilling recommences. By adding more and more drill pipe, the hole can steadily penetrate deeper.

Large volumes of fluid, generically called drilling mud, circulate down the drill pipe to the drill bit and back to the surface. The mud lubricates and cools the bit and carries drill cuttings to the surface. The composition of the mud system depends on the types of formations being drilled, economics, water availability, pressure, temperature, and many other significant factors. Mud can be as simple as freshwater, or a complex emulsion of water, oil, chemicals, clays, and weighting material. Chemicals added to the mud help drill and protect the hole's integrity. Weighting material is often added to prevent formation fluids from flowing into the well as it is being drilled. Mud systems can be highly toxic or relatively benign. The drilling mud along with cuttings from the well account for the largest volume of waste generated at the well site. Wells may also be drilled using compressed air instead of drilling mud. Drill cuttings and fluids produced from formations while drilling are blown into a lined pit next to the drilling rig through what is known as a blooey line.

The first part of the hole is known as the surface hole. Even though the formation that contains the hydrocarbons may lie many thousands of feet below this point, drilling ceases temporarily because steps must now be taken to protect and seal off the formations that occur close to the surface. For example, freshwater zones must be protected from contamination by drilling mud. To protect them, special pipe called casing is run into the hole and cemented.

Tripping Out—The first step in running casing is to pull the drill stem and bit out of the hole. Pulling the drill stem and bit out of the hole in order to run casing, change bits, or perform some other operation in the borehole is called tripping out. To trip out, the drilling crew uses the rig's hoisting system, or drawworks, to raise the drill stem out of the hole.

Attached to the traveling block is a set of drill pipe lifting devices called elevators. Elevators are gripping devices that can be latched and unlatched around the tool joints of the drill pipe. The crew latches the elevators around the drill pipe, and the driller raises the traveling block to pull the pipe upward. When the third joint of pipe clears the rotary table, the rotary helpers set the slips and use the tongs to break out the pipe. The pipe is usually removed in stands of three joints. Removing pipe in three-joint stands, rather than in single joints, speeds the tripping out process. With the stand of pipe broken out, the crew guides it into position on the rig floor to the side of the mast or derrick.

The derrickman unlatches the elevators from the top of the pipe and stands the pipe back in the derrick. Working as a close-knit team, the driller, rotary helpers, and derrickman continue tripping out until all the drill pipe, the drill collars, and the bit are out of the hole. At this point, the only thing in the hole is drilling mud, because mud was pumped into the hole while pipe was tripped out.

Running Surface Casing—Once the drill stem is out, often a special casing crew moves in to run the surface casing. Casing is large-diameter steel pipe, and is run into the hole with the use of special heavy-duty casing slips, tongs, and elevators. Casing accessories include centralizers, scratchers, a guide shoe, a float collar, and plugs.

Centralizers keep the casing in the center of the hole so that when the casing is cemented, the cement can be evenly distributed around the outside of the casing. Scratchers help remove mud cake from the side of the hole so that the cement can form a better bond. The guide shoe guides the casing past debris in the hole, and has an opening in its center out of which cement can exit the casing. The float collar serves as a receptacle for special cementing plugs, and allows drilling mud to enter the casing at a controlled rate.

The plugs begin and end the cementing job, and serve to keep cement separated from the mud so that the mud cannot contaminate the cement. The casing crew, with the drilling crew available to help as needed, runs the surface casing into the hole one joint at a time. Casing is available in joints of about 40 feet. Once the hole is lined from bottom to top with casing, the casing is cemented in place.

Cementing—The cementing of oil well casing annuli is a universal practice done for a number of reasons, depending on casing type. Conductor casings can be cemented to prevent the drilling fluid from circulating outside the casing, causing the very surface erosion the casing was intended to prevent. Surface casings must be cemented to seal off and protect freshwater formations, provide an anchor for blowout preventer equipment, and give support at the surface for deeper strings of casing. Intermediate strings of casing are cemented in order to seal off abnormal pressure formations, effectively isolate incompetent formations that might cause drilling problems unless supported by casing and cement, and shut off zones of lost circulation. Production casing is cemented to prevent the migration of fluids to thief zones, to prevent sloughing of formations that could result in reduced production, and to isolate productive zones for future development.

An oilwell cementing service company usually performs the job of cementing the casing in place. The cement used to cement oilwells is not too different from the cement used as a component in ordinary concrete. Basically, oilwell cement is Portland cement with special additives to make it suitable for various conditions of pumping, pressure, and temperature.

Cementing service companies stock various types of cement and use special trucks to transport the cement in bulk to the well site. Bulk cement storage and handling at the rig location make it possible to mix the large quantities needed in a short time. The cementing crew mixes the dry cement with water, often using a recirculating mixer. This device thoroughly mixes the water and cement by recirculating part of the already-mixed components through a mixing compartment. Powerful cementing pumps move the liquid cement (slurry) through a pipe to a special valve made up on the topmost joint of casing. This valve is called a cementing head, or plug container. As the cement slurry arrives, the bottom plug is released from the cementing head and precedes the slurry down the inside of the casing. The bottom plug keeps any mud that is inside the casing from contaminating the cement slurry where the two liquids interface. Also, the plug wipes off mud that adheres to the inside wall of the casing and prevents it from contaminating the cement.

The plug travels ahead of the cement until it reaches the float collar. At the collar the plug stops, but continued pump pressure breaks a seal in the top of the plug and allows the slurry to pass through a passageway in it. The slurry flows out through the guide shoe, and starts up the annulus between the outside of the casing and the wall of the hole until the annulus is filled.

A top plug is released from the cementing head and follows the slurry down the casing. The top plug keeps the displacement fluid, usually drilling mud, from contaminating the cement slurry. When the top plug comes to rest on the bottom plug in the float collar, the pumps are shut down and the slurry is allowed to harden. Allowing time for the cement to set is known as waiting on cement and varies in length. In some cases, it may be only a matter of a few hours; in other cases, it may be 24 hours or even more, depending on well conditions. Adequate waiting on cement time must be given to allow the cement to set properly and bond the casing firmly to the wall of the hole. After the cement hardens and tests indicate that the job is good – that is, that the cement has made a good bond and no voids exist between the casing and the hole – drilling can be resumed.

Tripping In—To resume drilling, the drill stem and a new, smaller bit that fits inside the surface casing must be tripped back into the hole. The bit is made up on the bottommost drill collar. Then, working

together, the driller, floormen, and derrickman make up the stands of drill collars and drill pipe and trip them back into the hole.

When the drill bit reaches bottom, circulation and rotation are begun and the bit drills through the small amount of cement left in the casing, the plugs, the guide shoe, and into the new formation below the cemented casing. As drilling progresses and hole depth increases, formations tend to get harder; as a result, several round trips (trips in and out of the hole) are necessary to replace worn bits.

Controlling Formation Pressure—During all phases of drilling, an important consideration is well control. Well control is preventing the well from blowing out by using proper procedures and equipment. A blowout is the uncontrolled flow of fluids – oil, gas, water, or all three – from a formation that the hole has penetrated.

Blowouts threaten lives, property, and pollution of the environment. Rig crews receive extensive training in how to recognize and react to impending blowouts, making them relatively rare events.

The key to well control is understanding pressure and its effects. Pressure exists in the borehole because it contains drilling mud and in some formations because they contain fluids. All fluids --drilling mud, water, oil, gas, and so forth – exert pressure. The denser the fluid (the more the fluid weighs), the more pressure the fluid exerts. A heavy mud exerts more pressure than a light mud. For effective control of the well, the pressure exerted by the mud in the hole should be higher than the pressure exerted by the fluids in the formation.

Pressure exerted by mud in the hole is called hydrostatic pressure. Pressure exerted by fluids in a formation is called formation pressure. The amount of hydrostatic pressure and formation pressure depends on the depth at which these pressures are measured and the density, or weight, of each fluid. Regardless of the depth, hydrostatic pressure must be equal to or slightly greater than formation pressure, or the well kicks. The well kicks, formation fluids enter the hole, if hydrostatic pressure falls below formation pressure. Thus, one of the crew's main concerns during all phases of the drilling operation is to keep the hole full of mud whose weight is sufficiently high to overcome formation pressure.

However, unexpectedly high formation pressures can be encountered. Formation fluids can be swabbed, or pulled, into the hole by the piston-like action of the bit as pipe is tripped out of the hole. Also, the mud level in the hole can fall so that the hole is no longer full of mud. Whatever the reason, when hydrostatic pressure falls below formation pressure, crew members have a kick on their hands, and they must take quick and proper action to prevent the kick from becoming a blowout.

Helping the crew keep an eye on the rig's operation are various control instruments located on the driller's console. Some rigs have data processing systems that utilize slave computer display terminals, or CRTs (short for cathode ray tubes), on the rig floor, in the mud logging trailer, in the toolpusher's trailer, and in the company man's trailer. When limits that have been programmed into the system are exceeded, the system goes into an alarm condition.

Whether the kick warning signs come from electronic monitors, a computer printout, or the behavior of the mud returning from the hole, an alert drilling crew detects the signs and takes proper action to shut the well in. To shut a well in, large valves called blowout preventers, which are installed on top of the cemented casing, are closed to prevent further entry of formation fluids into the hole. Once the well is shut in, procedures are begun to circulate the intruded kick fluids out of the hole. Also, weighting material is added to the mud to increase its density to the proper amount to prevent further kicks, and the weighted up mud is circulated into the hole. If the mud has been weighted the proper amount, then normal operations can be resumed.

When drilling with air, there is very little hydrostatic pressure exerted downhole, and formations are drilled through in an “underbalanced” mode. This means the formations can flow into the wellbore as drilling progresses. With air drilling, well control is more dependent on the blowout preventers. It is prudent and often a regulatory requirement to have 1) extra storage capacity to hold formation fluids and 2) materials and equipment on location to “mud up” if necessary to maintain well control and wellbore integrity.

Running and Cementing Intermediate Casing—At a predetermined depth, drilling stops again in order to run another string of casing. Depending on the depth of the hydrocarbon reservoir, this string of casing may be the final one, or it may be an intermediate one. Intermediate casing is smaller than surface casing because it must be run inside the surface string and to the bottom of the intermediate hole. In general, it is run and cemented in much the same way as surface casing.

Final Depth and Well Evaluation—Using a still smaller bit that fits inside the intermediate casing, the next part of the hole is drilled. Often, the next part of the hole is the final part of the hole unless more than one intermediate string is required. After cementing the intermediate casing, drilling resumes by tripping the new bit and drill stem back in the hole. The intermediate casing shoe is drilled out, and drilling the new hole resumes.

While drilling and once reaching the total depth of the well, the operator collects information to determine if hydrocarbons have been encountered. To help the operator decide whether to abandon the well or to set a final, or production, string of casing, several techniques can be used. A thorough examination of the cuttings made indicates whether the formation contains sufficient hydrocarbons. A geologist catches cuttings at the shale shaker and analyzes them in a portable laboratory at the well site. He often works closely with a mud logger logger – a technician who monitors and records information brought to the surface by the drilling mud as the hole penetrates formations of interest.

Well logging is another valuable method of analyzing downhole formations. Using a mobile laboratory, well loggers lower sensitive tools to the bottom of the well on wireline and then pull them back up the hole. As they pass back up the hole, the tools measure and record certain properties of the formations and the fluids (oil, gas, and water) that may reside in the formations. Logging tools can also be run as part of the drill string to measure hole conditions and formation properties as the well is being drilled. This is called “measurement while drilling.”

If logging results indicate commercial quantities, a drill stem test may be run. Tools are positioned on the drill pipe to isolate the zone to be flow tested. Downhole formation pressure and fluids enter the tool and activate a recorder. Test may be designed to allow formation fluids to flow to the surface during the test or just to allow a certain volume to enter into the wellbore. In either case, provisions must be made at the surface to separate formation fluids from the mud, and to store and dispose of formation liquids. Natural gas produced during drill stem test is vented or flared. A properly designed and run drill stem test can give excellent indication of the types and volumes of fluid the zone is capable of producing.

In addition to well logging and drill stem testing, formation core samples can be taken from the hole and examined in a laboratory.

Setting Production Casing—After the drilling contractor has drilled the hole to final depth and the operating company has evaluated the formations, the company decides whether to set production casing or plug and abandon the well. If the well is judged to be a dry hole --that is, not capable of producing oil or gas in commercial quantities – the well will be plugged and abandoned.

Several cement plugs will be put in the well to seal it permanently. Cement plugs will be designed and placed to protect the zones of usable water from pollution and to prevent escape of oil, gas, or other fluids to the surface or other zones. Plugging and abandoning a well is considerably less expensive than completing it.

On the other hand, if evaluation reveals that commercial amounts of hydrocarbons exist, the company may decide to set casing and complete the well. The services of a casing crew and cementing company will once more be arranged for; and the production casing will be run and cemented in the well.

The drilling contractor nears the end of his job when the hole has been drilled to total depth and production casing has been set and cemented. In some cases, the rig and crew remain on the location to “complete” the well, or make it ready for production. In other cases, the drilling contractor moves his rig, and the operator brings in a smaller, less expensive completion rig and crew to finish up the job.

Well Completion—Completion equipment and methods employed are quite varied. The perforated completion is by far the most popular method of completing a well. Perforating is the process of piercing the casing wall, cement, and rock to provide openings through which formation fluids may enter the wellbore. Perforating is accomplished by placing guns holding special explosive charges opposite the zone to be produced. The charges are shaped so that an intense, directional explosion is formed. The well must have a good cement job and well-designed and well-executed perforation methods to get effective formation flow.

Explosives used in perforating guns are very stable. Accidents are rare as long as the people involved use proper procedures. Perforating guns may be run in the well on tubing or by wireline. Firing is accomplished by applying electric current, pressure, or mechanical force to a firing head located on the perforating gun.

In some areas, formations are competent enough that production casing is not used. The drilled hole is left uncased. Many wells in Oklahoma are constructed with only surface casing and open hole below.

The final string of pipe usually run in a producing well is the tubing. Tubing is a string of relatively small diameter pipe through which the hydrocarbons are produced. Tubing sizes vary from less than 2 inches in diameter up to 4½ inches for large volume producers. In a flowing well, its smaller diameter produces more efficient flow than casing. Also, since it is not cemented in the hole, tubing may be removed when it becomes plugged or damaged. Tubing, when used with a packer, keeps well fluids and formation pressures away from the casing. Well fluids and high pressures can damage casing, necessitating costly repairs.

The packer consists of a pipe like device through which well fluids can flow. Rubber sealing elements form a fluid tight seal around the inside of the casing. Gripping elements, called slips, hold the packer in place. Because the packer seals off the space between the tubing and the casing, produced fluids are forced into and up the tubing.

Another device often installed in the tubing string near the surface is a “subsurface safety valve.” The valve remains opened, as long a flow is normal. When the valve senses a loss in pressure or significantly increased flow (such as would occur with a flowline break), the valve closes automatically. Subsurface safety valves can prevent uncontrolled well flow in the event of massive surface equipment failure.

Finally, a tubing head is installed at the top of the well to support the tubing. Valves, gauges, and flow control devices are installed on top of the tubing head. Together, they make up what is commonly called a Christmas tree.

When reservoir pressures are not sufficient for the well to flow on its own, operators employ artificial lift methods. The most common by far is rod pumping. A plunger pump is installed deep in the well and connected by rods to a pumping unit on the surface. The pump jack moves the rods up and down to work the downhole pump. Pump jacks are often driven with electric motors or natural gas engines. The gas lift method works by injecting high-pressure gas into the fluid column of a well to lighten and raise the fluid by expansion of the gas. Instead of pump jacks, there will be a source of high-pressure gas in the field, usually from a gas compressor. The hydraulic pumping method uses a fluid to drive a downhole motor, which in turn drives a pump that pumps the oil to the surface. Surface equipment for hydraulic pumping includes a high-pressure pump and vessels to separate the hydraulic fluid from produced fluid. Yet another type of artificial lift is electric submersible pumping, usually only used on very high-volume wells. An electric motor attached to a pump is installed downhole. Electric current is supplied to the motor through special heavy-duty armored cable. Surface facilities may just be a small transformer/control box.

The well may be stimulated to enhance flow. Stimulation may be performed before or after the completion equipment is installed. Two common types of stimulation are formation acidization and hydraulic fracturing. Stimulation treatments can improve flow to the point where commercial production is achieved in an otherwise uneconomical well.

Formation acidizing is treating the hydrocarbon-bearing rock with large volumes of acid. The most common types of acid used are hydrochloric (HCl) and hydrofluoric (HF). Oilfield acids contain additives to prevent or delay corrosion of the well's tubulars, inhibit sludging and emulsion reactions with oil in the formation, and make the acid easier to pump. The aim in acidizing is to enlarge the pore spaces and passages by dissolving rock, thus enlarging existing flow channels and opening new ones to the wellbore.

Acid is brought to the well location in tanker trucks and pumped using one or more truck-mounted pumps. Spent acid that is flowed back from the well is often kept separate from field production. The spent acid may be put into temporary tanks until it is trucked off to disposal.

In hydraulic fracturing, fluid is pumped into the formation at high enough pressures and rates to split the rock. Proppants are pumped with the fluid to hold the crack open once pumping stops. Sand and sintered bauxite beads are two common propping agents. Fracturing fluid must not only break down the formation, but also extend and transport the proppant into the fracture. The industry has developed a multitude of complex fluid and proppant systems to achieve the best results in the many varied types of reservoirs.

Many truck-mounted pumps and temporary storage tanks are needed on location to fracture-treat wells. Larger well locations may be needed if hydraulic fracturing is part of a completion procedure.

Field Development—If the wildcat well produces oil or gas in commercial quantities, one or more additional wells are normally drilled to confirm the initial finding and further test and define the extent of the oil or gas reserves. Location of the confirmation wells is dependent upon analysis of discovery well data and any existing seismic surveys. Confirmation progresses by drilling one well after another, each dependent on the results of the previous wells.

With more information in hand, facilities can be designed to handle production from the field. Next, development wells are drilled as needed to efficiently drain the reservoir. The procedures for drilling development wells are about the same as for wildcats, except that there may be a variation in the amount and type of subsurface sampling, testing, and evaluation. More detailed seismic work may be performed to aid in the location of development wells.

A state Oil & Gas Commission usually establishes the field well spacing pattern. Typical well spacing may be one well every 640, 320, 160, 80, or 40 acres. Completely filled spacing patterns would translate to 1, 2, 4, 8, or 16 wells per square mile, respectively. In general, oil well spacing is denser for oil wells than for gas wells, and shallow well spacing is denser than for deeper wells.

Access roads to development wells are usually better planned and constructed than those for wildcat wells because these wells are expected to have longer lives. Typically a lease area will have one main route, with side roads to each well or multi-well pad location. Change from temporary to permanent roads does not take place until a well has been established as being capable of production. The amount of roadway required per square mile of field is 4 miles, based upon a spacing pattern of 40 acres and a separate pad for each well.

Directional drilling is sometimes used to concentrate the surface locations of two or more wells in one area. This technique minimizes the amount of surface area (roads and well pads) needed to develop a field. Multiple well pads may be used when developing a field inside the limits of a city or in environmentally sensitive areas.

Other surface equipment and support facilities are brought in or constructed during field development. For example, a battery of storage tanks or a pipeline may be required to handle produced oil or gas. Separation and treatment facilities are required to separate gas and water from oil. Storage tanks are required to hold brines produced during oil extraction, and a proper disposal capability, most typically reinjection, must be developed. Natural gas must be properly disposed of (usually flared) or treated to remove impurities if it is to be used or sold.

Well Servicing and Workover Operations—Sometimes it is necessary to repair downhole mechanical problems. Workover rigs are often used to repair downhole equipment or assist in large stimulation jobs. The most common well servicing operation is related to artificial lift installation, tubing string repairs, and work on other downhole completion equipment that may be malfunctioning. More involved workover operations might include cleanout of sand, scale, or paraffin deposits that accumulate in the well, casing repair, cementing, perforating new or existing zones of production, or even some limited drilling operations.

Workover rigs are scaled-down drilling rigs. They are usually equipped to stand the pipe in the derrick, rotate pipe while it is in the hole, and circulate workover fluids down and back up the well. Workover rigs are usually self-contained on a truck. They are highly mobile and can be rigged up and rigged down quickly. A well servicing jog to replace a rod pump may last only 1 or 2 days. A major workover operation to change or “recomplete” to another productive zone may last more than a month.

PLUGGING/ABANDONMENT/RECLAMATION

Workover rigs are also used to plug and abandon wells once they are depleted. Plugging operations consist of removing the tubing, packer, and other completion equipment; pumping cement across producing zones; and placing cement plugs at various depths to protect freshwater zones. Finally, a cement plug is set at the surface to cap the well, and wellhead equipment is cut off. A permanent abandonment marker is often placed to identify the well’s location.

The surface owner and regulatory agencies often dictate surface reclamation. Reclamation can range from just removing equipment to reclaiming the area to conditions that existed before drilling the well.

Full-scale reclamation can include the following:

Appendix C. Types of Non-Federal Oil and Gas Development Conducted on the National Wildlife Refuge System

- Removal of structures, equipment, and debris used or generated during operations;
- Removal or remediation of contaminated soils;
- Recontouring of disturbed areas to near original grade;
- Spreading and preparation of topsoil;
- Planting of native vegetation, usually grasses, but sometimes also tree saplings;
- Erosion protection measures such as mulching; and
- Monitoring of revegetation and erosion control efforts.

Reclamation may last a few days or a few years, depending on the degree of contamination on the site and the ability of native species to grow.

APPENDIX D: NATIONAL WILDLIFE REFUGE SYSTEM UNITS WITH NON-FEDERAL OIL AND GAS WELLS.

TABLE D. NWRS UNITS WITH NON-FEDERAL OIL AND GAS WELLS

(Other includes wells other than oil and gas: injection, saltwater disposal, enhanced oil recovery, dry, observation, stratigraphic, other, and production type data not available (N/A)).

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total
Pacific Region (1)	0	0	0	0	0
Southwest Region (2)	358	282	26	308	974
<i>Arizona</i>				1	1
Buenos Aires National Wildlife Refuge				1	1
<i>New Mexico</i>	5	10		2	17
Bitter Lake National Wildlife Refuge	5	10			15
Sevilleta National Wildlife Refuge				2	2
<i>Oklahoma</i>	62	149		255	466
Deep Fork National Wildlife Refuge	26	147		227	400
Little River National Wildlife Refuge		1		7	8
Optima National Wildlife Refuge	13			2	15
Salt Plains National Wildlife Refuge	11	1		1	13
Sequoyah National Wildlife Refuge				4	4
Tishomingo National Wildlife Refuge	2			12	14
Washita National Wildlife Refuge	10			2	12
<i>Texas</i>	291	123	26	50	490
Anahuac National Wildlife Refuge	5	7		3	15
Aransas National Wildlife Refuge	58	8	4	2	72
Attwater Prairie Chicken National Wildlife Refuge	19	1			20
Big Boggy National Wildlife Refuge	1				1
Brazoria National Wildlife Refuge	12	4	3		19
Caddo Lake National Wildlife Refuge	2	2		1	5
Hagerman National Wildlife Refuge	3	71	4	38	116
Laguna Atascosa National Wildlife Refuge	11				11
Lower Rio Grande Valley National Wildlife Refuge	139	23	10	3	175
Mcfaddin National Wildlife Refuge	14	4		2	20
San Bernard National Wildlife Refuge	24	3	2	1	30
Texas Point National Wildlife Refuge			2		2
Trinity River National Wildlife Refuge	3		1		4
Midwest Region (3)	2	7		93	102
<i>Indiana</i>		7		89	96
Big Oaks National Wildlife Refuge				5	5

Appendix D. National Wildlife Refuge System Units with Non-Federal Oil and Gas Wells

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total
Muscatatuck National Wildlife Refuge				1	1
Patoka River National Wildlife Refuge		7		83	90
<i>Michigan</i>	2				2
Kirtlands Warbler Wildlife Management Area	2				2
<i>Missouri</i>				4	4
Big Muddy National Fish And Wildlife Refuge				4	4
Southeast Region (4)	1,709	530	16	1,172	3,427
<i>Alabama</i>				14	14
Cahaba River National Wildlife Refuge				14	14
<i>Arkansas</i>	8	51		6	65
Bald Knob National Wildlife Refuge	3				3
Cache River National Wildlife Refuge	2				2
Felsenthal National Wildlife Refuge	3	48		6	57
Overflow National Wildlife Refuge		1			1
White River National Wildlife Refuge		2			2
<i>Florida</i>				4	4
Florida Panther National Wildlife Refuge				2	2
National Key Deer Refuge				1	1
Ten Thousand Islands National Wildlife Refuge				1	1
<i>Kentucky</i>				1	1
Reelfoot National Wildlife Refuge				1	1
<i>Louisiana</i>	1,693	349	16	772	2,830
Atchafalaya National Wildlife Refuge	9	12	2	23	46
Bayou Cocodrie National Wildlife Refuge				49	49
Bayou Sauvage National Wildlife Refuge				4	4
Bayou Teche National Wildlife Refuge	14	3		18	35
Big Branch Marsh National Wildlife Refuge				4	4
Black Bayou Lake National Wildlife Refuge	78			7	85
Breton National Wildlife Refuge				3	3
Cameron Prairie National Wildlife Refuge				14	14
Cat Island National Wildlife Refuge	2			3	5
Catahoula National Wildlife Refuge	1	20		54	75
D'arbonne National Wildlife Refuge	183			100	283
Delta National Wildlife Refuge	52	214	11	86	363
Grand Cote National Wildlife Refuge				2	2
Lacassine National Wildlife Refuge	32	5	1	42	80
Lake Ophelia National Wildlife Refuge		5		51	56
Mandalay National Wildlife Refuge	13	5		25	43
Red River National Wildlife Refuge	6	24		27	57
Sabine National Wildlife Refuge	22	23	2	51	98

Appendix D. National Wildlife Refuge System Units with Non-Federal Oil and Gas Wells

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total
St. Catherine Creek National Wildlife Refuge				6	6
Tensas River National Wildlife Refuge	1	36		75	112
Upper Ouachita National Wildlife Refuge	1,280	2		128	1,410
<i>Mississippi</i>	8	130		375	513
Grand Bay National Wildlife Refuge				1	1
Mississippi Sandhill Crane National Wildlife Refuge				1	1
Panther Swamp National Wildlife Refuge				2	2
St. Catherine Creek National Wildlife Refuge	8	130		370	508
Yazoo National Wildlife Refuge				1	1
Northeast Region (5)	7	4	11	28	50
<i>New York</i>				1	1
Montezuma National Wildlife Refuge				1	1
<i>Pennsylvania</i>	2				2
Erie National Wildlife Refuge	2				2
<i>West Virginia</i>	5	4	11	27	47
Canaan Valley National Wildlife Refuge	4			3	7
Ohio River Islands National Wildlife Refuge	1	4	11	24	40
Mountain - Prairie Region (6)	42	37	2	41	122
<i>Colorado</i>				3	3
Baca National Wildlife Refuge				2	2
Rocky Mountain Arsenal National Wildlife Refuge				1	1
<i>Kansas</i>	1	25	1		27
Quivira National Wildlife Refuge	1	25	1		27
<i>Montana</i>	40	9		34	83
Benton Lake National Wildlife Refuge				2	2
Benton Lake Wetland Management District	4			7	11
Bowdoin National Wildlife Refuge	1			1	2
Bowdoin Wetland Management District	21			2	23
Hailstone National Wildlife Refuge				1	1
Halfbreed Lake National Wildlife Refuge	1			4	5
Hewitt Lake National Wildlife Refuge	13			1	14
Lake Mason National Wildlife Refuge				2	2
Medicine Lake National Wildlife Refuge		2		3	5
Northeast Montana Wetland Management District		7		11	18
<i>North Dakota</i>			1		1
Lake Ilo National Wildlife Refuge			1		1
<i>Utah</i>	1	3		3	7
Bear River Migratory Bird Refuge				3	3
Colorado River Wildlife Management Area	1	2			3
Ouray National Wildlife Refuge		1			1

Appendix D. National Wildlife Refuge System Units with Non-Federal Oil and Gas Wells

Region / State / NWRS Unit	Gas	Oil	Oil and Gas	Other	Total
<i>Wyoming</i>				1	1
Mortenson Lake National Wildlife Refuge				1	1
Alaska Region (7)	75	66	4	54	199
<i>Alaska</i>	75	66	4	54	199
Alaska Peninsula National Wildlife Refuge				5	5
Becharof National Wildlife Refuge				2	2
Kenai National Wildlife Refuge	75	66	4	46	191
Yukon Delta National Wildlife Refuge				1	1
Pacific Southwest Region (8)	8	45		75	128
<i>California</i>	8	45		70	123
Bitter Creek National Wildlife Refuge				12	12
Butte Sink Wildlife Management Area				1	1
Colusa National Wildlife Refuge	1			3	4
Delevan National Wildlife Refuge	1			7	8
Grasslands Wildlife Management Area				6	6
Guadalupe-Nipomo Dunes National Wildlife Refuge		2		1	3
Hopper Mountain National Wildlife Refuge		17		2	19
Humboldt Bay National Wildlife Refuge				1	1
Kern National Wildlife Refuge				2	2
Merced National Wildlife Refuge				1	1
North Central Valley Wildlife Management Area	6			22	28
Pixley National Wildlife Refuge				1	1
San Joaquin River National Wildlife Refuge				5	5
San Pablo Bay National Wildlife Refuge				1	1
Seal Beach National Wildlife Refuge		26		4	30
Tijuana Slough National Wildlife Refuge				1	1
<i>Nevada</i>				5	5
Fallon National Wildlife Refuge				1	1
Stillwater National Wildlife Refuge				4	4
Grand Total	2,201	971	59	1,771	5,002

APPENDIX E: CLASS I AND CLASS II NATIONAL WILDLIFE REFUGE SYSTEM UNITS IN DESIGNATED NONATTAINMENT AREAS

If the concentration of one or more criteria pollutants in a geographic area is found to exceed the regulated or threshold level for one or more NAAQS, the area may be classified as a nonattainment area

TABLE E-1. REFUGES IN NONATTAINMENT AREAS

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Class I National Wildlife Refuges				
Edwin B. Forsythe National Wildlife Refuge	I	Atlantic	Philadelphia-Wilmington- Atlantic City, PA-NJ-MD-DE	O ₃ , PM _{2.5}
Breton National Wildlife Refuge	I	St. Bernard Parish	St. Bernard Parish, LA	SO ₂
Class II National Wildlife Refuges				
Amagansett National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O ₃ , PM _{2.5}
Anahuac National Wildlife Refuge	II	Chambers	Houston-Galveston-Brazoria, TX	O ₃
Antioch Dunes National Wildlife Refuge	II	Contra Costa	San Francisco Bay Area, California	O ₃ , PM _{2.5} , CO
Atchafalaya National Wildlife Refuge	II	St. Martin; Iberville	Baton Rouge, LA	O ₃
Big Muddy National Fish and Wildlife Refuge	II	St. Charles; St. Louis County	St. Louis-St. Charles-Farmington, MO-IL	O ₃
Bitter Creek National Wildlife Refuge	II	Kern	San Joaquin Valley, CA	O ₃ , PM _{2.5} , PM ₁₀
Blackwater National Wildlife Refuge	II	Dorchester	Washington, DC-MD-VA	O ₃
Blue Ridge National Wildlife Refuge	II	Tulare	San Joaquin Valley, CA	O ₃ , PM _{2.5} , PM ₁₀
Brazoria National Wildlife Refuge	II	Brazoria	Houston-Galveston-Brazoria, TX	O ₃
Cabeza Prieta National Wildlife Refuge	II	Pima	Pima County, Ajo planning area, AZ	PM ₁₀
Cape May National Wildlife Refuge	II	Cape May	Philadelphia-Wilmington, PA-NJ-DE	O ₃

Nonattainment Areas

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Cibola National Wildlife Refuge	II	Imperial	Imperial County, CA	O ₃
Coachella Valley National Wildlife Refuge	II	Riverside	Riverside County (Coachella County), CA	O ₃ , PM ₁₀
Conscience Point National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O ₃ , PM _{2.5}
Desert National Wildlife Refuge	II	Clark	Las Vegas Area, NV	PM ₁₀ , CO
Detroit River International Wildlife Refuge	II	Wayne	Detroit-Ann Arbor, MI	PM _{2.5} , SO ₂ , CO
Don Edwards San Francisco Bay National Wildlife Refuge	II	Santa Clara	San Francisco Bay Area, CA	O ₃ , PM _{2.5} , CO
Elizabeth Alexandra Morton National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O ₃ , PM _{2.5}
Farallon National Wildlife Refuge	II	Marin	San Francisco Bay Area, CA	O ₃ , PM _{2.5} , CO
Featherstone National Wildlife Refuge	II	Prince William	Washington, DC-MD-VA	O ₃
Great Swamp National Wildlife Refuge	II	Morris	New York, NY-NJ-CT	O ₃ , PM _{2.5}
Havasu National Wildlife Refuge	II	Mohave	San Bernardino County (part), excluding Searles Valley Planning area and South Coast Air Basin, CA	PM ₁₀
Hopper Mountain National Wildlife Refuge	II	Ventura	Ventura County, CA	O ₃
Imperial National Wildlife Refuge	II	La Paz	Imperial County, CA	O ₃
John Heinz National Wildlife Refuge at Tinicum	II	Philadelphia; Delaware	Philadelphia- Wilmington, PA-NJ-DE	O ₃ , PM _{2.5} , CO

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Kern National Wildlife Refuge	II	Kern	San Joaquin Valley, CA	O3, PM2.5, PM10
Lower Klamath National Wildlife Refuge	II	Klamath	Klamath Falls, OR	PM2.5
Marin Islands National Wildlife Refuge	II	Marin	San Francisco Bay Area, CA	PM2.5
Mason Neck National Wildlife Refuge	II	Fairfax County	Washington, DC-MD-VA	O3
McFaddin National Wildlife Refuge	II	Jefferson	Houston-Galveston-Brazoria, TX	O3
McNary National Wildlife Refuge	II	Walla Walla	Walla Walla County, Wallula, WA	PM10
Merced National Wildlife Refuge	II	Merced	San Joaquin Valley, CA	O3, PM2.5, PM10
Middle Mississippi River National Wildlife Refuge	II	Monroe; Jefferson	Jefferson County, MO	O3, SO2
Minnesota Valley National Wildlife Refuge	II	Scott	Minneapolis-St. Paul Area, MN	CO
Nisqually National Wildlife Refuge	II	Pierce	Seattle-Tacoma Area, WA	CO
Nomans Land Island National Wildlife Refuge	II	Dukes	Dukes County, MA	O3
Occoquan Bay National Wildlife Refuge	II	Prince William	Washington, DC-MD-VA	O3
Ohio River Islands National Wildlife Refuge	II	Beaver	Marshall, WV	O3, PM2.5, SO2
Oyster Bay National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O3, PM2.5, CO
Pixley National Wildlife Refuge	II	Tulare	San Joaquin Valley, CA	O3, PM2.5, PM10

Nonattainment Areas

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Prime Hook National Wildlife Refuge	II	Sussex	Seaford, DE	O3
Ridgefield National Wildlife Refuge	II	Clark	Vancouver Area, Clark County (part), WA	CO
Rocky Flats National Wildlife Refuge	II	Jefferson	Denver-Boulder-Greeley-Ft. Collins-Loveland, CO	O3, PM10, CO
Rocky Mountain Arsenal National Wildlife Refuge	II	Adams	Denver-Boulder-Greeley-Ft. Collins-Loveland, CO	O3, PM10, CO
Sacramento River National Wildlife Refuge	II	Butte	Chico, CA	O3, PM2.5
San Bernard National Wildlife Refuge	II	Brazoria	Houston-Galveston-Brazoria, TX	O3
San Diego Bay National Wildlife Refuge	II	San Diego	San Diego County, CA	O3, CO
San Diego National Wildlife Refuge	II	San Diego	San Diego County, CA	O3, CO
San Joaquin National Wildlife Refuge	II	Stanislaus	San Joaquin Valley, CA	O3, PM2.5, PM10
San Luis National Wildlife Refuge	II	Merced	San Joaquin Valley, CA	O3, PM2.5, PM10
San Pablo Bay National Wildlife Refuge	II	Napa, Solano	San Francisco Bay Area, CA	O3, PM2.5, CO
Seal Beach National Wildlife Refuge	II	Orange	Los Angeles, CA	O3, PM2.5, PM10, NO2, CO
Seatuck National Wildlife Refuge	II	Suffolk	New York-N. New Jersey-Long Island, NY-NJ-CT	O3, PM2.5
Seeds-kadee National Wildlife Refuge	II	Sweetwater	Upper Green River Basin Area, WY	O3
Silvio O. Conte National Wildlife Refuge	II	Middlesex	New York-N. New Jersey-Long Island, NY-NJ-CT	O3, CO

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Sonny Bono Salton National Wildlife Refuge	II	Imperial	Imperial Co, CA	O3, PM2.5, PM10
Steigerwald Lake National Wildlife Refuge	II	Clark	Vancouver Area, Clark County (part), WA	CO
Stewart B. McKinney National Wildlife Refuge	II	Fairfield	New York, NY-NJ-CT	O3, PM2.5, CO
Stone Lakes National Wildlife Refuge	II	Sacramento	Sacramento, CA	O3, PM2.5, PM10
Supawna Meadows National Wildlife Refuge	II	Salem	Philadelphia- Wilmington, PA-NJ-DE	O3, PM2.5
Sutter National Wildlife Refuge	II	Sutter	Yuba City-Marysville, CA	PM2.5
Target Rock National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O3, PM2.5
Tijuana Slough National Wildlife Refuge	II	San Diego	San Diego County, CA	O3, CO
Trinity River National Wildlife Refuge	II	Liberty	Houston-Galveston-Brazoria, TX	O3
Tualatin River National Wildlife Refuge	II	Washington	Portland Area, Portland Metro Service District Boundary, OR	CO
Two Ponds National Wildlife River	II	Jefferson	Denver-Boulder-Greeley-Ft. Collins-Loveland, CO	O3, PM10, CO
Two Rivers National Wildlife Refuge	II	St. Charles, Jersey	St. Louis-St. Charles-Farmington, MO-IL	O3
Upper Klamath National Wildlife Refuge	II	Klamath	Klamath Falls, OR	PM2.5
Wallkill River National Wildlife Refuge	II	Sussex	New York, NY-NJ-CT	O3, PM2.5
Wapanocca National Wildlife Refuge	II	Crittenden	Memphis, TN-MS-AR	O3

Nonattainment Areas

NWR Unit	PSD Class	County	NAAQS Nonattainment Area	Pollutant(s)
Watercress Darter National Wildlife Refuge	II	Jefferson County	Birmingham, AL	PM2.5
Wertheim National Wildlife Refuge	II	Suffolk	New York, NY-NJ-CT	O3, PM2.5

APPENDIX F: WETLANDS IN NATIONAL WILDLIFE REFUGE SYSTEM UNITS

TABLE F-1. SELECTED WETLAND DESCRIPTIONS

Classification	Type	Description
System	Marine	The marine system consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30‰, with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves, are also considered part of the marine system because they generally support typical marine biota.
	Estuarine	The estuarine system consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of seawater. The estuarine system includes both estuaries and lagoons. It is more strongly influenced by its association with land than the marine system.
	Riverine	The riverine system includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5‰. A channel is an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water. The riverine system is divided into four subsystems: tidal, lower perennial, upper perennial, and intermittent. Each is defined in terms of water permanence, gradient, water velocity, substrate, and the extent of floodplain development.
	Lacustrine	The lacustrine system includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet)

Classification	Type	Description
		at low water. Lacustrine waters may be tidal or nontidal, but ocean-derived salinity is always less than 0.5%.
	Palustrine	The palustrine system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5%. The palustrine system was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent, or intermittent water bodies often called ponds.
Subsystem	Intertidal	The substrate is exposed and flooded by tides; includes the associated splash zone.
	Subtidal	The substrate is continuously submerged.
	Tidal	The gradient is low and water velocity fluctuates under tidal influence. The streambed is mainly mud with occasional patches of sand. Oxygen deficits may sometimes occur and the fauna is similar to that in the lower perennial subsystem. The floodplain is typically well developed.
	Lower Perennial	The gradient is low and water velocity is slow. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. Oxygen deficits may sometimes occur, the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The gradient is lower than that of the upper perennial subsystem, and the floodplain is well developed.
	Upper Perennial	The gradient is high and velocity of the water fast. There is no tidal influence, and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. The natural dissolved oxygen concentration is normally near saturation. The fauna is characteristic of running water, and there are few or no planktonic forms. The gradient is high compared with that of the lower perennial subsystem, and there is very little floodplain development.
	Intermittent	The channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent.
	Limnetic	All deepwater habitats within the lacustrine system; many small lacustrine systems have no limnetic subsystem.

Classification	Type	Description
	Littoral	All wetland habitats in the lacustrine system. Extends from the shoreward boundary of the system to a depth of 2 m (6.6 feet) below low water or to the maximum extent of nonpersistent emergent plants, if these grow at depths greater than 2 m.
Class	Scrub-Shrub	The scrub-shrub wetland class includes areas dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. All water regimes except subtidal are included. Scrub-shrub wetlands may represent a successional stage leading to forested wetland, or they may be relatively stable communities. They are known by many names, such as shrub swamp, shrub carr, bog, and pocosin. For practical reasons we have also included forests composed of young trees less than 6 m tall.
	Aquatic Bed	The aquatic bed class includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Water regimes include subtidal, irregularly exposed, regularly flooded, permanently flooded, intermittently exposed, semipermanently flooded, and seasonally flooded.
	Persistent	Persistent emergent wetlands are dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the estuarine and palustrine systems. Persistent emergent wetlands dominated by saltmarsh cordgrass (<i>Spartina alterniflora</i>), saltmeadow cordgrass (<i>S. patens</i>), big cordgrass (<i>S. cynosuroides</i>), needlerush (<i>Juncus roemerianus</i>), narrowleaved cattail (<i>Typha angustifolia</i>), and southern wild rice (<i>Zizaniopsis miliacea</i>) are major components of the estuarine systems of the Atlantic and Gulf Coasts of the United States.
	Emergent	The emergent wetland class is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed.
	Unconsolidated Bottom	The unconsolidated bottom class includes all wetland and deepwater habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30%. Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded. Unconsolidated bottoms are characterized by the lack of large, stable surfaces for plant and animal attachment. They are usually found in areas with lower energy than rock bottoms, and may be very unstable. Exposure to wave and current action, temperature, salinity, and light penetration determines the composition and distribution of organisms.
	Unconsolidated	The unconsolidated shore class includes all wetland habitats having

Classification	Type	Description
	Shore	three characteristics: (1) unconsolidated substrates with less than 75% areal cover of stones, boulders, or bedrock; (2) less than 30% areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded. Unconsolidated shores are characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms such as beaches, bars, and flats, all of which are included in this class.
	Rock Bottom	Includes all wetlands and deepwater habitats with substrates having a covered area of stones, boulders, or bedrock 75% or greater and vegetative cover of less than 30%. Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded.
	Rock Shore	Includes wetland environments characterized by bedrock, stones, or boulders which singly or in combination have a covered area of 75% or more and coverage by vegetation of less than 30%. Water regimes are restricted to irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, and intermittently flooded.
	Forested	The forested wetland class is characterized by woody vegetation that is 6 m tall or taller. All water regimes are included except subtidal. Forested wetlands are most common in the eastern United States and in those sections of the West where moisture is relatively abundant, particularly along rivers and in the mountains. They occur only in the palustrine and estuarine systems and normally possess an overstory of trees, an understory of young trees or shrubs, and an herbaceous layer. Forested wetlands in the estuarine system, which include the mangrove forests of Florida, Puerto Rico, and the Virgin Islands, are known by such names as swamps, hammocks, heads, and bottoms. These names often occur in combination with species names or plant associations such as cedar swamp or bottomland hardwoods.

Source: Cowardin et al. 1979.

APPENDIX G: GLOSSARY

Abandon—To stop producing or injecting fluid from a well when it becomes unprofitable, or has failed beyond repair, or to stop further work on a newly drilled well when it does not contain profitable quantities of oil or gas.

Affected environment—A term used in the National Environmental Policy Act to denote surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that could potentially be affected by a proposed action; the environment of the area to be affected or created by the alternatives under consideration. (40 CFR § 1502.15)

Alternative—A combination of management actions applied in specific amounts and locations to achieve desired management goals and objectives.

Barrel (bbl)—A measure of volume of petroleum product used in the United States. One barrel equals 42 U.S. gallons or 0.15899 cubic meters (6.29 barrels = 1 cubic meter).

Best management practices (BMPs)—BMPs are state-of-the-art mitigation measures applied to oil and natural gas drilling and production to help ensure that energy development and operations are conducted in an environmentally responsible manner. BMPs can be simple, such as choosing a paint color that helps oil and gas equipment blend in with the natural surroundings, while others involve cutting edge monitoring and production technologies.

Borehole (wellbore)— the hole made by a drilling rig.

Bottomhole—The deepest portion of an oil well.

Brine—Formation water produced along with oil and gas and containing relatively large concentrations of dissolved salts, particularly sodium chloride. Brine has higher salt concentrations than ocean water.

Casing—Steel pipe threaded together and cemented into a well as drilling progresses to (1) prevent the wall of the hole from caving in during drilling, and (2) provide a means of extracting oil and/or gas if the well is productive.

Cement plug—A balanced plug of cement slurry placed in the wellbore. Cement plugs are used for a variety of applications including hydraulic isolation, provision of a secure platform, and in window-milling operations for sidetracking a new wellbore.

Code of Federal Regulations (CFR)—A publication that codifies the general and permanent rules and regulations published in the Federal Register by the Executive Branch departments and agencies of the Federal Government, and which carry the force of law.

Completion—The activities and methods used to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

Contaminating substance—Those substances, including but not limited to: saltwater or any other injurious or toxic chemical; waste oil or waste emulsified oil; basic sediment; mud with injurious or toxic substances produced or used in the drilling, development, production, transportation, or onsite storage, refining, and processing of oil and gas.

Cultural resource—Cultural resources include archaeological sites, historic sites, buildings, and districts; cultural landscapes; and ethnographic resources.

Development phase—The phase in which a proven oil or gas field is brought into production by drilling production (development) wells.

Directional drilling—Intentional deviation of a wellbore from the vertical (90 degrees). Although wellbores are normally drilled vertically, it is sometimes necessary or advantageous to drill at an angle from the vertical to avoid surface resources.

Disturbance—Significant alteration of habitat structure or composition or of the behavior of wildlife. May be natural (e.g., fire) or man-made (e.g., seismic testing).

Drill pipe—A steel pipe, in approximately 30-foot (9-meter) lengths, screwed together to form a continuous pipe extending from the drilling rig to the drilling bit at the bottom of the hole. Rotation of the drill pipe and bit causes the bit to bore through the rock.

Drilling fluid (“mud”)—Circulating fluid, one function of which is to lift cuttings out of the wellbore and to the surface. While a mixture of clay, water, and other chemical additives is the most common drilling fluid, wells can also be drilled using oil-based muds, air, or water as the drilling fluid.

Endangered species—An animal or plant species in danger of extinction throughout all or a significant portion of its range.

Environmental impact statement (EIS)—A document required by NEPA and prepared to analyze the impacts on the environment of a proposed project or action and released to the public for comment and review. EISs are prepared when there is the potential for major impacts on natural, cultural, or socioeconomic resources.

Exploration phase—The part of operations that covers the search for oil or gas. It involves carrying out detailed geological and geophysical surveys followed up, where appropriate, by exploratory drilling.

Federal Register—Daily publication of the National Archives and Records Administration that updates the Code of Federal Regulations, in which the public may review the regulations and legal notices issued by Federal agencies.

Floodplain—Any land area susceptible to being inundated by floodwaters from any source. Typically low, flat land along a stream or river that may flood but also includes relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands.

Flowlines and gathering lines—Lines or pipelines that transport produced fluids (e.g., oil, gas, brine) from the wellhead to storage, treatment or transportation facilities.

Fracturing—A method of stimulating production by opening new flow channels in the rock by pumping fluid at very high pressures into the formation of a production well. Often called a “frac job” or “frac-ing”.

Gas—Any fluid, either combustible or noncombustible, which is produced in a natural state from the earth, and which maintains a gaseous or rarefied state at ordinary temperature and pressures.

Geophysical exploration—Geophysical exploration consists primarily of seismic operations and typically involves selective cutting of vegetation along source and receiver lines as needed, use of shotholes/explosives or seismic vibrators as a source of vibration, and recording the data produced from the soundwaves generated in the ground by the source.

Hydrocarbon—An organic compound containing only the elements hydrogen and carbon. An organic compound can be a solid, liquid, or gas. The term is mainly used in a catchall sense for oil, gas, and condensate (a low-density mixture of hydrocarbon liquids usually produced with natural gas, also referred to as natural gasoline).

Impacts—The likely effects of an action upon specific natural, cultural, or socioeconomic resources. Impacts may be short-term or long-term, beneficial or adverse, and direct or indirect.

Natural gas—A highly compressible and expandable mixture of hydrocarbons with low specific gravity that occurs naturally in a gaseous form.

Mitigation—Activities that can be undertaken to avoid, minimize, restore, or offset impacts of energy development.

Oil—A simple or complex liquid mixture of hydrocarbons that can be refined to yield products such as gasoline, kerosene, and diesel fuel.

Operations Permit—A type of Special Use Permit specifically geared to oil and gas operations that provides stipulations and practices for oil and gas operations on Refuge System lands and waters.

Operator—The person or company actually operating an oil well or lease. It is generally the oil company that engages the drilling, service, and workover contractors.

Petroleum—A thick, flammable, naturally occurring liquid that is a mixture of various hydrocarbons. It is used in a natural or refined state as fuel, or separated by distillation into products such as gasoline, naphtha, benzene, kerosene, or paraffin.

Performance-based standards—Regulatory standards that are results-oriented rather than prescribing specific measures to achieve an outcome. A performance-based standard specifies the outcome required but leaves the concrete measures to achieve that outcome up to the discretion of the regulatory entity.

Plug—An object or device that serves to block a hole or passageway, such as a cement plug in a borehole.

Plug and Abandon—To place cement plugs in a hole to prevent unwanted vertical migration of fluids in an abandoned well into aquifers or other geologic formations. Also referred to as “P & A”.

Plugging—Permanent closing of a well by removing the completion equipment, pumping cement across producing zones, placing cement plugs at various depths to protect freshwater zones, setting a plug at the surface to cap the well, and removing wellhead equipment.

Preferred Alternative—The alternative determined to best achieve the purpose and need of the proposed action, contribute to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management.

Programmatic—Following a plan, policy, or program.

Production—Bringing the well fluids to the surface and separating them, and storing, gauging, and otherwise preparing product for the pipeline. Also refers to the amount of oil or gas produced over a given period.

Regulations—Rules or orders prescribed by Federal agencies to regulate conduct, and published in the CFR.

Reservoir—The subsurface, porous, permeable rock body in which oil and gas accumulate. It consists of a porous rock to hold the oil or gas and a caprock that prevents its escape.

Rotary drilling—A method of drilling in which the drill pipe is rotated, thereby rotating the bit.

Seismic survey—Relating to or denoting geological surveys using artificially produced vibrations in the earth, using explosives, air guns or large weights dropped from a vehicle.

Shothole—A drilled hole in which a charge of dynamite placed in the hole and detonated as a way of creating vibrations for seismic surveys. The shothole directs the energy of the explosion downward.

Shut-in well—A well that has been shut off so there is no production occurring because of well problems, lack of a suitable market for selling the oil or gas, or pending connection of the well with a pipeline.

Special Use Permit—General term for all permits issued by the National Wildlife Refuge System of the U.S. Fish and Wildlife Service.

Threatened species—An animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Vertical drilling—Drilling of a well vertically (90 degrees) to reach a target zone straight underneath the surface location.

Well—A relatively narrow-diameter hole drilled through the ground and geologic formations to either produce oil and or natural gas or to inject fluids or gases such as saltwater, steam or carbon dioxide.

Well blowout—The uncontrolled release of oil, gas, or other drilling fluids from a well into the atmosphere or other zone after pressure control systems have failed.

Wellbore—The hole made by a drilling bit, including the openhole or uncased portion of the well.

Well completion—The installation of permanent wellhead equipment for the production of oil and gas; the method to establish one or more flow paths for hydrocarbons between the reservoir and the surface.

Well Pad—Well site, usually constructed of local materials, such as gravel, and commonly 4 to 6 acres in size. Pad constructed to support the drilling rig and associated equipment. A well pad can contain one or more wells. After drilling is completed the well pad can be reduced in size depending on the amount of area needed for production equipment such as storage tanks.

Well Stimulation—technique used to increase the permeability of an oil and gas reservoir around the wellbore to increase production. This can include hydraulic fracturing or the use of acids.

Wetlands—Lands that are transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

Workover—The performance of remedial or maintenance work on a producing well to try to increase production.

Workover rig—A portable rig used in the workover or maintenance of a well.

APPENDIX H: REFERENCES

- Adams, M.B., P.J. Edwards, W.M. Ford, J.B. Johnson, T.M. Schuler, M. Thomas-Van Gundy, F. Wood. 2011. Effects of development of a natural gas well and associated pipeline on the natural and scientific resources of the Fernow Experimental Forest. Gen. Tech. Rep. NRS-76. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 24 p. Available at: http://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs76.pdf. Accessed January 14, 2015.
- AWWA (American Water Works Association). 2013. Water and hydraulic fracturing. Am. Water Works Assoc. Denver, CO. Available at: <http://www.awwa.org/Portals/0/files/legreg/documents/AWWAFrackingReport.pdf>. Accessed January 29, 2015.
- Bailey, R.G. 1995. Description of the ecoregions of the United States. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Available at: http://www.fs.fed.us/land/ecosysmgmt/colorimagemap/ecoreg1_provinces.html. Accessed October 20, 2014.
- Bayne, E.M, L. Habib, and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. *Conservation Biology* 22(5): 1186-1193.
- Bradbury, J., M. Obeiter, L. Draucker, W. Wang, and A. Stevens. 2013. "Clearing the Air: Reducing Upstream Greenhouse Gas Emissions from U.S. Natural Gas Systems." Working Paper. Washington, DC: World Resources Institute. Available at: <http://www.wri.org/publication/clearing-the-air>.
- Brittingham, M.C., K.O. Maloney, A.M. Farag, D.D. Harper, and Z.H. Bowen. 2014. Ecological risks of shale oil and gas development to wildlife, aquatic resources and their habitats. *Environmental Science and Technology*. 48(19): 11034-47.
- Bulluck, J, J. Weber, D. Kulas, P. Comer, and P. Crist. 2011. Resource Vulnerability Assessment and Strategies for Management Options for the Eastern Shore of Virginia and Fisherman Island National Wildlife Refuges. NatureServe. Arlington, VA. 123 pp.
- BLM. 2006. Final Environmental Impact Statement Jonah Infill Drilling Project, Sublette County, Wyoming. Wyoming State Office, Cheyenne, WY. Available at: <http://www.blm.gov/style/medialib/blm/wy/information/NEPA/pfodocs/jonah.Par.1828.File.dat/09chap3.pdf>. Accessed October 28, 2014.
- Caltrans (California Department of Transportation). 2013. Technical Supplement to the Traffic Noise Analysis Protocol. California Department of Transportation, Division of Environmental Analysis, Environmental Engineering, Sacramento, CA. Available at: http://www.dot.ca.gov/hq/env/noise/pub/TeNS_Sept_2013B.pdf. Accessed January 23, 2015.
- Carver, E. and J. Caudill. 2013. Banking on Nature: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities. U.S. Fish and Wildlife Service, Division of Economics, Washington, DC. 365 pp. Available at <http://www.fws.gov/refuges/about/RefugeReports/>. Accessed October 15, 2014.
- CEQ (Council on Environmental Quality). 1981 "Forty Most Asked questions Concerning CEQ's National Environmental Policy Act Regulations." *Federal Register* 46(55):18026-38. Available at <http://energy.gov/nepa/downloads/forty-most-asked-questions-concerning-ceqs-national-environmental-policy-act>. Accessed October 6, 2014.

References

- _____. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Council on Environmental Quality. January 1997. Available at: <https://ceq.doe.gov/nepa/ccenepa/exec.pdf>. October 6, 2014.
- _____. 2005. Executive Office of the President. Memorandum. RE: Guidance on the Consideration of Past Actions in Cumulative Effects Analysis. June 24, 2005. FROM: James L. Connaughton, Chairman. TO: Heads of Federal Agencies. Available Available at: http://www.gsa.gov/graphics/pbs/CEQ_Guidance_Consideration_PastActions_CumulativeEffectsAnalysis.pdf. Accessed January 6, 2015.
- _____. 2007. A Citizen's Guide to the NEPA. Available at: http://ceq.hss.doe.gov/nepa/Citizens_Guide_Dec07.pdf. Accessed October 6, 2014.
- Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Available at: <https://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf>. Accessed October 20, 2014.
- Crush, J.R. and E.R.Thom. 2011. Review: The effects of soil compaction on root penetration, pasture growth and persistence. Pasture Persistence – Grassland Research and Practice Series 15: 73-78. Available at: http://www.grassland.org.nz/publications/nzgrassland_publication_2237.pdf. Accessed January 8, 2015.
- Czech, B., S. Covington, T.M. Crimmins, J.A. Ericson, C. Flather, M. Gale, K. Gerst, M. Higgins, M. Kaib, E. Marino, T. Moran, J. Morton, N. Niemuth, H. Peckett, D. Savignano, L. Saperstein, S. Skorupa, E. Wagener, B. Wilen, and B. Wolfe. 2014. Planning for Climate Change on the National Wildlife Refuge System. US Fish and Wildlife Service, National Wildlife Refuge System, Washington, DC. 132 pp. Available at: <http://www.fws.gov/refuges/vision/pdfs/PlanningforClimateChangeontheNWRS.pdf>. Accessed October 20, 2014.
- Darrah, T.H., A. Vengosh, R.B. Jackson, N.R. Warner and R.J. Poreda. 2014. Noble gases identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales. Proceedings of the National Academy of Sciences, 2014 DOI: 10.1073/pnas.1322107111. Available at: <http://www.pnas.org/content/111/39/14076.full.pdf>. Accessed January 28, 2015.
- DeJong-Hughes, J., J.F. Moncrief, W.B. Voorhees, and J.B. Swan. 2001. Soil Compaction: Causes, Effects and Control. University of Minnesota Extension. Available at: <http://www.extension.umn.edu/agriculture/tillage/soil-compaction/index.html>. Accessed January 14, 2015.
- Duiker, S.W. 2004. Avoiding and Mitigation Soil Compaction Associated with Natural Gas Development. Available at: <http://extension.psu.edu/natural-resources/natural-gas/publications/avoiding-and-mitigating-soil-compaction-associated-with-natural-gas-development>. Accessed January 14, 2015.
- EIA (U.S. Energy Information Administration). 2013. AEO2013 Early Release Report. Available at: [http://www.eia.gov/forecasts/aeo/er/pdf/0383er\(2013\).pdf](http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2013).pdf). Accessed January 15, 2015.
- Engesser M. 2013. An assessment of state oil and gas regulations. Report to the U.S. Fish and Wildlife Service, National Wildlife Refuge System, Div of Natural Resources and Conservation Planning, Wildlife Resources Branch, Washington, DC. August. 26 pp.

- FERC (Federal Energy Regulatory Commission). 2004. Research of Wetland Construction and Mitigation Activities for Certificated Section 7(c) Pipeline Projects. FERC, Office of Energy Projects. Washington, D.C. Available at: <http://www.ferc.gov/legal/maj-ord-reg/land-docs/2004-wet-lands.pdf>. Accessed January 16, 2015.
- FHWA (Federal Highway Administration). 2006. FHWA Roadway Construction Noise Model User's Guide. Final Report. January 2006. U.S. Department of Transportation, FHWA-HEP-05-054. Washington, DC. 28 pp. Available at: http://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/rcnm.pdf. Accessed January 22, 2015.
- FEN (Forest Encyclopedia Network). 2008. The Appalachian Plateau Province. Available at: <http://www.forestencyclopedia.net/p/p1522>. Accessed October 20, 2014.
- Fink, J.K. 2003. Oil field chemicals. Gulf Professional Publishing. New York. 495 pp.
- Francis, C.D., C.P. Ortega, and A. Cruz. 2009. Noise pollution changes avian communities and species interactions. *Current Biology* 19: 1-9.
- Glick P, J. Clough, A. Polaczyk, B. Couvillion, and B. Nunley. 2013. Potential effects of sea-level rise on coastal wetlands in southeastern Louisiana. *Journal of Coastal Research, Special Issue No. 63*, pp. 211–233.
- Goddard Institute for Space Studies. 2007. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York, New York. Available at: <http://data.giss.nasa.gov/gistemp/graphs/fig.B.lrg.gif>. Accessed October 21, 2015.
- GWPC (Groundwater Protection Council). 2014. State oil and natural gas regulations designed to protect water resources, 2014 Edition. Report to the U.S. Dept Energy, Nat'l Energy Tech. Lab. Prepared by the Groundwater Protection Council, Oklahoma City, OK. 118 pp. Available at: <http://www.gwpc.org/sites/default/files/files/Oil%20and%20Gas%20Regulation%20Report%20Hyperlinked%20Version%20Final-rfs.pdf>
- GWPC and All Consulting. 2009. Modern Shale Gas Development in the US: A Primer. US Department of Energy, Office of Fossil Energy and National Energy Technology Laboratory. Available at: http://energy.gov/sites/prod/files/2013/03/f0/ShaleGasPrimer_Online_4-2009.pdf. Accessed January 15, 2015.
- Hawkins, A.D., A.E. Pembroke, and A.N. Popper. 2015. Information gaps in understanding the effects of noise on fishes and invertebrates. *Reviews in Fish Biology and Fisheries* 25:39-64.
- Howard, R.J., C.J. Wells, T.C. Michot, and D.J. Johnson. 2014. Effects of disturbance associated with seismic exploration for oil and gas reserves in coastal marshes. *Environmental Management* 54:30-50.

References

- IPCC (International Panel on Climate Change). 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, New York. Available at: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm. Accessed October 14, 2014.
- _____. 2013. Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf. Accessed October 21, 2014.
- Johnson, D.H. 2001. Habitat Fragmentation Effects on Birds in Grasslands and Wetlands: A Critique of our Knowledge. *Great Plains Research* 11 (Fall 2001) 21: 1-31.
- Keel, J. 2007. An Audit Report on Inspection and Enforcement Activities in the Field Operations Section of the Railroad Commission. Texas State Auditor's Office, Report No. 07-046, August. Austin, TX. 26 pp.
- La Plata County. 2002. *La Plata County Impact Report*. La Plata County, Durango, CO. Available at: http://www.co.laplata.co.us/departments_elected_officials/planning/natural_resources_oil_gas/impact_report. Accessed January 14, 2015.
- McBroom, M., T. Thomas, and Y. Zhang. 2012. Soil erosion and surface water quality impacts of natural gas development in East Texas, USA. *Water* 4(4):944-958.
- Reinke, D.C., D.K. Ingram. 2009. Working Smart: NIOSH develops technology and products that address exposure to noise at the work site. *Water Well Journal* 61 (12):16-17.
- Mall, A., S. Buccino, and J. Nichols. 2007. *Drilling Down: Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production*. October, 2007. Natural Resource Defense Council, New York, New York. Available at: <http://www.nrdc.org/land/use/down/down.pdf>. Accessed January 7, 2015.
- Goddard Institute for Space Studies. 2007. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York, New York. Available at: <http://data.giss.nasa.gov/gistemp/graphs/fig.B.lrg.gif>. Accessed October 21, 2015.
- NRCS (Natural Resources Conservation Service). nd. National soil survey handbook, title 430-VI. Part 622.03 Farmland Classification. Available online: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054226. Accessed December 9, 2014.
- _____. 2007. Hydrologic Soil Groups, Chapter 7, Part 630 Hydrology, National Engineering Handbook. Washington, DC. Available at: <http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>

- NYDEC (New York State Department of Environmental Conservation). 2011. Revised Draft Supplemental Generic Environmental Impact Statement (SGEIS) on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs issued in September 2011. NYDEC, Division of Mineral Resources, Albany, NY. Available at: <http://www.dec.ny.gov/energy/58440.html>. Accessed January 27, 2015.
- Nicot, J., A. Hebel, S. Ritter, S. Walden, R. Baier, P. Galusky, J. Beach, R. Kyle, L. Symank and C. Breton. 2011. Current and Projected Water Use in the Texas Mining and Oil and Gas Industry. The University of Texas at Austin Bureau of Economic Geology for Texas Water Development Board. Available at: http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0904830939_MiningWaterUse.pdf. Accessed January 22, 2015.
- Palaneasu-Lovejoy M, C. Kranenburg, J.A. Barras, and J.C. Brock. 2013. Land loss due to recent hurricanes in coastal Louisiana, U.S.A. *Journal of Coastal Research*, Special Issue No. 63, pp. 97-109.
- Parida, A.K. and A.B. Das. 2005. Salt tolerance and salinity effects on plants: a review. *Ecotoxicology and Environmental Safety*, Volume 60, Issue 3: pp 324–349.
- Pennsylvania State University. 2009. Effects of Soils Compaction. Penn State College of Agricultural Sciences. Agricultural Research and Cooperative Extension. Available at: <http://pubs.cas.psu.edu/FreePubs/pdfs/uc188.pdf>. Accessed January 7, 2015.
- Purpera, D.G. 2014. Regulation of oil and gas wells and management of orphaned wells, Office of Conservation – Dept Natural Resources, Performance Audit. Louisiana Legislative Auditor, Report ID No. 40120061, Baton Rouge, LA. May 28, 2014. 54 pp.
- Rozell, D.J. and S.J. Reaven. 2012. Water pollution risk associated with natural gas extraction from the Marcellus Shale. *Risk Analysis* 32(8):1382-1393.
- Sawyer, H., F. Lindzey, D. McWhirter, and K. Andrews. 2002. Potential Effects of Oil and Gas Development on Mule Deer and Pronghorn Populations in Western Wyoming. *Transactions of the North American Wildlife and Natural Resources Conference*. 67: 350-365.
- Sexton N.R., A.M. Dietsch, A.W. Don Carlos, H.M. Miller, L.M. Koontz, and A. N. Solomon. 2012. National wildlife refuge visitor survey results—2010/2011: U.S. Geological Survey Data Series 685. Available at: <http://pubs.usgs.gov/ds/685/DS685.pdf>. Accessed November 19, 2014.
- SHIP (Shale Gas Information Platform). 2013. Information on Drilling, Land Disturbance, Air Emissions, and Noise. Available at: <http://www.shale-gas-information-platform.org/categories/operations/the-basics.html>. Accessed January 17, 2015.
- Stanturf, J.A., S.H. Schoenholtz, C.J. Schweitzer, J.P. Shepard. 2001. Achieving Restoration Success: Myths in Bottomland Hardwood Forests. *Restoration Ecology* 9 (2): 189-200.
- Trombulak, S C. and C.A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology* 14: 18–30.
- Tylianakis, J.M., R.K. Didham, J. Bascompte, and D.A. Wardle. 2008. Global Change and Species Interactions in Terrestrial Ecosystems. *Ecology Letters* 11: 1351–1363. doi: 10.1111/j.1461-

References

- 0248.2008.01250.x. Accessed January 20, 2015.
- USDA (U.S. Department of Agriculture). 2006. Soil Orders Map of the United States. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/?cid=nrcs142p2_053589. Accessed October 23, 2014. Accessed October 14, 2015.
- USDOI (U.S. Department of the Interior). 1980. *516 Departmental Manual 1-7 – NEPA Policies*; 45 FR 27541, amended by 49 FR 21437.
- _____. 1981. *517 Departmental Manual 1 – Pesticides*.
- _____. 1983. *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation*, 48 FR 44716.
- _____. 1988. *Onshore Oil and Gas Order Number 2, Section III, Drilling Abandonment Requirements*, 53 FR 46810-811.
- _____. 1994. *519 Departmental Manual 1-2 – Protection of the Cultural Environment*.
- USEPA (U.S. Environmental Protection Agency). 1999. Regional Haze Regulations; Final Rule. Available at: http://www.epa.gov/ttn/caaa/t1/fr_notices/rhfedreg.pdf. Accessed November 7, 2014.
- _____. 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study. EPA 816-\$-04-003. U.S. Environmental Protection Agency, Office of Water, Office of Ground Water and Drinking Water. Washington, DC. Available at : http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm. Accessed October 15, 2014.
- _____. 2009. A national assessment of impaired waters within or near U.S. Fish and Wildlife Service properties – Phase II Final Report. Document #EPA841-R-09-006. Office of Water, US Environmental Protection Agency, Washington, DC. 69 pp.
- _____. 2011. Plan EJ 2014. U.S. Environmental Protection Agency, Office of Environmental Justice. Washington, DC. Available at: <http://www.epa.gov/environmentaljustice/resources/policy/plan-ej-2014/plan-ej-2011-09.pdf>. Accessed October 16, 2014.
- _____. 2012. Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report. EPA/601/R-12/011. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. Available at: <http://www2.epa.gov/hfstudy/study-potential-impacts-hydraulic-fracturing-drinking-water-resources-progress-report-0>. Accessed January 15, 2015.
- _____. 2013a. National Ambient Air Quality Standards (NAAQS). U.S. Environmental Protection Agency, Washington, DC. Available at: <http://www.epa.gov/air/criteria.html>. Accessed November 7, 2014.
- _____. 2013b. Integrated Science Assessment for Ozone and Related Photochemical Oxidants. EPA 600/R-10/076F. February 2013. U.S. Environmental Protection Agency, National Center for Environmental Assessment-RTP Division, Office of Research and Development, Washington, DC. Available at: <http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492>. Accessed January 6, 2015.

- _____. 2015. Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector. EPA-452/R-15-002, August 2015. US EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Available at: http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf Accessed October 20, 2015.
- USGS (U.S. Geological Survey). 2014. Geologic Provinces of the United States: Parks by Geologic Province. USGS Geology in the Parks. U.S. Geological Survey. Available at: <http://geomaps.wr.usgs.gov/parks/province/index.html>. Accessed October 21, 2014.
- USNPS (U.S. National Park Service). 2012. Final Non-Federal Oil and Gas Management Plan / Environmental Impact Statement for the Big South Fork National River and Recreation Area / Obed Wild and Scenic River. Big South Fork National River and Recreation Area, Oneida, TN. Available at: <http://parkplanning.nps.gov/document.cfm?documentID=48597>. Accessed January 8, 2015.
- Vavrek, M.C., H. Hunt, W. Colgan III, and D.L. Vavrek. 2004. Status of oil brine spill site remediation. Paper presented at the 11th Annual International Petroleum Environmental Conference, Albuquerque, NM, Oct. Available at: http://ipec.utulsa.edu/Conf2004/Papers/vavrek_hunt_colgan_vavrek.pdf
- Vilà, M., J.L. Espinar, M. Hejda, P.E. Hulme, V. Jarošík, J.L. Maron, J. Pergl, U. Schaffner, Y. Sun, and P. Pyšek. 2011. Ecological Impacts of Invasive Alien Plants: A Meta-Analysis of Their Effects on Species, Communities and Ecosystems. *Ecology Letters*, 14: 702–708.
- Wiles, G.J. and H.P. Weeks, Jr. 1986. Movements and Use Patterns of White-Tailed Deer Visiting Natural Licks. *Journal of Wildlife Management* 50 (3): pp. 487-496.
- Williams, S.J. 2013. Sea-level rise implications for coastal regions. *Journal of Coastal Research*, Special Issue No. 63, pp. 184-196.
- Yang, Z., T. Wang, R. Leung, K. Hibbard, T. Janetos, I. Kraucunas, J. Rice, B. Preston, T. Wilbanks. 2014. A modeling study of coastal inundation induced by storm surge, sea-level rise, and subsidence in the Gulf of Mexico. *Natural Hazards* 71 (3): 1771-1794.

APPENDIX I

Public Comments Analysis Report

On December 11, 2015, the Service released the Draft Environmental Impact Statement (Draft EIS) and the Proposed National Wildlife Refuge System Revision of Regulations Governing Management of Non-Federal Oil and Gas Rights (Proposed Rule) for public review. The Environmental Protection Agency (USEPA) also issued a Notice of Availability that was published in the Federal Register on December 11, 2015.

Members of the public also received notice of the availability of the Draft EIS through a press release posted on the Service website at <http://www.fws.gov/refuges/oil-and-gas/rulemaking.html>. Following the release of the Draft EIS and Proposed Rule, the Service opened a 60-day public comment period that ended on February 9, 2016. The public was encouraged to submit comments regarding the Draft EIS via the www.regulations.gov or by mail.

NATURE OF THE COMMENTS RECEIVED

During the comment period, 13 unique pieces of correspondence were received on the Draft EIS. Once all the correspondence was received, Service staff read each one and identified specific comments within each piece of correspondence. Correspondence reviewers derived a total of 53 substantive comments from the correspondences received. A substantial number of commenters expressed support for the proposed rule change, citing existing concerns over the adequacy of the current rule to provide resource protection on refuges. Several commenters suggested the Service include additional elements in the provisions of the rule, as described under Alternative C of the Draft EIS. Other commenters believed the proposed rule is unnecessary as current state and Federal laws and regulations provide the necessary protections for refuge uses and resources. Some commenters expressed concerns over the accuracy of data presented in the Draft EIS and called for additional detail to be incorporated in the analysis of impacts. Commenters also expressed concern over the extent of analysis regarding directionally drilled operations.

THE COMMENT ANALYSIS PROCESS

Comment analysis is a process used to compile and correlate similar public comments into a format that can be used by decision makers and the Draft EIS and Proposed Rule planning team. Comment analysis assists the team in organizing, clarifying, and addressing technical information pursuant to National Environmental Policy Act (NEPA) regulations. It also aids in identifying the topics and issues to be evaluated and considered throughout the planning process.

The Service received comments from 13 submitters on various aspects of the Draft EIS – several individual submissions included multiple signatories. Multiple members of the planning team read and analyzed all comments, including those of a technical nature; opinions, feelings, and preferences of one element or one potential alternative over another; and comments of a personal or philosophical nature. The team grouped and organized comments by issues and themes, drafted concern statements, and participated in developing this comment summary.

Although the analysis process attempts to capture the full range of public concerns, this content analysis report includes the following caveats. Comments from people who chose to respond do not necessarily represent the sentiments of the entire public. Furthermore, this was not a vote-counting process, and the emphasis was on the content of the comment rather than the number of times a comment was received.

ORGANIZATION OF THIS REPORT

This report is organized as follows.

Content Analysis — This is the basic summary report, which provides information on the numbers and types of comments received. Data show the amount of correspondence received by organization type (conservation organizations, city governments, individuals, etc.); and amount received by state.

Concern Response Report — This section summarizes the substantive comments received during the plan/DEIS public review comment process. These comments are organized by topic and further consolidated into concern statements. Representative quotes are then provided for each concern statement. The Service provides a response for each concern statement.

Attachment: Copies of Correspondences from all Entities, Excluding those Received from Unaffiliated Individuals — This appendix contains copies of correspondences that were received during the comment period from all entities (government, organizations, businesses, etc.) excluding those received from individual commenters (unaffiliated individuals).

CONTENT ANALYSIS

Table 1 – Correspondence by Organization Type

Organization Type	Number of Correspondence	Percentage of Total
Conservation/Preservation	5	38.4
Industry Organization/Company	3	23.1
Federal Agency	1	7.7
State Agency	3	23.1
Unaffiliated Individual	1	7.7
Total	13	100.0

Table 2 – Correspondence Distribution by State

State	Number of Correspondence	Percentage of Total
Nationwide/Multi-State	5	38.4
Alaska	1	7.7
California	1	7.7
Florida	1	7.7
North Dakota	2	15.4
Pennsylvania	1	7.7
Texas	1	7.7
Utah	1	7.7
Total	13	100.0

CONCERN RESPONSE REPORT

Topic 1 – Regulation of Non-Federal Oil and Gas Rights within the NWRS		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
1.1 The Service does not have the authority to regulate private oil and gas rights.	The USFWS lacks the legal authority to implement its “Preferred Alternative” in the DEIS. And because Alternatives B and C both rely on legal authority which the USFWS does not possess, the only legally viable Alternative presented in the DEIS is the “No Action” (i.e., Alternative A). Accordingly Alternative A must be chosen.	The Service continues to assert that the NWRSA, as amended by the NWRSA grants us the authority to promulgate and implement these regulations as discussed in the three alternatives laid out in the EIS. All three alternatives are intended to respect an operator’s right to use the surface estate on NWRS lands to exercise their mineral right while protecting and minimizing impacts to refuge resources and uses to comply with the unique mission of these public lands “for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (16 U.S.C. § 668dd(a)(2)).

Topic 2 – Regulation on Private Lands (Inholdings and Directional Drilling)		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>2.1. The Service does not have the authority to regulate activities on non-Federal lands, and as such, Alternative C cannot be adopted.</p>	<p>The agency must recognize it does not have the authority to regulate activities on non-Federal lands, and as such Alternative C cannot be adopted. Such a change would clearly exceed, FWS’s authority, which is limited to operations on Federal lands. A final EIS must make it clear the FWS does not seek and will not attempt to regulate oil and natural gas operations that fall outside the boundaries of the refuge units.</p>	<p>Alternative C does not extend the Service’s jurisdiction to all activities on non-Federal lands, but only to those activities where there is a nexus to Federal lands, such as downhole operations underneath NWRS lands or to activities on inholdings that would impact NWRS lands or resources. The Service does believe it has the authorities to regulate such activities. Congress has the authority to protect Federal lands and resources under the Property Clause of the United States Constitution (U.S. Const. art. IV, sec. 3); and, specifically, the Service has been provided the statutory authority to manage Federal lands and resources under NWRSA, as amended by the NWRSA, as discussed further in Final Rule, as well as Chapter 1 in the EIS.</p> <p>However, the Service has chosen not to extend its authority to regulate activities on private lands for the many reasons discussed throughout the Final Rule and EIS.</p>

Topic 2 – Regulation on Private Lands (Inholdings and Directional Drilling)		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
2.2 The Service should regulate operations on non-Federal lands directionally drilling under Service-administered surface estate.	The Service should regulate oil and gas operations from non-Federal lands that are directionally drilled under the Service-administered surface estate, as was discussed in Alternative C. Exempting such drilling from regulation is likely to result in significant, adverse environmental consequences to refuge resources. The presumed benefits of keeping such drilling outside Refuges are greatly exaggerated...	<p>The incremental environmental benefits on refuge resources and uses of Alternative C’s component to regulate directional drilling beyond the boundary of the NWRS are described throughout the impact topics analyses. The economic costs and benefits are described in Management of Refuge Operations and Socioeconomics sections of Chapter 4.</p> <p>The comments received did not provide any new information that changed our analysis nor did they prompt the Service to expand its jurisdiction beyond the boundaries of the NWRS.</p> <p>The Service has a clear legal and policy directive to protect refuge lands, and having oil and gas operations sited off refuge property is preferable to having impacts occur on refuge lands. Locating all operations (surface and downhole) inside the boundary of a refuge unit would subject refuge resources and values to the long term impacts of surface occupancy within the park – impacts that would last years, if not decades. Therefore, the Service feels the best course of action is to maintain the incentive in the proposed rule to encourage operators to locate operations outside the boundary of a unit.</p> <p>The exemption is expected to result in fewer wells drilled on refuge lands and waters resulting in an overall benefit to refuge resources and uses (avoidance or minimization of direct impacts). The exemption would be removed under Alternative C. The Service could require actions, such as noise abatement or visual screening, which serve to reduce cross-boundary effects on Service resources and uses. However, these benefits to resources</p>

		<p>and uses could evaporate, and many adverse consequences could occur, if just a small percentage of wells that otherwise would have been located outside a refuge are drilled inside the boundary. Gains in resource protection under Alternative C would likely be lost when balanced with the loss of the incentive to locate operations outside the refuge. Therefore, Alternative B continues to be the Service’s preferred alternative in respect to regulating operations on non-Federal surfaces.</p>
<p>2.3. The Service does not provide sufficient evidence that the directional drilling exemption is an “incentive” for operators to locate operations outside of refuge boundaries and inadequately analyzes the impacts of exempting operations on on-Federal lands.</p>	<p>Additionally, the value of a directional drilling exemption in reducing refuge impacts is not based on evidence. While the Service calls the directional drilling exemption to be an “incentive” for FWS to not exercise its jurisdiction (80 FR77204), factual evidence was not provided to evaluate this statement, nor to evaluate the direct, indirect and cumulative effects to refuge purposes and resources from such an exemption.</p>	<p>To be clear, the proposed exemption applies to the downhole activities that would occur with the NWRS. The surface and subsurface activities that occur outside the NWRS are beyond the scope of the final rule.</p> <p>We edited the description of the NPS directional well review in Chapter 4 to clarify a demonstrated incentive based on actual actions of operators choosing less favorable surface locations to avoid NPS regulation. The evaluations of actions of operators in over 68 instances does represent factual evidence.</p> <p>Chapter 4 describes the typical impacts of oil and gas activities and a discussion of impacts on adjacent lands is included for all impact topics. When directional drilling is used to access oil and gas beneath NWRS lands, those impacts of oil and gas activities would occur on those adjacent lands where the operations are located. The discussion of impacts on adjacent lands is included for all impact topics.</p> <p>Maintaining the incentive (i.e., Alternative B) for operators to use directional drilling from adjacent lands to reach oil and gas beneath refuge lands results in less wells drilled inside refuges. As a result, analysis under all impact topics reveals a decrease in direct, indirect, and cumulative effects on refuge purposes and resources</p>

<p>2.4. The DEIS fails to analyze the impacts of not regulating operations on inholdings. Such operations could cause significant harm to refuge resources and uses.</p>	<p>Failing to regulate non-Federal inholdings on NWRS units would cause significant harm to refuge resources. The EIS performs no analysis of these significant effects of exempting inholding operations and fails to address their mitigation.</p>	<p>from the exemption.</p> <p>Under each impact topic, the EIS does evaluate the impact reduction resulting from extending the rule to cover inholdings. Analysis found there are some possible cross boundary impacts from oil and gas development on refuge resources and uses, such as spills or leaks migrating into NWRS lands or waters or noise disturbance on wildlife and visitor experience. When issues with the actual activities on the inholding are identified, the Service has and will continue to work with landowners, other permitting agencies, and the operator to mitigate or avoid any potential cross-boundary impacts. For instance if an operator was proposing to site an operation close to a refuge boundary we may ask them to set the operation back, ensure they have proper spill or leak protection methods, and site the operation away from any waterways that flow into a refuge unit. Furthermore, despite regulation of inholding being beyond the scope of the final rule, operators do not have a right to cause unreasonable damage to refuge resources and uses and would be responsible for any damage done from these operations (e.g. leaks or spills). Existing Federal and/or State laws provide enforcement remedies for activities on private lands that damage Refuge resources and uses.</p> <p>Additionally, inholdings are by definition surrounded by Federal surface, and any access across the Federal surface would be subject to regulation by the Service. Impacts from such access and how these regulations would minimize and avoid these impacts has generally been discussed throughout Chapter 4 of the EIS.</p>
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Topic 3 – Regulation on Less than Fee (Easements)

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>3.1 The EIS does not clearly describe how oil and gas rights on less than fee properties (easements) would be regulated, and, therefore does not adequately analyze the impacts of regulation of easements.</p>	<p>The EIS suggests that the application of the Proposed Rule would be limited as shown by the statement on page 2.6 as it relates to Alternative B. “For example, where the Service has purchased a wetland easement, the regulations would apply only as necessary to protect the values and functions of wetlands that could be affected by proposed operations on that property.” This is an ambiguous statement and is repeated in other sections concerning grassland easements. There is no clear statement of the limitations of the Proposed Rule for easements and the pressure from the environmental community to tightly regulate oil and gas development on those easements would likely be significant. When State owned minerals underlie privately owned land with wetland or grassland easements, the damage to the State from lost royalty income could be significant.</p>	<p>The Service holds many unique and varied easement interests throughout the United States. To determine the applicability of these regulations, the Service will review the terms of the legal instrument by which the United States acquired or reserved its easement interest to determine what regulation is appropriate in relation to that interest. The Service intends to work with operators and landowners in determining what is reasonable in protecting the Service’s easement interests. Therefore, it is difficult to determine how this regulation would apply to operations on these various less than fee interests or analyze the impacts of such regulation in this programmatic EIS. Therefore, the Service’s regulation of an easement would be subject to further compliance with the National Environmental Policy Act, and the public will have further opportunity to participate as afforded by the Act.</p> <p>The EIS provides examples of how the regulation might function on both a grassland easement and a wetland easement in order to provide the public with the Service’s intent in protecting these less than fee property interests. For instance, depending on the easement, the Service may require an operator to obtain an operations permit to ensure that activities minimize the destruction of vegetative cover, control the spread of invasive species, and/or avoid ecologically sensitive habitats by using technologically feasible, least damaging methods. On the other hand, if an operator avoids burning, draining, filling, or dredging wetlands on one of the Service’s conservation easements acquired for the purpose of protecting wetlands, there would be no need to impose any operating or reclamation standards on the operations.</p> <p>Ultimately, the Service wants to ensure it is notified of</p>

		operations that may affect the Service’s less-than-fee interests and work cooperatively with the landowner and mineral rights holder, if different, to minimize or avoid impacts to our conservation interest in the land. However, the Service would provide reasonable access to mineral rights holders for the development of their mineral rights, and intends to work with operators and landowners in determining what is reasonable in protecting the Service’s easement interests.

Topic 4 – Service Regulation of Downhole Operations

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
4.1. Service regulation of downhole operations as describe in Alternative C would not provide any reduction to impacts or risks to refuge resources as state regulations provide adequate protections from such activities.	It is our contention that USFWS regulation [of downhole operations] as suggested in Alternative C would yield no reduction of impacts or risks to refuge resources and is not authorized by the statutory language in the National Wildlife Refuge system Administration Act and the national Wildlife Refuge System Improvement Act.	<p>The Service agrees with commenter that Alternative C would be duplicative of State regulations in most instances. The Service’s analyses demonstrated that regulating downhole operations under Alternative C would provide minimal additional protection of Refuge resources and uses while the administrative costs would be high. The approach outlined in Alternative B to not generally regulate downhole operations, including operations that use hydraulic fracturing, continues to be the Service’s preferred alternative.</p> <p>Our analyses found that other Federal and state regulations combined with the expectation that operators will act in their own best interests (i.e. economic, health and safety, and legal liability) to provide the necessary protections to refuge resources and uses. For example, the materials and services used in hydraulic fracturing represent a substantial cost to operators, and any portion of treatment that is not contained in the zone targeted for stimulation is unproductive. Therefore, operators will take steps to ensure mechanical integrity of the wellbore tubulars that are conveying the treatment to the target zone, and</p>

		design the job to limit fracture growth beyond the target zone. See also response to Concern Statement 4.2.
<p>4.2. Service regulation of downhole operations as described in Alternative C is necessary to provide needed protections of refuge resources and uses.</p>	<p>[We] support broadening the proposed rule consistent with Alternative C in the November 2015 EIS. Alternative C incorporates changes proposed in Alternative B while also addressing oil and gas operations on refuge inholdings, directional drilling under the refuge from private lands, and <u>downhole operations</u>.</p>	<p>The Service’s goals in regulating downhole aspects of hydraulic fracturing would be to; 1) prevent escape of fluids to the surface and 2) isolate and protect usable water zones throughout the life cycle of the well.</p> <p>The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of Americans’ drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. State requirements for isolation and protection of usable quality water zones during the drilling, production, and abandonment phases vary, but serve to meet the mandates of the Safe Drinking Water Act (SDWA). Service regulation in the downhole aspects of well construction and operations would duplicate other Federal and state efforts with only slight reduction of risks to groundwater.</p> <p>However, recognizing the public concern regarding impact to water resources from these activities and the Service’s responsibility to ensure that it protect these resources, Alternative B, the Service’s preferred alternative, does include standards for well control and isolation and protection of usable water. These provisions create regulatory requirements in the unforeseen event of a systematic failure of other Federal and State laws and regulations.</p> <p>Alternative B also includes provisions (information requirements, operating standards, and reporting requirements) that address the management of wastes including flowback fluids. The Service anticipates that all future hydraulic fracturing operations would be</p>

		<p>conducted under new operations permits or modifications to existing Service approved permits. Thus, management of flowback fluids would include tanks to capture and temporarily store flowback fluids, no use of earthen pits, and prompt removal of wastes from the refuge.</p> <p>In developing and analyzing the alternatives, the Service found that preponderance of impacts and risks of impacts to refuge resources associated with exploration and development of oil and gas emanate from the related surface activities. This holds true for operations that include the use of hydraulic fracturing. Our analysis found that activities specific to downhole operations of well construction and maintenance, production, reservoir stimulation including hydraulic fracturing, and well plugging and abandonment present a substantially lower risk to refuge resources. We found that Service regulation of such downhole activities would largely be duplicative of other Federal and State agency rules with little discernable reduction of risk. Therefore, the Service’s proposed regulatory role in managing hydraulic fracturing is focused on the associated surface activities.</p> <p>For these reasons and those described in Concern Statement 4.1, it remains the Service’s preferred alternative to not generally regulate downhole activities.</p>

Topic 5 – Hydraulic Fracturing		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
5.1 Some commenters suggested that the Service should consider a no fracking alternative for	Fracking poses significant risks to water resources, air quality, climate change, wildlife, and seismicity. The EIS fails to study a “no fracking alternative” and these significant risks.	The Service considered these comments, as well as other information and studies provided by commenters regarding hydraulic fracturing, and does not believe they provide the Service with additional information that would change our approach towards hydraulic fracturing

analysis.		<p>in the rule. Comments requesting the ban on hydraulic fracturing used the term to encompass all the activities and impacts that are associated with oil and gas development that happens to use hydraulic fracturing. They did not provide facts, data, or science that demonstrates the actual process of hydraulic fracturing creates impacts or risks of impacts that are so elevated above those of oil and gas operations in general that a ban would be justified. It is the Service's policy that "scientific and scholarly information that we consider in our decision-making must be robust, of the highest quality, and the result of the most rigorous scientific and scholarly processes as can be achieved." (212 FW 7). As the Service has noted in the EIS, studies show that, in some limited instances oil and gas operations which include hydraulic fracturing stimulation completion methods can negatively affect surrounding resources and the environment (e.g., improper cementing of casing and well integrity issues or surface mismanagement of fracking and flowback fluids). However, as also noted in the EIS, other studies show that done properly, wells completed using hydraulic fracturing completion methods would present no more risk to the surrounding environment than conventionally completed wells.</p> <p>Based on the Service's review of studies provided during the public comment period, we do not believe that a blanket ban on hydraulic fracturing completion methods in refuge units is necessary or appropriate at this time. The Service will continue to revisit and update its policy as more information on hydraulic fracturing completion methods becomes available. Further, the Service notes that well completion programs using hydraulic fracturing were not given blanket approval under either of the action alternatives. Alternative B, the</p>
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		<p>Service’s preferred alternative includes operating and approval standards developed with the knowledge that hydraulic fracturing operations would likely be proposed by operators and are designed to ensure that operators employ technologically feasible least damaging methods that will not impact refuge resources and uses. The Service will consider hydraulic fracturing operations on a case by case basis and analyze potential impacts on refuge resources and uses under the regulations’ approval standards.</p>
<p>5.2. The risk to groundwater from hydraulic fracturing operations can be reduced by use of EPA’s UIC program permitting guidance for hydraulic fracturing that use diesel in the injected fluid.</p>	<p>We continue to recommend that the final PEIS consider using EPA’s Underground Injection Control Program permitting guidance specific to oil and gas hydraulic fracturing activities using diesel fuels. Although developed specifically for hydraulic fracturing where diesel fuels are used, many of the guidance’s recommended practices are consistent with best practices for hydraulic fracturing in general, including those found in state regulations and model guidelines for hydraulic fracturing developed by industry and stakeholders.</p>	<p>We have added language to the EIS to inform that the use of EPA’s UIC permitting guidance for hydraulic fracturing operations that use diesel is also appropriate for all hydraulic fracturing operations. Use of the recommended practices would serve to further reduce the risk to groundwater.</p>
<p>5.3. In support of a general ban on hydraulic fracturing, one commenter called for the DEIS to fully analyze in detail the impacts of hydraulic fracturing on water resources, air quality, human health and safety, and other impact topics. The</p>	<p>Example: Following the commenter’s discussion of potential for surface water contamination, the commenter stated, “Contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming, and other activities, and may be infeasible to restore the original water quality once surface water is contaminated. The Service should consider this analysis in the EIS.”</p> <p>Similar representative comments followed the</p>	<p>The EIS describes the effects of oil and gas operations in general for each of the impacts topics. In addition, it describes the incremental impacts (scope, intensity, duration) that can occur when hydraulic fracturing is used. The commenter uses the term “hydraulic fracturing” to encompass all aspects of oil and gas development that includes the use of hydraulic fracturing – from road and site construction through final reclamation.</p> <p>The Service believes the level of detail in the EIS is appropriate for a programmatic study. Once an oil and gas operator’s application is received, the Service will conduct site specific analysis of the proposal, including consideration of the impacts</p>

<p>commenter also called for detailed discussion of issues such as expansion into new areas (and refuges), increase risks of spills and accidents, risk of long-term migration of fracking fluids due to newly created subsurface pathways, public disclosure of chemicals used in hydraulic fracturing, contributions to climate change, additional waste volumes of flowback fluids, and others.</p>	<p>commenter’s discussion of each of the items listed in Concern Statement 5.3.</p>	<p>and issues listed in Concern Statement 5.3. Additionally, the Service’s regulation of any future operation, including hydraulic fracturing, will be subject to further analysis under the National Environmental Policy Act, and, therefore, the public will have further opportunity to participate.</p>
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Topic 6 – Regulation of Pre-existing Operations

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>6.1. The DEIS analysis does not provide sufficient information to support Alternative B as its preferred alternative for regulating pre-existing operations.</p>	<p>The DEIS does not contain enough information to support FWS’ conclusion that the administrative and operational costs of regulating existing operations within refuges outweigh the environmental benefit. FWS justifies its exemption [under Alternative B] for pre-existing operations by claiming that most negative environmental impacts from existing operations have already happened, so applying the proposed regulations would not provide many environmental benefits. The EIS does not</p>	<p>The comment is in context of their support for applying full permit requirements to pre-existing operation during the production phase, as described in Alternative C. We disagree that information is lacking. The incremental environmental benefits on refuge resources and uses of Alternative C’s component (to not require pre-existing operations to obtain a permit, post a bond, and comply with operational standards during production) are described throughout the impact topics analyses. The economic costs and benefits are described in Management of Refuge Operations and</p>

	<p>contain information on what the impacts from existing operations are or whether those impacts are difficult to avoid. Without this information, FWS' conclusion that the costs of regulation outweigh the benefits to refuges is conclusory.</p>	<p>Socioeconomics sections of Chapter 4. The Service's approach to this rulemaking was to analyze the costs and benefits of each regulatory requirement and its alternatives, as required by the law (Executive Order (EO) 12866).</p> <p>Since new operations create the greatest additional impacts, proper site planning, timing restrictions, and best management practices (BMPs) can accomplish a great improvement in resource protection, thus justifying a permit system. The permit process focuses on the full suite of time, place, and manner considerations on those new operations that create the highest level of incremental impacts. By requiring a reclamation standard for all operations, including pre-existing operations, it also ensures long-term rehabilitation of habitat damaged by all operations.</p> <p>The EIS describes that while applying full regulatory requirements to pre-existing operations may provide some additional protection to refuge resources and uses, it would not be able to remedy a majority of the impacts to refuge resources and uses caused when the operators chose the time, place, and manner of these pre-existing operations. For example, on existing operations, the operator's well has already been drilled and the area of operations (access route, well site, production facilities, and routes for gathering lines) were established and impacts to refuge resources, such as geology and soils, wetlands, and wildlife-dependent recreation, occurred prior to this rule being finalized.</p> <p>A general permit requirement would necessitate the Service to roughly double its oil and gas management resources from current levels, while the administrative costs to operators of pre-existing wells is estimated to be approximately \$1800 per well on an annual basis. Our</p>
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		analysis indicates these costs, in general, would be inefficiently applied and disproportionately high in general relative to the benefits to refuge resources and uses.
6.2. The DEIS does not adequately describe the environmental effects of assimilating state regulations for pre-existing operations during the production phase under Alternative B.	The EIS does not address the potential impacts from the enforcement of inadequate state regulations. Even where state regulations may be adequate to protect natural resources within wildlife refuges, state oil and gas agencies often have difficulty enforcing compliance, penalty fees are generally too low to deter noncompliance, and the same rules are repeatedly violated. The EIS must include these considerations in its analysis of the potentially significant impacts on refuge lands from its failure to regulate pre-existing oil and gas operations.	<p>The Service has considered these comments and would like to provide additional clarity to the sufficiency of utilizing other Federal and State laws to regulate pre-existing operations during the production phase.</p> <p>In terms of ongoing impacts from production, our analysis indicates that assimilating Federal and State laws will help protect refuge resources and uses from ongoing impacts from these operations, such as removal of waste, storage of chemicals, leak and spill prevention. Where individual states' regulations do not specifically address an issue, the Service would continue to work cooperatively with state agencies and operators to reduce impacts or risks or impacts to refuge resources and uses. This approach enables managers to focus limited resources on those operations with the greatest possible impacts to refuge resources and uses rather than an indiscriminant administration of permits for the approximately 4000 pre-existing operations.</p> <p>The Service would work cooperatively with State programs to enhance the efficiencies and effectiveness of both the Service's and States' programs.</p> <p>See also Service Response to Concern Statement 6.1.</p>
Topic 7 – Recommend Adoption of Alternative A or C		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
7.1 Alternative A, the no action alternative should be selected	Western Energy Alliance urges the adoption of Alternative A, the no action alternative. Current rules and regulations, including those specific to	The FWS and the states have different missions. The Service is squarely focused on meeting its legal mandate to conserve fish, wildlife and plant resources and their

<p>because existing State and Federal laws provide sufficient protection for refuge resources and uses.</p>	<p>FWS management of refuge lands and general federal and state laws, are sufficient to protect refuge resources.</p>	<p>habitats for the benefit of present and future generations. From a regulatory perspective, this translates to an emphasis on managing the surface uses of oil and gas operators.</p> <p>In contrast, state oil and gas regulations typically focus on the protection of mineral rights and conservation of the oil and gas resources (maximizing recovery and utilization). Most states do provide for protection of surface and groundwater via well design requirements and oil pollution control. State programs vary widely with regard to protection of surface resources and surface use conflicts, but generally leave the details to be worked out between the surface owner, in this case the FWS, and the operator.</p> <p>Operators face many different procedures and requirements from state to state. The proposed regulation of Alternative B provides a consistent set of procedures and operational standards to accomplish the “surface use agreement” between the FWS and operator.</p> <p>Therefore, the Service will not be adopting Alternative A as its Preferred Alternative.</p>
<p>7.2. Alternative C, the modified proposed rule should be selected to provide maximum protection of refuges resources and uses.</p>	<p>[We] support broadening the proposed rule consistent with Alternative C in the November 2015 EIS. Alternative C incorporates changes proposed in Alternative B while also addressing oil and gas operations on refuge inholdings, directional drilling under the refuge from private lands, and downhole operations.</p>	<p>Alternatives B and C are identical in how they address the majority of objectives, but differ in their treatment of directional oil and gas wells drilled beneath refuges from surface locations outside refuge boundaries and regulatory requirements of pre-existing operations.</p> <p>Our analysis shows avoiding the cost and time delay of Service regulation provides an incentive for operators to use directional drilling from a surface location outside a refuge to reach their oil and gas rights within a refuge. Exempting their downhole operations that occur inside a refuge from these regulations is expected to result in fewer wells drilled on refuge lands and waters resulting in an overall benefit to refuge resources and uses (avoidance or minimization of direct impacts). If the Service extended</p>

		<p>its regulation beyond the NWRS as evaluated in Alternative C of the EIS, the Service could require actions, such as noise abatement or visual screening, which serve to reduce cross-boundary effects on Service resources and uses. However, these benefits to resources and uses could evaporate, and many adverse consequences could occur, if just a small percentage of wells that otherwise would have been located outside a refuge are drilled inside the boundary.</p> <p>The incremental environmental benefits on refuge resources and uses of Alternative C's component (to require pre-existing operations to obtain a permit, post a bond, and comply with operational standards during production) are described throughout the impact topics analyses. The EIS describes that while applying full regulatory requirements to pre-existing operations during their production phase may provide some additional protection to refuge resources and uses, it would not be able to remedy a majority of the impacts to refuge resources and uses caused when the operators chose the time, place, and manner of these pre-existing operations. The economic costs are described in Management of Refuge Operations and Socioeconomics sections of Chapter 4. The Service's approach to this rulemaking was to analyze the costs and benefits of each regulatory requirement and its alternatives, as required by the law (Executive Order (EO) 12866). A general permit requirement would necessitate the Service to roughly double its oil and gas management resources from current levels. Operators could incur nearly \$10 million incremental costs annually, of which nearly 75% would be administrative in nature (e.g., permitting, financial assurance) leaving only 25% of costs working to provide on-the-ground environmental benefits. Our analysis indicates these costs, in general, would be inefficiently applied and disproportionately high in general relative to</p>
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		<p>the benefits to refuge resources and uses. The approach of Alternative B enables managers to focus limited resources on those operations with the greatest possible impacts to refuge resources and uses rather than an indiscriminant administration of permits for the approximately 4000 pre-existing operations.</p> <p>Therefore, the Service will not be adopting Alternative C as its Preferred Alternative and proposes to implement proposed alternative as described in the Record of Decision.</p>

Topic 8 – Fully Evaluate Acquisition of Non-Federal Oil and Gas Rights

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
7.1 The DEIS should fully evaluate the cost of acquiring all non-Federal oil and gas rights within the NWRS and include acquisition as a reasonable alternative	FWS should determine the cost of mineral rights that exist under the NWRS and include this in the DEIS. After this is done, then FWS should acquire this mineral rights and retire them so there are no more problems with oil/gas in the future.	While the Service did not undertake a costly and time intensive evaluation of the fair market value of non-Federal oil and gas rights within the NWRS, we did consider full or partial acquisition of oil and gas rights. This alternative was described in Chapter 2, but dismissed from further detailed analysis because based on common knowledge of what acquiring a mineral right can cost in areas where there is potential for oil and gas development, it would be too costly and unnecessary for the Service to acquire all mineral rights that exist under the NWRS. We provided additional discussion of the acquisition alternative in the FEIS.

Topic 9 – Performance Bonding (Financial Assurance)

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
8.1 A financial assurance requirement is unnecessary as states already require performance bonds. Further, FWS lacks the authorities to require performance bonds.	It is our contention that the proposed USFWS regulation would yield no reduction of impacts or risks to refuge resources and is not authorized by the statutory language in the National Wildlife Refuge system Administration Act and the National Wildlife Refuge System Improvement Act.	The Service’s rule does not rely on State bonds to ensure timely well plugging and site reclamation to Service standards for two primary reasons. State bond amounts do not typically cover the actual costs of well plugging and reclamation. However, States administer well plugging funds with money derived from sources other than forfeited bonds, e.g., permitting fees, taxes on production, or penalties. So, the two primary reasons that state bonding programs do not meet the Service’s needs are that State plugging funds may not be directly available to wells on refuges that become orphaned, and these funds may not be available to conduct site reclamation to standards higher than what a State may typically require. While States have developed programs for plugging orphaned wells, many State programs

		<p>remain backlogged, orphaned wells on federally managed lands rank do not usually rank as top priorities on their priority lists for plugging. (Office of Inspector General, Report No. CR-EV-FWS-002-2014: Oil and Gas Development on U.S. Fish and Wildlife Service Refuges). Even where a State may expeditiously address plugging of an orphaned well on a refuge, funds may not be available to restore sites in a manner that meets Service standards in the rule (§29.117(d)). Finally, in the event that a State and the Service were in formal agreement that state plugging funds would be used to plug a well directly upon its becoming orphaned as well as to conduct site reclamation, the Service would consider this to be a condition under § 29.152 that would justify reducing the financial assurance required by the Service.</p> <p>Though financial assurance is not specifically mentioned the NWRSA, the use of financial assurance to help ensure an operator’s compliance with its permit and obligation under the rule is an appropriate regulatory tool to meet the Service’s responsibilities as outlined by the NWRSA. Improved compliance and assurance that funds will be available to complete reclamation in the event of an operator default both serve to reduce impacts or risks of impacts to refuge resources and uses.</p>
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Topic 10 – Third-Party Monitoring

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
10.1. The Service should not delegate its monitoring responsibilities to third-party contractors.	I prefer that FWS employees conduct monitoring of oil/gas operations rather than third-party monitors. There is a better chance for strong enforcement when your own employees understand the FWS mission and are motivated to fulfill it than delegation of this	We agree third-party monitors must not have any conflict of interest, and reinforce that concept in the preamble to the proposed rule and in the definition of <i>Third-Party Monitor</i> in §29.50.

	<p>important job to someone who is just doing a job.</p> <p>FWS should add a "conflict of interest" provision for "third-party monitor" to ensure that these people have no "conflict of interest" (do not work for the operator or have ties to it) and can operate on behalf of the FWS in an "unbiased manner" and not in favor of the operator.</p>	

Topic 11 – Technologically Feasible, Least Damaging Methods Standard

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>11.1. The Service’s regulations, including requirements that an operator use “technologically feasible, least damaging methods” is not necessary to reduce impacts or risks to refuge resources as State and other Federal laws and regulation provide necessary protections.</p>	<p>It is our contention that the proposed USFWS regulation [implementation of technologically feasible, least damaging methods] would yield no reduction of impacts or risks to refuge resources and will impair [the State's] ability to administer its oil and gas regulatory program.</p>	<p>Because of the differences between the objectives of State regulation and the Final Rule, we do not believe that State regulations fully address the necessary protections for the conservation of fish and wildlife resources and public use on NWRS lands. The Service’s legal mandate is to conserve fish, wildlife and plant resources and their habitats for the benefit of present and future generations. In contrast, state oil and gas regulations typically focus on the protection of mineral rights and conservation of the oil and gas resources (i.e., minimizing waste of oil and gas resources). States do provide for protection of surface and groundwater via well design requirements, setbacks, and oil pollution control measures.</p> <p>State programs vary widely with regard to protection of surface resources and surface use conflicts, but generally leave the details to be worked out between the surface owner, in this case the FWS, and the operator. Operators face many different procedures and requirements from state to state. The proposed regulation provides a consistent set of procedures and operational standards to accomplish the “surface use agreement” between the FWS and operator.</p>

Topic 12 – Climate Change		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>12.1. The DEIS does not adequately consider the effects of climate change in its analyses.</p>	<p>While the Draft EIS evaluated climate change effects on refuge resources in Chapter 3, Affected Environment, it failed to adequately address the environmental consequences and alternative steps that could be taken in the proposed regulations including the operational standards. The Service failed to provide sufficient analysis of the direct, indirect, and cumulative effects of greenhouse gas emissions of non-Federal and Federal oil and gas operations on refuges, and failed to provide a comprehensive plan for managing these increasing risks to refuge resources across the System, by merely considering to do it piecemeal on a permit by permit basis (Draft EIS 1-16, 1-17).</p> <p>Additionally, climate change-caused river and coastal erosion, permafrost melt, increased severity and frequency of storms and flooding, etc., will have impacts on refuge oil and gas facilities and operations. These events will have increasingly serious effects on refuge lands, waters, and resources. The information and operational requirements for permits for existing, modified, and new oil and gas infrastructure need to address these likely climate change impacts.</p>	<p>The Service disagrees that the EIS does not adequately consider the effects of climate change in its analysis based on two factors: 1) the action alternatives do not authorize any activities that create additional adverse impacts on natural and cultural resources or refuge uses compared to Alternative A: No Action and 2) overall beneficial impacts on natural and cultural resources are expected for the action alternatives.</p> <p>This EIS is programmatic in nature and, as such, the Service has acknowledged throughout the EIS that further site-specific analysis will need to be done in compliance with NEPA at the time the Service is considering an action on an operations permit application. The impacts of climate change are variable based on time and place of an operation. Therefore, the Service believes that a site-specific analysis of impacts is more appropriate as the Service does not know at this time the exact time or place of operations. The EPA has recommended that the Service conduct appropriate greenhouse gas (GHG) and climate change analyses for subsequent project-specific operation actions and consider both the potential effects of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate change for the environmental effects of a proposed action. The Service will be following this recommendation for project-specific operations actions.</p>

Topic 13 – Induced Seismicity

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
<p>13.1 The Service should further analyze the risk of induced seismicity from underground injection of produced/flowback waters associated with operations that include hydraulic fracturing.</p>	<p>We recommend that the final PEIS discuss whether there is potential for induced seismicity due to underground injection of produced/flowback waters and whether mitigation or management controls could be used to reduce or eliminate any problems or concerns. Induced seismicity is an increasing concern in regions of the United States where the produced fluids and wastewaters from oil and natural gas production activities are being injected into the subsurface through deep disposal wells.</p>	<p>The Service has added discussion and additional analysis in Chapter 4 – Soils and Geology on potential for induced seismicity.</p> <p>Produced water (typically of high saline content) often represents the largest volume of waste generated at oil and gas sites. Disposal by injection into deep formations is currently the most common method of disposal. Injecting large volumes of water into deep sedimentary formations raises the pore pressure of large areas and has been associated with induced earthquakes. Of the approximately 40,000 waste fluid disposal wells nationwide, only a small fraction have induced earthquakes large enough to be of concern to the public. The USGS is working closely with the Environmental Protection Agency, state and local regulators, and state geological surveys to better understand the causes of these earthquakes and develop recommended mitigation techniques to avoid these hazards.</p> <p>Furthermore, the Service is not authorizing any on-the-ground proposals for operations through this EIS. If an operator proposed an injection well on NWRS lands, the Service would conduct site specific analysis to determine the potential for induced seismicity, and that such disposal method was the “technologically feasible, least damaging method.” Additionally the Service would use the most recent data and science, including results of how other agencies have addressed the issue, to apply avoidance and mitigations to reduce the risk of increased seismicity.</p>

Topic 14 – Aquatic Resources

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
14.1 The final EIS should provide inventories of existing wetlands and waters of the U.S. to improve its analyses.	We recommend that the final PEIS include a preliminary assessment of aquatic resources. Consider including inventories of existing wetlands and waters of the U.S. in the planning areas, including wetlands that are regulated under Section 404 of the CWA and wetlands that are determined to be non-jurisdictional and protected under Executive Order 11990 - Protection of Wetlands (May 24, 1977).	The impact topic “Wildlife and Aquatic Species (Including Animal Species of Special Management Concern)” addresses impacts for each alternative on a programmatic level. The Affected Environment section in Chapter 3 provides a discussion on wetlands and references Appendix F which includes descriptions of the major wetland types in refuges. We suggest that inventories of wetlands and waters of the U.S., while necessary for analysis at the permitting phase, would not contribute substantially to the analysis of the final EIS.

Topic 15 – Air Resources

<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
The DEIS should reference use of the "Memorandum of Understanding (MOU) Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process" in evaluating future projects.	As appropriate, use the "Memorandum of Understanding (MOU) Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process," which the EPA, U.S. Department of Agriculture and U.S. Department of Interior entered into on June 11 , 20 11. Based on this MOU, future projects implemented under the FWS regulations may be subject to additional air quality analyses and project level mitigation. It may be appropriate to utilize the MOU's agency stakeholder process to share reasonable and foreseeable development and emissions inventory information and to determine appropriate steps for the air quality analysis, such as quantitative air quality modeling.	Inserted text under Chapter 4. Air Quality – Methodology explaining that future projects would fall under the umbrella of the MOU.

Topic 16 – Solitude and Wilderness		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
16.1 Impact topics should include solitude.	"Solitude" should be an "impact topic" in the DEIS.	We have added language in the final EIS under methodologies for assessing impacts to Visitor Uses and Experiences to inform that while solitude is addressed as a separate impact topic, it is considered as a value inherent with visitor uses and experience.
16.2 Wilderness is not addressed as an impact topic.	There is no discussion of wilderness areas and how they will be managed for oil/gas activities if the mineral rights under them are not held by the federal government.	Chapter 1 (ISSUES AND IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS) describes the reasoning for Wilderness being an impact topic considered but dismissed from further analysis.
Topic 17 – Subsistence (Application in Alaska)		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
17.1 The DEIS should address subsistence as a vital purpose of refuges in Alaska.	Subsistence should be addressed in the Final EIS as a vital purpose of refuges in Alaska and as a cultural resource which has significant socioeconomic values that could be impacted by oil and gas activities and infrastructure.	Since the Service has decided to exclude management of non-Federal oil and gas in Alaska from this rulemaking, the final EIS does not provide discussion on subsistence values in Alaska as it should not be impacted.
Topic 18 – Data Correction		
<i>Concern Statement</i>	<i>Representative Comment</i>	<i>Service Response</i>
18.1 There are inaccuracies in the well data presented in the DEIS.	Appendices A and D of the DEIS states that there are 19 non-federal oil wells in the Hopper Mountain NWR, and 12 "other" wells in the Bitter Creek NWR. However, according to records maintained by DOGGR, there are 18 and 13 wells on each refuge, respectively. Please verify these numbers prior to finalizing the DEIS. In addition, the 13 wells in the DOGGR database that occur on the Bitter Creek NWR formerly	The Service recognizes this inconsistency and is verifying and updating the information on over 5,000 wells on NWRS lands as more accurate information is available. Well data reported in the EIS is from Ramirez and Mosley (2015). Ramirez and Mosley (2015) report that the source of the well data was from 30 state regulatory agencies or geological agencies. Well status and type can change from year to year. Ramirez and Mosley (2015) noted that errors are inherent in the

	produced oil and gas (they are now plugged and abandoned). We suggest that all wells in both the Hopper Mountain NWR and Bitter Creek NWR be reclassified in this table as “oil and gas” so that they are consistent with the well types designated by DOGGR.	collection of data on thousands of wells due to inaccurate data transcription, typing errors, errors made during the data collection process, programming errors, unclear definitions for data items, or not adhering to the data collection protocol.
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ATTACHMENT: COPIES OF CORRESPONDENCES FROM ALL ENTITIES

December 27, 2015

RECEIVED
Div. of Policy, Perf. &
MGMT. Programs

JAN 04 2016

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Public Comments Processing
Attention: [FWS-HQ-NWRS-2012-0086]
Division of Policy, Performance, and Management Programs
U.S. Fish and Wildlife Service
MS: BPHC
5275 Leesburg Pike
Falls Church, Virginia 22041-3803

Dear U.S. Fish and Wildlife Service,

Enclosed are my personal comments about the U.S. Fish and Wildlife Service (FWS) Proposed Changes for Regulation/Rules and Draft Environmental Impact Statement (DEIS) for the Management of Non-Federal Oil and Gas Rights, Docket No. FWS-HQ-NWRS-2012-0086, for the National Wildlife Refuge System (NWRS).

1) **Pages i through iii, Purpose and Need for Action, DEIS**, FWS fails to include "solitude" as an important value, benefit, and use that the NWRS provides to humans. "Solitude" should be an "impact topic" in the DEIS and the impacts that oil/gas activities have on this important and valuable benefit should be covered. **There is no discussion of wilderness areas and how they will be managed for oil/gas activities if the mineral rights under them are not held by the federal government. This is a major oversight that must be addressed.**

2) **Pages iii and iv, Alternative B: Proposed Rule (Preferred Alternative)**, unlike FWS, I do not consider Alternative B to be the environmentally preferred alternative because Alternative B does not fully regulate and protect the NWRS from environmental impacts due to drilling outside but under or through the subsurface of the NWRS.

3) **Page v, Alternative C: Modified Proposed Rule**, I favor this alternative with changes. It is important for FWS to regulate those who drill under the NWRS to ensure that both subsurface and surface impacts do not occur. Currently and with this proposal, FWS encourages operators to directionally drill under NWRS lands. This process directs most of the oil/gas impacts onto private lands with little or no FWS regulatory authority. The DEIS fails to clearly state what the environmental impacts are on these private lands and these environmental impacts affect the environment that surrounds the NWRS.

I prefer a more controlled regulatory process for directionally drilled wells outside the NWRS. FWS must have authority to visit the drill site that is off-site to ensure that it is being done correctly and that the operators abide by mitigation

measures that are mandatory. In this way, a less risky type of drilling will occur without the need for a formal plan of operations.

FWS refers to the National Park Service (NPS) and its DEIS on non-federal oil/gas activities several times. However, the NPS DEIS, states inaccurately, on **pages 169, 200, 218, 235, 255, 277, 295, 311, 329, 347, and 383**, that "... and logistics were neutral for another 37% of operations. Thus, only 26% of operations would have located outside of park boundaries. Stated another way, the vast majority of operations, or nearly three quarters of the total, would have located within the park boundaries if no NPS regulations existed."

This is a misleading and inaccurate statement that FWS apparently accepts. If 37% of operators were neutral about where they favored locating their drilling site, then this means they are neither for nor against drilling in the National Park System and could be persuaded either way. What can be said is that 37% of the operators would have preferred a drilling site within the National Park System, 26% would have located their drilling site outside the National Park System, and 37% has no strong preference and are subject to persuasion to drill outside the National Park System. **FWS must not deceive the public with the acceptance of NPS statements that are erroneous and thus overplay the risk of environmental impacts for Alternative C in this DEIS.**

4) Pages 1-4 through 1-7, Relevant Issues Pertaining to Non-Federal Oil and Gas on National Wildlife Refuge, DEIS, apparently, FWS is not interested in determining the cost of oil/gas mineral rights within the entire NWRS or within certain National Wildlife Refuges and then using this information to prepare alternatives which either in toto or selectively buy oil/gas mineral rights and retire them so there will be no more existing or future environmental damages to fish and wildlife and other natural resources. FWS should pursue this option as a reasonable alternative.

FWS should determine the cost of mineral rights that exist under the NWRS and include this in the DEIS. After this is done then FWS should acquire these mineral rights and retire them so there are no problems with oil/gas activities in the future. We should look to the future and envision what the NWRS will be in the next 100 years and not what it is now. By acquisition of mineral rights FWS reduces the financial burden on the NWRS. FWS spends much of its natural resource protection budget in refuges subject to oil/gas activities, processing and monitoring oil/gas activities. Other more important resource protection issues get neglected like biodiversity, restoration, and adaptation to climate change.

5) Pages 1-12 through 1-17, Impact Topics, DEIS, FWS should estimate direct/indirect carbon dioxide (CO₂) and methane (CH₄) emissions (for example, the approximate CO₂ emissions due to the estimated amount of fossil fuel removed from the reservoir and used). FWS must estimate direct, indirect, connected, and cumulative climate change gas emissions due to drilling and put

this information in the DEIS so the public and decision-makers can review, comment on, and understand the total environmental impacts of this proposal on climate change and total environmental impacts of climate change on this proposal.

The FWS must provide mitigation measures to reduce climate change gases and the effects of climate change gases in the DEIS. To suggest that overall incremental contributions to greenhouse gas emissions from operations located on FWS lands are "relatively low", whatever that means, is an abdication of FWS responsibility under NEPA to clearly state what environmental impacts are.

The suggestion that in comparison to total greenhouse gas emissions that drilling on or under NWRS lands produces very little CO₂ or CH₄ is like saying that killing of one person is insignificant in relation to the killing 100's of people. The person is still dead! The planet still gets hotter and more uninhabitable for people, other organisms, and ecosystems. The public deserves better than this!

Climate change alters existing ecosystems and makes it more difficult for plants and animals to adapt successfully to changed ecosystems. FWS must in the DEIS address questions like:

- a. How will this proposal affect and be affected by climate change?
- b. What can be done to create more resilient and resistant habitats and ecosystems?
- c. What can NPS do to reduce CO₂, CH₄, or other greenhouse gas emissions due to the NWRS?
- d. What can be done to assist plants and animals in the NWRS so they can adapt to climate change?

FWS should prepare and include in this programmatic DEIS a climate change ecological resilience and resistance plan (CCERRP) for the NWRS. The programmatic CCERRP would assess the biological and ecological elements in the NWRS and the effects that climate change has had and will have on them. The CCERRP would also assist plants, animals, and ecosystems in adapting to climate change and would require monitoring of changes and mitigation measure effectiveness to reduce the impacts of oil/gas activities. The CCERRP would be based on:

- a. Protection of existing functioning ecosystems in the NWRS.
- b. Reduction of stressors on the ecosystems in the NWRS.
- c. Restoration of natural functioning ecological processes in the NWRS.

d. Use of natural recovery in the NWRS in most instances.

e. Acquisition of buffers and corridors to expand and ensure connectivity of ecosystems in the NWRS.

f. Intervention to manipulate (manage) ecosystems in the NWRS as a last resort.

h. Reduction of climate change gases that are emitted directly, indirectly, caused by connected actions, or cumulatively from the NWRS.

6) Pages 2-5, 2-11, and 2-13, Alternatives A, B, and C, DEIS, Page 77211 Section 29.120 through 29.122 General Terms and Conditions, and Page 77216, Identification of Wells and Related Facilities, Section 29.119(b)(3), I prefer that FWS employees conduct monitoring of oil/gas operations rather than third-party monitors. There is a better chance for strong enforcement when your own employees understand the FWS mission and are motivated to fulfill it than delegation of this important job to someone who is just doing a job. I do not believe in privatizing FWS monitoring and enforcement. I pay taxes to ensure that there are enough FWS employees to do the job right.

FWS should add a "conflict of interest" provision for "third-party monitor" to ensure that these people have no "conflict of interest" (do not work for the operator or have ties to it) and can operate on behalf of the FWS in an "unbiased manner" and not in favor of the operator.

7) Pages 2-6 through 2-13, Alternative B, FWS fails to document surface disturbance on private lands adjacent to the NWRS lands where directional drilling occurs. FWS should document this disturbance since FWS urges operators to drill off-site and are the cause for some of the environmental damages that occur here due to federal policies. Federal access is required for these wells to ensure that down-hole activities are conducted appropriately and FWS should claim this access that it is legally entitled to. NEPA requires that all impacts be represented in a DEIS.

FWS assumes that there will be minimal disturbance to geology and soils. However, this assumption only exists if FWS ignores the impacts to geology and soils that occur next door on private lands due to FWS policy to push drilling and environmental impacts there. FWS should not ignore the environmental impacts that occur on private lands due to FWS policy.

FWS does not acknowledge how fast non-native invasive plant species (NNIPS) can spread due to geophysical activities. NNIPS are a long-term threat and seismic testing over large areas (often 10's or 100's of square miles) potentially can cause the spread of NNIPS.

8) Pages 4-1 through 4-167, Chapter 4: Environmental Consequences, DEIS, FWS ignores and fails to implement Sierra Club v. Mainella that Judge John D. Bares made regarding the use of conclusory language used to define environmental impacts from National Environmental Policy Act (NEPA) analyses. In Sierra Club v. Mainella, Judge Bates found that the environmental assessments (EA's) that NPS prepared for oil/gas activities in BTNP were inadequate, arbitrary, and capricious. Judge Bates stated the following in his ruling:

"Because NPS's impairment analysis served as its NEPA analysis, the flaws in the impairment analysis also apply to the environmental assessment. Those shortcomings are, first, NPS's lack of explanation as to how it reached its conclusions, typically simply describing the impacts followed by a conclusion that the impact was not an impairment or, in the case of NEPA, that it was not "significant"; and second, the use of the descriptors "negligible", "minor", "moderate", and "major" that are largely undefined or are defined in a manner that includes few objective bounds ... nowhere explained the basis for its conclusion that potentially "moderate" impacts could not be significant under NEPA ... There is no basis in the administrative record for accepting NPS's conclusion that even a "minor" impact is not significant under NEPA, because there are no determinate criteria offered for distinguishing a "minor" impact from a "moderate" or "major" impact other than NPS's conclusory say-so ... the scoping regulations still require the agency to explain why they {dismissed issues} will not have a significant effect on the human environment ... Thus, the EA must provide a realistic evaluation of the total impacts and cannot isolate a proposed project, viewing it in a vacuum ... In short, NPS's three findings of no significant impact are, the court concludes, arbitrary and capricious for many of the same reasons as are the impairment determinations. In each decision, NPS has failed to take a "hard look" at impacts on the Preserve from adjacent surface activities, as evidenced by the lack of explanations supporting its conclusions and, in particular, its methodology of describing impacts using conclusory labels and then setting forth a bare conclusion without explanation as to the significance of an impact. NPS also failed to provide an adequate cumulative impacts analysis that included the other oil and gas operations in the Gore Baygall Unit ... However, NPS's ultimate conclusions that the drilling activities would not result in impairment of park resources and values under the Organic Act, or a significant impact on the human environment under NEPA, are not supported by reasoned explanations, and hence are arbitrary and capricious and an abuse of discretion."

This DEIS uses "conclusory statements" that Judge Bates ruled against. Judge Bates stated in his decision that the descriptors are largely undefined or are defined in a manner that include few objective bounds. These descriptors and others in this DEIS are not defined with objective bounds as required by Judge Bate's decision. FWS has failed to take the "hard look" that Judge Bates stated must be done.

In this DEIS phrases are defined so that they are “conclusory” and so that they do not have “objective bounds”. Some of the phrases used in this DEIS (for different impact topics this can mean very different impacts), just for air quality, that do not meet Judge Bate's decision include:

- 1) consistent and higher level of protection, pg. 4-33
- 2) slight to moderate, pg. 4-34
- 3) would be avoided to a greater extent than, pg. 4-34
- 4) would provide some additional protection, pg. 4-34
- 5) would likely be a significant increase, pg. 4-34
- 6) would be unnecessary impacts, pg. 4-35
- 7) would be subject to consistent standards, pg. 4-36
- 8) may provide for the implementation of higher standards, pg. 4-36

These not even qualitative phrases and do not provide to the public any real comparative difference between the alternatives as required by the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) NEPA regulation/rules for impact topics like Geology and Soil, Air Quality, Water Resources, Wetlands, Floodplains, Vegetation, Wildlife and Aquatic Species, Visitor Use and Experience, Scenic Views and Night Sky Resources, Natural Soundscapes and Acoustic Environment, Cultural Resources, Refuge Management and Operations, and Socioeconomics.

These phrases overwhelmingly populate the DEIS and provide no clue to the public about how they differ and what they really mean with regard to each impact topic discussed. The public has no way to weigh which impacts are worse and by how much. This lack of definition for these phrases makes it impossible for the public to accurately know how, for example, slight, moderate, and higher are different from each other and how additional qualifiers like greater extent and significant extent affect their meanings. Dictionary definitions are not sufficient when so many different impact topics are assessed using the same definition-less descriptor phrases with additional definition-less qualifier words added. There is no clear understanding of how much harm/benefit these phrases connote. This is not acceptable environmental impact analysis.

For this DEIS, dictionary usage of phrases will not suffice to provide the public with a clear picture of what the intensity, significance, and context of environmental impacts are. A qualitative assessment, analysis, and evaluation of environmental impacts is not sufficient to deal with the clearly articulated CEQ

requirements in **Section 1502.14**, which state that the DEIS “should present the environmental impacts of the proposal and the alternatives in comparative form, thus **sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public**”.

Quantitative assessment, analysis, and evaluation are necessary, whenever possible, to ensure that alternatives and environmental impacts are clearly defined and shown in the DEIS. As stated in the CEQ NEPA regulation/rules, **Section 1500.1(b)**, Purpose, “NEPA procedures must insure that environmental information is available to public officials and citizens ... The information must be of high quality. Accurate scientific analysis ... are essential to implementing NEPA”.

As stated in **Section 1501.2(b)**, “Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses.”

As stated in **Section 1502.8**, “which will be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts.”

As stated in **Section 1502.18(b)**, about the Appendix, “Normally consist of material which substantiates any analysis fundamental to the impact statement”.

As stated in **Section 1502.24**, “Agencies shall insure the professional integrity, of the discussions and analyses ... They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.”

Analyses in the DEIS appear based upon “best professional judgment” which is what a group of people think is important based on their experience and training. This level of assessment, analysis, and evaluation for environmental impacts and alternatives is insufficient for this DEIS.

FWS must define what “**best professional judgment**” means for this DEIS so that the public can review, comment on, and understand what FWS refers to. The qualitative description of phrases used to describe environmental impacts or the protectiveness of an alternative does not provide the public with the degree of alternatives comparison required by the CEQ.

The use of “**best professional judgment**” is not a substitute when quantitative information is available to show what impacts are or could be. The methodology that FWS uses appears based, in most part, on “**best professional judgment**” but the public is not told how this phrase is defined and what it means. The interaction of the methodologies used with the requirement in **Section 1502.22** of the CEQ’s NEPA regulation/rules must be discussed in the DEIS.

Section 1502.22, requires that when evaluating reasonably foreseeable significant adverse effects on the human environment in an DEIS that incomplete or unavailable information be plainly stated as lacking in the DEIS. This section also requires that if the costs of obtaining this information are "not exorbitant" then the agency must include the information in the DEIS. Finally, this section also requires that if the information cannot be obtained due to exorbitant costs that the agency must state the information is incomplete or unavailable; state the relevance of this information to evaluating the significant adverse impacts; summarize the credible scientific evidence; and then provide the agency's evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community."

The use of "**best professional judgment**" is the theoretical approach and method that FWS appears to use to assess the environmental impacts of oil/gas activities in, on, or through the NWRS. Therefore FWS must give a thorough discussion of the use of this evaluation method in place of using quantitative data for each impact issue that is discussed. FWS cannot substitute "best professional judgment" for gathering existing quantitative data that it does have or gathering quantitative data that does not cost an exorbitant amount to collect for this DEIS.

I oppose the use of "**best professional judgment**" in lieu of using existing or not exorbitantly costly acquired quantitative data. **I request that FWS clarify and detail clearly the comparative differences between each alternative and define clearly what the words/phrases used to define their impacts mean.**

9) **Pages 4-17 through 4-19, Geology and Soils, DEIS**, FWS fails to address how fracking or the injection of fracking wastes causes "earth quakes". FWS must state what it will do to eliminate or mitigate this impact so that NWRS lands are not adversely impacted.

Comments on Proposed Alternative B, Preferred Alternative, Management of Non-Federal Oil and Gas Rights

1) **Page 77203, Overview of Proposed Regulations**, both in the DEIS and this proposed regulation/rules FWS fails to provide draft regulation/rules for Alternative C so that the public can compare Alternative B to C and how they actually operation, look, and function. Such comparisons is required by CEQ NEPA regulation.

2) **Page 77203, Proposed Permitting Approach**, I support that an operator will not be authorized to begin operations until he/she has received all other required State and Federal permits. This ensures that when operation begins that the operator is legal and ready to drill on the NWRS.

3) **Page 77204, Operations not under a Service permit and Page 77207, Section 29.60 through 29.64 Pre-Existing Operations**, I do not support the continued existence of "pre-existing operations". "Pre-existing operations" is another term for "grandfathered operations". In this day and age there is no reason for "grandfathered operations". A lot of pollution and other violations (failure to keep a site clean) come from "grandfathered operations". These public NWRS lands are precious and deserve the very best protection from environmental damage and not ancient practices that no longer are appropriate. "Do the right thing"

4) **Page 77204, Wells drilled from outside refuges or on non-Federal inholdings to access non-Federal minerals and Page 77207, Section 29.80 Accessing Oil and Gas Rights From a Non-Federal Surface Location (Including Inholdings)**, I do not agree with the exemption of wells that drill under the NWRS. The FWS should ensure that anyone who penetrates federal public lands, like those who drill under the NWRS, is doing so safely so that any environmental impacts are minimized. This can only be done via FWS requirements for certain information and monitoring of the well to determine that underground operations are proceeding appropriately. Even the NPS requires this.

The casing, cementing, blowout prevention program, etc., is done off-site via directional drilling through the NWRS and this is why FWS must regulate these operations and have access to them to ensure they are done appropriately and NWRS resources are not put at unnecessary risk of damage.

5) **Page 77204, Wells drilled from outside refuges or on non-Federal inholdings to access non-Federal minerals**, I support requiring Federal and State rules for oil/gas activities be enforced as stipulations for drilling in the NWRS. FWS personnel must be able to enforce compliance with those requirements on the NWRS.

6) **Page 77204, Operating Standards**, the FWS states that "... the performance-based standards approach provided the most efficient means of successfully avoiding or minimizing the effects of oil and gas operations on refuge resources and visitor uses." The FWS fails to state if performance-based standards are as good as prescriptive regulations for the protection of the environment. Efficiency must take a back seat to environmental protection. I believe that a combination of prescriptive regulations and performance-based standards would be the best alternative to protect the environment in the NWRS. I support a combined regulatory system for the NWRS and this should be reflected in alternatives for this DEIS.

Suggesting that the NPS has had 35 years of successful use of performance-based standards for regulation of oil/gas activities is a biased statement. NPS has had problems too! FWS does not share with the public the political and

technical problems that NPS has had with its performance-based regulatory system. NPS spells out some of these problems in the DEIS it released in November 2015. FWS should not hide the problems that NPS has had. This is unfair to the public.

7) **Page 77205, Operating Standards**, FWS should require as a performance-based regulatory system that under no circumstances there be mud pits. If an operator cannot conduct drilling without a mud pit then that entity does not deserve to drill on or under NWRS lands.

8) **Page 77205, Operating Standards**, the FWS should define what “maximum extent practicable” means with regard to protection of the NWRS. This is particularly confusing since **Page 77219, Section 29.32 Non-Federal minerals rights**, uses the “greatest extent practicable” standard and does not use the word “maximum”. The FWS should state clearly why the standard should not be “maximum extent possible” so that NWRS lands and resources are maximally protected. FWS mandates the “extent possible” requirement under **Section 29.32 Non-Federal Mineral Rights**, when it says, “all structures and equipment are removed when no longer necessary and the area restored to pre-operation conditions to the extent possible”. The public deserves the best protection for its public lands not the most favorable for operators.

FWS should make each operator, whether drilling on or off-site to access minerals under NWRS lands, post a list of all chemicals used for any type of drilling. The public has a right to know what chemicals are being used on its public lands with no exceptions for trade secrets.

9) **Page 77205, State Regulations and Page 77219, Section 29.32((a)2) Non-Federal mineral rights**, as the FWS knows state regulations usually do not protect surface landscapes well. That is why FWS must do so. State regulations usually pertain to protection of human drinking water (not wildlife needs) and conservation of the oil/gas so that a field can be produced as much and as long as possible. State regulations alone will not protect the NWRS adequately particularly since each state has different regulations, with different levels of protection, and protect different elements and therefore will offer different levels of protection for different National Wildlife Refuges.

10) **Page 77206, Section 29.40 through 29.44**, I support the rules applying on and within waters subject to the jurisdiction of the United States and “waters or an interest in land and waters”. Operations should include “reconnaissance surveys” to ensure that NWRS public lands are protected as much as possible.

By not regulating down-hole activities FWS ignores possible negative environmental impacts like “earthquakes” which have been caused during the fracking or the waste water injection well disposal process. Down-hole activities must be regulated just as thoroughly as other oil/gas activities.

I support charging for access across NWRS lands to ensure that damage does not occur to public resources and that if it does that it gets fixed.

11) **Page 77209, Section 29.110 through 29.119, Operating Standards**, FWS should require that leak detection and repair programs (LDAR) be implemented to ensure that hydrocarbon, carbon dioxide, and other air pollutant emissions are minimized. The performance-based standard of just “minimize leakage of air pollutants and hydrocarbons” is too loose and easy for operators to get around. Operators will implement the least costly and effective air pollutant reductions. The FWS has created loopholes that are so large that operators can take advantage of them to limit their costs while increasing risk for public resources.

12) **Page 77209, Section 29.110 through 29.119, Operating Standards, Page 77225, Section 29.111 What general facility design and management standards must I meet?, (h) and (i) and Section 29.113 What hydrologic standards must I meet?**, FWS should require that all equipment brought onto the NWRS be cleaned to ensure that NNIPS are not spread throughout the NWRS.

FWS should also require mandatory safe distance limits so that protection is guaranteed for natural resources. The FWS proposal allows 0 to 500 foot protective buffer. You can bet operators will push FWS toward zero and natural resources will be at greater risk due to political pressure. I do not favor less protection for wetlands, and watercourses. FWS fails to include perennial streams in this protection since it only names intermittent or ephemeral watercourses. This is not appropriate. “Do the right thing!” and protect all water from oil/gas activities.

13) **Page 77210, Section 29.110 through 29.119, Operating Standards**, FWS should require the operator to initiate reclamation within 3 months and not 6 months. Reclamation should be implemented as soon as possible so the public gets its natural resource values/benefits back as soon as possible.

FWS should require an ecosystem restoration plan, that is approved by it, and includes planting of the appropriate native vegetation for the appropriate location on the landscape for reclamation. FWS should require specifically that if the landscape is altered due to blowouts from explosive seismic charges that it will be immediately restored.

14) **Page 77211, Section 29.120 through 29.122 General Terms and Conditions, Page 77216, Identification of Wells and Related Facilities, Section 119(b)(3), and Page 77226, Section 29.121 What monitoring and reporting is required for all operators?, (c) and (d)**, the FWS should require that when an accident occurs that causes loss of life, injury, or a release that instead of 24 hours, the standard be “as soon as possible but no later than 2

hours". It is critical that FWS knows as soon as possible that someone has been killed, injured, or that a release has occurred on public lands. No less than the best will do.

FWS should require that a "full written report" be provided to it within 60 days and not 90 days after a fatality, injury, or release because the public has a right to know what has happened on its public lands as soon as possible.

FWS states in **Section 29.141(c)** that it will give the operator the ability to "undertake in-kind services to offset fees to the extent permitted by law". FWS also states this in **Section 29.151(b)** where it will allow an operator to reduce its bond if it does "in-kind-reclamation". If the FWS seriously considers this then it must prepare criteria that would be used to determine what types of projects would be done and how they would be judged as equivalent to a fee.

I would rather have FWS collect the fee and then use it to conduct the work. I am not in favor of FWS privatizing its responsibility to restore and manage ecosystems or other elements in the NWRS. I do not feel comfortable reducing a bond to fix damage in the NWRS predicated on some in-kind services. This appears to me to be playing a game of "penny-wise, and pound-foolish". That bond must be available at its full value in case it is needed to reclaim a site on public lands.

15) **Page 77212, Section 29.160 Modification to an Operation**, FWS must clearly define what "minor actions" mean and cover so that operators and refuge personnel do not bend this rule to allow actions that are not "minor". This is a potentially large loophole.

16) **Page 77212, Section 29.180 through 29.181 Well Plugging, Page 77216, Identification of Wells and Related Facilities, Section 29.119(b)(3), and Page 77228, Section 29.181 Can I get an extension to the well plugging requirement?, (a) and (b)**, the approval for a shut-in a well should be for 2 years and not 5 years. The operator must make a decision so that public lands are not left in a degraded condition any longer than possible.

17) **Page 77212, Section 29.190 through 29.192 Prohibited Acts and Penalties**, "substantial violations" should be defined so that this loophole is closed.

18) **Page 77213, Section 29.210 Public Information**, I do not support the withholding of any information about chemicals. The public has the right to know what chemicals are used on public lands.

19) **Page 77216, Change of Operator (Section 29.170 and 29.171, Transfer of Right to Operate, Page 77227, Section 29.170 What are my responsibilities if I transfer my right to operate?, (a), and Page 77228, Section 29.171, What**

must I do if operations are transferred to me?, (a), FWS should be notified in writing within 15 days, and not 30 days. FWS, as the steward of public lands, must be notified as quickly as possible about a change in ownership, so that monitoring of a new operator's activities can commence immediately. The protection of public lands and landscapes requires no less an effort.

20) **Page 77219, Section 29.32 Non-Federal mineral rights, (a)(4)**, FWS uses the phrase "as nearly as possible". This statement should be removed. This causes confusion as to what is acceptable. Just say "the area must be restored to its pre-existing condition".

21) **Page 77220, Section 29.40 What are the purpose and scope of the regulations in this subpart?, (a)**, FWS should define for the public what "coordination areas" are and clearly state why these rules do not apply to them.

22) **Page 77221, Usable water**, the definition for 'Usable water' should include water for wildlife purposes so that shallow water aquifers, seeps, and springs will be protected for wildlife on the NWRS.

23) **Page 77221, Waste**, waste should not include fuel drums, pipes, oil, contaminated soil, etc. with any residue of oil or hazardous chemicals. Oil has benzene, toluene, xylene, and other hazardous chemicals in it. These chemicals are "contaminating substances" and should be treated as such.

24) **Page 77221, Section 29.62 What if I intend to conduct new operations or modify my pre-existing operations? (a) and (b)**, I support requiring an operator to obtain an operations permit before any operations are conducted and before modifying any pre-existing operations.

25) **Page 77222, Section 29.72 When will the Service grant a temporary access permit**", FWS should only issue a permit during the right time of the year so that disturbance of important wildlife activities is minimized.

26) **Page 77222, Section 29.80 do I need a permit for accessing oil and gas rights from a non-Federal location**, FWS should require that this information be provided since drilling under NWRS lands can result in accidents that cause damage to natural resources on NWRS lands.

27) **Page 7223, Section 29.97 What additional information must be included if I am proposing production operations?**, FWS should include the location and specifications of flares as information that must be submitted.

28) **Page 77224, Section 29.111, What general facility design and management standards must I meet?**, the standards are too loose here. FWS should state what the "largest potential spill incident" definition is; at a minimum what "minimizing emissions of air pollutants" means (like the LDAR

programs), and as a minimum what is acceptable for reducing flaring. FWS should state clearly what "extent reasonably practicable" is. A definition is needed, and FWS should explain why this standard is used and not "extent possible", or "extent practicable", or "maximum extent practicable", or "maximum extent possible". The public will be confused by these phrases that have no definitions, can mean anything, and are ripe for use as loopholes by operators.

29) **Page 77225, Section 29.117 What reclamation and protection standards must I meet?, (d)(5)**, remove "reasonably". Either grading contours conform to 'pre-existing elevations" or they do not. There is no "reasonably" about it.

30) **Pages 77225 and 77226, Section 29.118, What additional operating standards apply to geophysical operations?**, FWS should require as a standard that any shot-holes that blowout will be filled in.

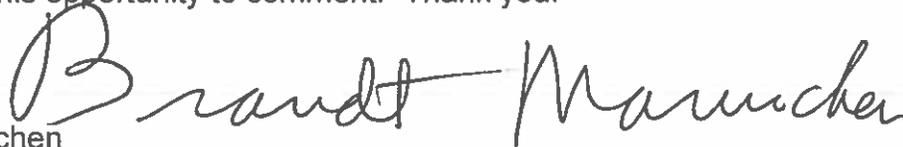
31) **Page 77226, Section 29.119, What additional operating standards apply to drilling and production operations?**, FWS should define what "Take all necessary precautions" and "industry-accepted well control equipment and practices" mean. The FWS should not rely on what "industry" says is appropriate. FWS should require what is needed to protect the public's natural resources and lands "to the maximum extent possible".

32) **Page 77226, Section 29.120 What terms and conditions apply to all operators?, (g)**, FWS should define what "take all reasonable precautions" means.

33) **Page 77226, Section 29.121 What monitoring and reporting is required for all operators?, (a)**, I agree that FWS can access any oil/gas sites at "any time". Surprise inspections ensure that operators are doing their best and are not in violation of the law.

I appreciate this opportunity to comment. Thank you.

Sincerely,



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Protecting Southwest Florida's unique natural environment and quality of life. www.conservancy.org

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RE: Management of Non-Federal Oil and Gas Rights

Dear Director Ashe,

The Conservancy of Southwest Florida is writing on behalf of our 6,000 members and supporters to provide comment on the proposed rule to address non-federal oil and gas development within national wildlife refuge units. Refuge lands provide essential habitat for imperiled species in southwest Florida—including the Florida panther. We support efforts by the U.S. Fish and Wildlife Service (FWS) to revise the outdated oil and gas regulations in order to better protect natural resources and would like to offer recommendations to strengthen the proposed rule.

The Conservancy is a regional environmental nonprofit dedicated to the protection of land, water, and wildlife in southwest Florida. Our five-county work area includes several refuge units such as the Florida Panther refuge, Ten Thousand Islands, and J.N. "Ding" Darling. In addition, we have been actively involved in local oil and gas issues. The Conservancy sought appropriate enforcement and remediation following an unauthorized hydraulic fracturing operation in Collier County, Florida. We also commented on a drilling proposal adjacent to the Florida Panther Refuge and on a proposal to conduct exploration over 70,454 acres in Big Cypress National Preserve. Most recently, we provided recommendations to the Florida legislature to update state oil and gas laws to address the use of unconventional extraction techniques.

Based on our experience and research, we would like to provide the following comments on the proposed rule:

- The proposed rule should capture any operations that access resources under refuge units even if the operation involves horizontal drilling from outside the refuge. The rule also must address downhole activities—including all forms of well stimulation. To accomplish this, the Conservancy recommends the rule be based on Alternative C in the Draft 2015 Environmental Impact Statement (EIS), which captures these operations, as opposed to Alternative B.
- The rule should clarify what operations constitute a "new permit" versus what constitutes a "modification" to an existing operation.
- The rule should establish an online database to make permit applications, and proposals to modify existing operations, readily available for public review and comment.

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Conservancy of Southwest Florida has been awarded Charity Navigator's prestigious 4-star top rating for good transparency, sound fiscal management and commitment to accountability and transparency. Charity Navigator's America's largest and most respected independent evaluator of charities.

- FWS should support the development of refuge-specific individual mineral management plans in addition to the proposed rule as impacts may be site-specific and some refuges may have different needs and greater sensitivities than others. Operators should meet any requirements outlined in management plans in addition to those in the proposed rule.
- The rule must require all applicants submit wildlife survey data.
- The rule should require pre-existing operations to come into compliance with updated standards, including financial assurance requirements.
- The rule should clarify FWS may deny an application that would injure refuge units and resources and require consideration of the feasibility of purchasing non-federal minerals prior to issuing an operations permit.

Support for Alternative C in Environmental Impact Statement

The Conservancy supports broadening the proposed rule consistent with Alternative C in the November 2015 EIS. Alternative C incorporates changes proposed in Alternative B while also addressing oil and gas operations on refuge inholdings, directional drilling under the refuge from private lands, and downhole operations.

Even if the wellhead is located outside of the refuge, horizontal drilling could still have adverse effects on FWS lands and should be incorporated into the proposed rule. For instance, siting the horizontal leg near old abandoned boreholes or underground faults and fractures within the refuge could result in the upward migration of injection fluids into water resources. Furthermore, oil and gas projects from just outside the boundary of wildlife refuges may still have indirect impacts on the refuge including increased light and noise disturbance, air pollution, and more frequent vehicle traffic on local roads. This in turn may alter wildlife behavior or result in an increase in wildlife deaths on roadways.

The Service acknowledges the risks of nearby oil and gas operations in the Patoka Refuge case study:

“Placement of an oil and gas facility in a 100-year floodplain that has a history of annually flooding is poor planning. Flood waters do not recognize property boundaries, and adjacent properties do not have to have oil and gas infrastructure directly on them to be impacted.”¹

In this case, an oil and gas facility was placed in the floodplain along the Patoka River. In 2011, the facility leaked 5 to 15 barrels of oil into floodwaters which then receded into the Patoka River, putting the refuge at risk. Implementation of Alternative C would provide an added layer of protection by confirming FWS authority over nearby drilling operations that access minerals under the refuge and operations on inholdings, which may indirectly affect FWS lands.

In the EIS, FWS states that Alternative C is not preferable because this alternative offers no incentive to locate drilling operations outside of refuge boundaries. However, incentives could be developed to direct operations outside of refuge units while still retaining oversight of nearby operations. For instance, surface operations located outside refuge units could be subject to reduced permit application fees. At a minimum, the Conservancy recommends FWS look to the National Park Service’s (NPS) proposed 36 CFR 9B rules and require (instead of encourage) operators drilling under a refuge unit from

¹ U.S. Fish and Wildlife Service. July 2014. Leaking oil into a river floodplain. Retrieved from <http://www.fws.gov/refuges/oil-and-gas/pdfs/Patoka-Case-Study.pdf>

an outside surface location to submit contact information and a description of the operations. FWS could then review this information and determine if a permit is necessary.

Furthermore, well construction and integrity play a critical role in preventing leaks and contamination of water resources. In order to adequately address the risk of contamination, FWS must include downhole operations in the proposed rule. In the EIS, FWS states that the downhole aspects of oil and gas extraction are already sufficiently addressed by the states and therefore regulation by the Service is not necessary. However, state oversight of downhole activities varies widely as was shown in the FWS 2013 assessment of state oil and gas resources.² It was found that 36% of states do not meet technical guidelines and 33% do not meet administrative guidelines produced by the State Review of Oil and Natural Gas Environmental Regulations.³

Florida currently does not have a formal permitting process in place to oversee the use of hydraulic fracturing, acid stimulation, or other well stimulation techniques. Consequently, any standards put in place by FWS would provide management of this activity on refuge lands in the absence of a state process. Bills being considered by the state legislature this session propose a permitting process for *hydraulic fracturing only*, leaving other well stimulation techniques unaddressed. In addition to a lack of a permitting process, Florida also does not currently have comprehensive rules in place related to well stimulation. For instance, there is no state rule similar to section 9.118(b) of the proposed NPS 36 CFR 9B rules to require losses of mechanical integrity during well stimulation be reported within 24 hours.

Furthermore, Florida currently has no process for well stimulation chemical disclosure in place. Bills proposed by the state legislature, if passed, would only address disclosure for chemicals in hydraulic fracturing—not in other well stimulation operations. Section 29.121 of the proposed FWS rule only requires disclosure for hydraulic fracturing fluids after the fact. Consequently, FWS would be unable to consider chemical usage in well stimulation during the permitting phase and raise any concerns to the applicant *prior* to the injection of fluids. If FWS were to adopt similar application requirements to those in section 9.80 of the proposed NPS 36 CFR 9B rules, these would ensure that chemicals are reported to FWS *before* use.

In addition to requiring chemical disclosure up front, it is critical that the FWS rule capture all forms of well stimulation including, but not limited to, hydraulic fracturing and acid stimulation. No standards exist or are proposed in Florida for the use of acid stimulation techniques. The Conservancy recommends FWS make clear in the proposed rule that *all* forms of well stimulation involving the injection of fluids to enhance oil and gas production are captured—whether or not the operation is done under high pressure.

Downhole standards established by FWS could fill any gaps in state regulatory frameworks and ensure FWS receives the documentation needed to ensure well integrity is not compromised. These standards include: requiring submission of cementing and casing programs, pressure testing plans, steps to verify mechanical integrity, and providing chemical disclosure documents in the permitting phase. Such standards are outlined in the proposed NPS 36 CFR 9B rules and should also be incorporated into the FWS rule.

² U.S. Fish and Wildlife Service. November 2015. National wildlife refuge system revision of regulations governing non-federal oil and gas activities: Draft environmental impact analysis. Appendix B.

³ U.S. Fish and Wildlife Service. November 2015. National wildlife refuge system revision of regulations governing non-federal oil and gas activities: Draft environmental impact analysis. Appendix B Table 14.

Clarification is needed for what constitutes a new permit versus what constitutes permit modification

Under the proposed rule, operations include: well servicing, installation of flow lines, storage of petroleum, excavation, inspection, maintenance of wells, geophysical operations, drilling, and well stimulation. Section 29.90 requires operators to apply for a permit to conduct any operations within a refuge, including the above mentioned. Section 29.160 offers operators the ability to modify an existing operations permit.

While modifications may be necessary to adjust for unforeseen conditions, it should be made clear that pursuing a different *type* of operation warrants a new permit. For instance, an operator with a permit to operate or produce a well using conventional techniques should not be authorized to simply modify that permit to include hydraulic fracturing. Hydraulic fracturing is a different type of operation and warrants a new permit.

The Conservancy recommends the Service include language in the proposed rule to clarify a modification is a minor change made to an existing type of operation. Changes in extraction technique or operation type require a new permit.

Permit materials should be made available to the public online

Under Section 29.210, the public may view documents in the refuge's office during business hours. However, this may be overly burdensome for individuals without a means of transportation or with long travel times to the refuge office. Furthermore, it does not provide an adequate system of public notification of new permit applications. Under Section 29.210, the public would need to routinely check with refuge offices for updated information on permit applications.

The Conservancy recommends the Service implement an online Service-maintained database of oil and gas records, including the chemicals proposed to be used in operations and permit application materials. This would allow for a more efficient means of disseminating information to the public for review and comment.

Need for refuge-specific mineral management plans

Geology and ecology vary widely across refuge units. As a result, the risks of oil and gas activities will also vary. The Conservancy encourages the Service to support the adoption of refuge-specific mineral management plans and require permit applicants to demonstrate compliance with refuge unit planning documents. This is similar to the procedure outlined in the NPS 36 CFR 9B rules which require applicants to consider and discuss NPS unit management planning documents.

Refuge-specific mineral management plans may identify particularly environmentally sensitive areas, limit the area that may be impacted at any one time by oil and gas activities, and put in place buffers for protected wildlife. The proposed FWS 50 CFR 28 and 29 rules will establish requirements across all refuges while refuge-specific mineral management plans may offer more detailed guidance to applicants.

Applicants must be required to submit wildlife survey data

The proposed rule must require applicants to conduct wildlife surveys of the project area and submit that information to the Service as part of the operations permit application. Currently, applicants are required to submit natural resource survey reports and plans to mitigate impacts to wildlife. However, the rule does not specify how current survey reports must be. Relying on outdated wildlife survey information may prevent the applicant from devising appropriate plans to mitigate and avoid impacts to wildlife.

For instance, a seismic survey operation proposed in Big Cypress National Preserve relies on outdated wading bird data from 1999 and intends to conduct surveys for wading birds and other species *during* the operation to establish avoidance buffers.⁴ Conducting surveys during operations is problematic because the Service cannot review avoidance measures prior to permitting. Furthermore, for species with large buffers, it is possible that the buffer zone will already be violated by the time that species is discovered during operations.

In order to ensure potential impacts to wildlife are adequately addressed, the proposed rule should require applicants provide current survey data for protected species within the project area.

Pre-existing operations should not be excluded

Pre-existing operations conducted prior to the adoption of the proposed rule, or prior to a boundary change or establishment of a new refuge unit, should not be excluded from the requirements in the proposed rule. The proposed rule currently subjects pre-existing operations to the reclamation standards outlined in section 29.117(d), general terms and conditions in sections 29.120 and 29.121, requirements to transfer rights to operate in section 29.170(a), well plugging standards in sections 29.180 and 29.181, prohibited acts in section 29.190, and the appeals process as described in section 29.200. However, the proposed rule does not appear to require pre-existing operations to provide financial assurances. The Conservancy recommends the Service require pre-existing operations provide federal bonds and proof of insurance. Currently, there are over 5,000 oil and gas wells on refuge units.⁵ However, several refuges have not historically required bonds.⁶ Those pre-existing operations must be required to provide financial assurance to ensure funds are available for required remediation under the proposed rule.

Clarify FWS has authority and responsibility to deny applications that are not sufficiently protective

Lastly, the proposed rule should clarify that FWS has the authority and a responsibility to deny applications that are not sufficiently protective of the refuge unit. Currently, the proposed rule states that permit denials must be consistent with Section 29.40(c) which states that the intent of the rule is not to result in a taking but to reasonably regulate operations to protect federal lands. The Conservancy

⁴ Nobles Grade 3-D Seismic Survey Big Cypress National Preserve and Big Cypress National Preserve Addition Plan of Operations. December 2014. Prepared for U.S. Department of the Interior, National Park Service. At 17.

⁵ U.S. Fish and Wildlife Service. November 2015. National wildlife refuge system revision of regulations governing non-federal oil and gas activities: Draft environmental impact analysis.

⁶ United States General Accounting Office. August 2003. National Wildlife Refuges: Opportunities to improve the management and oversight of oil and gas activities on federal lands. Table 6 at 33.

recommends FWS consider incorporating language similar to that found in 36 CFR 9.37 (a), which states a permit shall not be approved:

- (1) *Until the operator shows that the operations will be conducted in a manner which utilizes technologically feasible methods least damaging to the federally-owned or controlled lands, waters and resources of the unit while assuring the protection of public health and safety.*
- (2) *For operations at a site the surface estate of which is not owned by the Federal government, where operations would constitute a nuisance to Federal lands or waters in the vicinity of the operations, would significantly injure federally-owned or controlled lands and waters; or*
- (3) *For operations at a site the surface estate of which is owned or controlled by the Federal government, where operations would substantially interfere with management of the unit to ensure the preservation of its natural and ecological integrity in perpetuity, or would significantly injure the federally-owned or controlled lands or waters; Provided, however, that if the application of this standard would, under applicable law, constitute a taking of a property interest rather than an appropriate exercise of regulatory authority, the plan of operations may be approved if the operations would be conducted in accordance with paragraph (a)(1) of this section, unless a decision is made to acquire the mineral interest.*
- (4) *Where the plan of operations does not satisfy each of the requirements of 9.36 applicable to the operations proposed.*

The Conservancy also recommends the proposed rules include language to require consideration of a federal purchase of mineral rights as an alternative to issuing an operations permit for oil and gas activities. In evaluating permit applications, the Service must consider all feasible, least damaging alternatives—including purchase of minerals. This course of action would provide the Service with the necessary information to determine if it is feasible to purchase mineral rights and prevent impacts to the refuge unit in perpetuity.

The Conservancy of Southwest Florida supports the Service's work to provide much needed updates to the regulations governing oil and gas activities on refuge units. We appreciate your consideration of our comments to develop the most effective rules.

Thank you,



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CC: Jennifer Hecker, Director of Natural Resource Policy, Conservancy of Southwest Florida



February 9, 2016

Karen Hyun

Deputy Assistant Secretary for Fish and Wildlife and Parks
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RE: Proposed Rule & Draft Environmental Impact Analysis for the Management of Non-Federal Oil & Gas Activities in the National Wildlife Refuge System

Dear Ms. Hyun:

Thank you for this opportunity to submit comments on the U.S. Fish and Wildlife Service's ("Service") proposal to revise regulations governing the management of non-federal oil and gas development on units of the National Wildlife Refuge System ("NWRS") (80 Fed. Reg. 77200) and associated Draft Environmental Impact Analysis on National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Activities ("DEIS").

Los Padres ForestWatch is a local nonprofit organization that works to protect the Los Padres National Forest along California's central coast, along with other public lands such as the Hopper Mountain National Wildlife Refuge ("Hopper Mountain NWR") and Bitter Creek National Wildlife Refuge ("Bitter Creek NWR") located immediately adjacent to the forest. Our comments today are focused primarily on the Hopper Mountain NWR, which contains active oil and gas drilling and production operations. It also serves as a hub of the California Condor Recovery Program, a multi-year effort aimed at bringing California condors – one of the most endangered birds in the world – back from the brink of extinction. The Hopper Mountain NWR contains some of the best nesting, roosting, and foraging habitat in the range of the condor. Pre-existing oil and gas drilling activities on the Hopper Mountain NWR have caused significant impacts to California condors that are well-documented, and it is important to take additional steps to ensure that existing and new drilling operations here do not cause further impacts. To this critically-imperiled species.

These comments supplement the letter submitted today on behalf of several conservation organizations, including Defenders of Wildlife. While we are a signatory to that letter, we also recognized the value in submitting these comments specific to the Hopper Mountain NWR. We

commend the Service for taking this long-overdue step to update the current, inadequate regulations to protect the Hopper Mountain NWR and others in the NWRS from the risks posed by exploration, development and production of non-federal oil and gas.

The Hopper Mountain NWR was established in 1974 with the specific aim of protecting some of the most valuable and important habitat for endangered California condors. In acquiring the lands that would ultimately become the Refuge, the Service purchased the surface rights while various oil companies retained the underground mineral rights. Several pre-existing oil wells and associated infrastructure were incorporated into the Hopper Mountain NWR, some of which still remain to this day.

According to records maintained by the California Division of Oil, Gas & Geothermal Resources (“DOGGR”), the Hopper Mountain NWR contains 18 non-federal oil and gas wells. The first well was drilled in 1923, and the most recent well was drilled in 2006. Three of the 18 wells have been formally plugged and abandoned, four of the wells are idle (non-producing), and the remaining 11 wells are active producers. The wells are located on three pads, and additional pads, storage tanks, electrical transmission lines, and several miles of roads and pipelines are also located in the Hopper Mountain NWR.

Similarly, the Service established the Bitter Creek NWR in 1985 and it serves as one of the primary sites where condors are released into the wild as part of the California Condor Recovery Program. The Bitter Creek NWR contains 13 oil and gas wells, all of which have been formally plugged and abandoned. None of them are currently producing.

Appendices A and D of the DEIS states that there are 19 non-federal oil wells in the Hopper Mountain NWR, and 12 “other” wells in the Bitter Creek NWR. However, according to records maintained by DOGGR, there are 18 and 13 wells on each refuge, respectively. Please verify these numbers prior to finalizing the DEIS. In addition, the 13 wells in the DOGGR database that occur on the Bitter Creek NWR formerly produced oil and gas (they are now plugged and abandoned). We suggest that all wells in both the Hopper Mountain NWR and Bitter Creek NWR be reclassified in this table as “oil and gas” so that they are consistent with the well types designated by DOGGR.

We support Alternative C: Modified Proposed Rule because it would require all operations, including pre-existing operations and operations outside of the boundary of a refuge, to obtain a permit and meet the standard of technologically feasible, least damaging methods. The DEIS identifies this as the Environmentally Preferable Alternative, yet the Service selects Alternative B (Proposed Rule) as its preferred alternative. In dismissing the Environmentally Preferable Alternative, the Service reasons that existing Federal and State laws adequately protect refuge resources and uses from any adverse impacts.

This is an incorrect assumption, at least with respect to the Hopper Mountain NWR, where state and local regulations are inadequate to protect California condors from the known adverse impacts of oil development. All active and idle wells in the Hopper Mountain NWR are

regulated primarily by the local land use authority, which is the Ventura County Planning Division. The wells are authorized under Conditional Use Permit (“CUP”). Specifically, most wells in the Hopper Mountain NWR are authorized under CUP 3470, which was initially approved in 1974 and amended most recently in 1981. While those permits contain some measures to protect condors, they fail to incorporate most of the mitigation measures that the Service recently identified as necessary to protect condors from the adverse impacts of oil development. See Letter from the Service to the Ventura County Planning Director dated July 2013, attached.

The remaining wells inside the boundary of the Hopper Mountain NWR are authorized under CUP 2250. This permit was approved in 1965 and is commonly referred to as an “antiquated” or “legacy” permit because it was issued prior to the California Environmental Quality Act (“CEQA”) and has no expiration date and no limits on the number of wells that can be drilled. It also has no conditions to protect condors, and – like CUP 3470 – fails to incorporate any of the Service’s condor protection measures.

Additional wells under these two CUPs are issued under a Zoning Clearance by the Ventura County Planning Division, without environmental review or advance public notice or hearing. Zoning Clearances are considered a ministerial action that is not subject to the environmental review and public notice provisions of the CEQA. Thus, opportunities are limited to incorporate the condor protection measures into new wells drilled under these antiquated permits.

The state agency that oversees non-federal oil drilling in the Hopper Mountain NWR – DOGGR – relies on the local planning agency to complete the CEQA analysis, and conducts no public notice or environmental review of site-specific activities. And as described above, the local agency – in this case, the Ventura County Planning Division – does not perform CEQA analysis or any other environmental review on wells that fall under antiquated permits, either. Thus, the Ventura County Planning Division and DOGGR routinely fail to incorporate any of the Service’s condor protection measures, rendering local and state regulations inadequate to protect refuge resources on the Hopper Mountain NWR. The Service’s preferred Alternative B perpetuates this cycle and falls short of what is necessary to avoid adverse impacts. On the other hand, Alternative C and its applicability to existing operations *would* ensure that adverse impacts to condors and other refuge resources are avoided.

Should the Service continue to support Alternative B, then we strongly urge the Service to clarify in the regulations the various activities that constitute “modification” of a pre-existing operation. The proposed regulations currently state: “Modifying means conducting new activities that will have additional impacts on refuge resources, visitor uses, refuge administration, or human health and safety beyond the scope, intensity, and/or duration of existing impacts. In order to determine if new activities would have additional impacts, you must consult with the Service.” See Sec. 29-50. The Service’s Federal Register notice provides examples of what types of activities constitute a modification. See 80 Fed. Reg. 77207 (“Examples of a modification could include drilling additional wells from the same pad, creating

additional surface disturbance (expanding the footprint of a well pad, realigning a road), or converting a natural gas well into a wastewater disposal well so that the resulting modification has notable impacts to the refuge resource.”). We urge the Service to amend this language as follows, and to incorporate it into the text of the proposed rule:

Examples of a modification ~~could~~ include, but are not limited to, drilling additional wells from the same pad, conducting hydraulic fracturing or other well stimulation activities, creating additional surface disturbance (expanding the footprint of a well pad, realigning a road, constructing new pipelines or gathering lines), or converting a natural gas well into a wastewater disposal well so that the resulting modification has notable impacts to the refuge resource.

The discussion in the DEIS on the environmental impacts to wildlife should be supplemented with the information contained in the Service’s July 2013 letter regarding the impacts of oil drilling on condors, as well as our December 2015 summary of the impacts of oil drilling on condors (both attached). These impacts include microtrash ingestion, contamination from hazardous materials left onsite, entrapment and entanglement in wires, collisions with power lines, perching on equipment, habituation to human activity and infrastructure, and modification of behavior through disturbance. We suggest that the Service include a discussion of these impacts in the Final EIS.

We appreciate the Service’s efforts to increase oversight of oil drilling operations in and around the Hopper Mountain NWR, the Bitter Creek NWR, and other refuges across the country. Thank you for considering our comments. Please continue to keep us updated as your agency works to finalize these important regulations.

Sincerely,

A handwritten signature in black ink that reads "Jeff Kuyper". The signature is written in a cursive, flowing style.

Jeff Kuyper
Executive Director



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2013-CPA-0148

July 18, 2013

Kim L. Prillhart, Planning Director
Planning Division
County of Ventura
800 S. Victoria Avenue
Ventura, California 93009-1740

Subject: Measures to Protect the California Condor at Oil and Gas Exploration,
Development, and Production Facilities in Ventura County

Dear Ms. Prillhart:

The U.S. Fish and Wildlife Service (Service) recognizes the vital role that local jurisdictions play in the conservation of endangered and threatened species. You are often the first to become aware of proposed development projects or other changes in land use that could affect undeveloped areas, and typically implement environmental review processes that require disclosure of important information on the presence of sensitive species. The Service appreciates this function and we are writing to provide you with information that we recommend considering during project review. Specifically, we have become aware that you are reviewing the impacts of proposed oil and gas facilities on biological resources. To assist in that process, we are enclosing a list of measures for you to consider incorporating into your review process, which will help protect the California condor (*Gymnogyps californianus*) from the potential adverse effects of oil and gas projects.

The Service's responsibilities include administering the Endangered Species Act of 1973, as amended (Act), including sections 7, 9, and 10. Section 9 of the Act and its implementing regulations prohibit the taking of any federally listed endangered or threatened wildlife species. Section 3(18) of the Act defines take to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Service regulations (50 CFR 17.3) define harm to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species.

Exemptions to the prohibitions against take may be obtained through coordination with the Service through interagency consultation for projects with Federal involvement pursuant to section 7 or through the issuance of an incidental take permit under section 10(a)(1)(B) of the Act. If the subject project is to be funded, authorized, or carried out by a Federal agency and may affect a listed species, the Federal agency must consult with the Service, pursuant to section 7(a)(2) of the Act. If a proposed project does not involve a Federal agency but may result in the take of a listed animal species, the project proponent should apply for an incidental take permit, pursuant to section 10(a)(1)(B) of the Act. Once a project proponent determines if the proposed project will have a lead Federal agency, we can provide more detailed information regarding section 7 interagency consultation or the 10(a)(1)(B) permitting process.

California condor

The California condor was federally listed as endangered on March 11, 1967 (32 Federal Register (FR) 4001), and State listed as endangered on June 27, 1971. Critical habitat for the California condor was designated on September 24, 1976 (41 FR 187), and consists of nine critical habitat units scattered throughout the species' range in California totaling approximately 570,400 acres; 180,302 acres of critical habitat are within Ventura County. An experimental population of California condors was established in Arizona in 1996 under section 10(j) of the Act.

The California condor is a member of the family Cathartidae or New World vultures, a family of seven species, including the closely related Andean condor (*Vultur gryphus*) and the sympatric (occurring in the same area) turkey vulture (*Cathartes aura*). California condors are among the largest flying birds in the world. Adults weigh approximately 22 pounds and have a wing span up to 9.5 feet. They are generally black, with prominent white underwing linings as adults. California condors have naked skin on the head and neck that ranges from gray to shades of yellow, red, and orange. California condors nest in various types of rock formations including crevices, overhung ledges, and potholes, and, more rarely, in cavities in giant sequoia trees (*Sequoia giganteus*) (Snyder et al. 1986) and giant coast redwoods with cavities or broken out tops.

California condors are opportunistic scavengers, feeding only on the carcasses of dead animals. Typical foraging behavior includes long-distance reconnaissance flights, lengthy circling flights over a carcass, and hours of waiting at a roost or on the ground near a carcass. Currently, newly released California condors are provided with stillborn calf carcasses as supplemental food to help juvenile birds acclimate to the wild and for trapping and release purposes. Most California condor foraging occurs in open terrain of foothill grassland and oak savannah habitats.

California condors use topography and associated thermal weather patterns for flight. This is best illustrated by historical observations indicating that almost all flights by California condors, whether covering long distances or not, followed routes over the foothills and mountains bordering the southern San Joaquin Valley. California condors are highly dependent on topography as it dictates prevailing wind patterns (Service 1984). The species is totally

dependent on favorable wind conditions to move throughout its range, and long periods of inclement weather will keep birds immobile.

The California condor declined over the past century to such a low level that only 22 individuals existed in 1982. The last free-flying California condors were captured by 1987 and brought into a captive breeding program. Following several years of increasingly successful captive breeding, captive-produced California condors were first released back to the wild in southern California in early 1992.

Currently, the most serious sources of human-related mortality are lead poisoning, shooting, collision with power lines, and the ingestion of small pieces of garbage (micro-trash) which, in combination with hair and other natural items, become compacted in the birds' digestive tract and can lead to death. Two California condors have been shot and killed since 1999.

Eleven of the California condors released since 1992 were killed in collisions with power lines. At least two deaths from collisions with manmade objects, including power lines, were known historically (Koford 1953). Because of deaths from contact with power lines, condors started undergoing power line aversion training in 1995 before their release. As problem power lines are identified in the field, the Service works with power companies to eliminate or reduce the risk.

As of June 2013, there were 435 California condors, 237 of which comprise the wild population; the remaining birds are in captivity. Of the wild population, there are 134 condors in California, including 66 free-flying birds and 6 chicks in the Southern California flock (Service 2013).

The Sespe Wilderness in the Los Padres National Forest provides important habitat for the California condor. Condors historically roosted, foraged, and nested in the area. In recognition of the area's value to the California condor, the Sespe Condor Sanctuary was established in 1951. In 1974, the Service purchased 2,471 surface acres adjacent to the Sespe Condor Sanctuary and established the Hopper Mountain National Wildlife Refuge near the city of Piru. California condors were once released and fed at the Hopper National Wildlife Refuge. California condors occur throughout the Los Padres National Forest in Ventura County and, because condors are so mobile, any individual may fly over oil and gas projects in Ventura County at any given time during daylight hours.

In 2006, condor releases from Hopper Mountain National Wildlife Refuge were discontinued and a new release site and associated supplemental feeding site were established at Bitter Creek National Wildlife Refuge. However, there was a transition period of approximately 1 year, during which supplemental feeding was still conducted at Hopper Mountain National Wildlife Refuge until such time that all of the free-flying condors utilized Bitter Creek National Wildlife Refuge, including the recently released juveniles dependent on supplemental food at that time.

During 2007, condors landed on four well pads that were the source of most of the micro-trash that condors in southern California were finding (U.S. Forest Service 2010). In the recent past,

young condors had frequented oilfield areas (M. Hall, former Refuge Manager, Hopper Mountain National Wildlife Refuge, pers. comm. 2006 *in Service* 2009). This behavior was not observed during 2005 and 2006, but a few months into 2007, condors began to frequent oilfield areas again, including four well pads identified as the main locations where condors continued to land (J. Grantham, former California Condor Recovery Coordinator, and R. Posey, former Service Supervisory Wildlife Biologist, pers. comm. 2007 *in Service* 2009). Up to the present, condors continue to investigate and land at oil and gas facilities, where they may be at risk of exposure to micro-trash and the other threats described above.

Oil and gas development

To assist us with the conservation of the California condor, we recommend that the Ventura County Planning Department require project proponents to implement the enclosed avoidance and minimization measures at oil and gas facilities within the range of the species. We understand that each oil and gas project is unique, and every measure will not be applicable to all projects. We would appreciate being involved early in the design/planning stages of projects that could impact the California condor; through early involvement we would be able to provide recommendations on the applicability of the measures to specific projects and locations. While implementing the enclosed measures may, in certain circumstances, ensure that impacts to condors are minimized or avoided, incorporating the measures into a project should not be construed as take avoidance or authorization without separate explicit coordination with and input from the Service.

As you know, Ventura County is a focal point of the California condor's ongoing recovery given its central location in the species' current range in California, and as the geographic base of operations for the Service's California condor recovery program. With your cooperation, we can help ensure that oil and gas exploration, development, and production activities in Ventura County are compatible with conservation of the California condor. We appreciate the County's assistance in maintaining the progress and momentum of recovery efforts for this species. If you have any questions regarding the California condor or other federally listed species in Ventura County, please contact Colleen Draguesku of my staff at (805) 644-1766, extension 221.

Sincerely,



Roger P. Root
Assistant Field Supervisor

Enclosure

REFERENCES CITED

- Janssen, D.L., J.E. Oosterhuis, J.L. Allen, M.P. Anderson, D.G. Kelts, and S.N. Wiemeyer. 1986. Lead poisoning in free ranging California condors. *Journal of the American Veterinary Medicine Association* 189:1115-1117.
- Koford, C.B. 1953. The California condor. *National Audubon Society Research Report* 4:1-154.
- Snyder, N.F.R., R.R. Ramey, and F.C. Sibley. 1986. Nest-site biology of the California condor. *California condor* 88:228-241
- [Service] U.S. Fish and Wildlife Service. 1984. California condor recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.
- [Service] U.S. Fish and Wildlife Service. 2009. Biological opinion for the proposed leasing of two drilling sites on well pads in the Sespe Oil Field, Ventura County, California. Ventura Fish and Wildlife Office, Ventura, California.
- [Service] U.S. Fish and Wildlife Service. 2013. California condor recovery program: population size and distribution. Prepared by California Condor Recovery Program, Ventura, California. June 30, 2013. Overview page.
- U.S. Forest Service. 2010. Re-initiation of and additional information for the biological assessment on the proposal to lease oil and gas resources within the boundaries of the Los Padres National Forest. June 1, 2010. Prepared for U.S. Fish and Wildlife Service by Kevin Cooper, Los Padres Forest Biologist, Los Padres National Forest. Goleta, California. 41 pp.
- Wiemeyer, S.N. J.M. Scott, M.P. Anderson, P.H. Bloom, and C.J. Stafford. 1988. Environmental contaminants in California condors. *Journal of Wildlife Management* 52:238-247.

***Recommended Minimization and Avoidance Measures to Protect the California Condor at Oil and Gas Facilities in Ventura County**

1. Oil and gas facilities will not be developed within 1.5 miles of active and historic nest sites and reintroduction sites, or within 0.5 mile of an active roost site.
2. If new power transmission and distribution lines are necessary, they will be placed underground to avoid potential for collision by California condors. Where undergrounding of power lines is not possible, location and design of such lines will be developed in collaboration with the U.S. Fish and Wildlife Service.
3. All existing power lines, poles, and guy wires within flyways used frequently by California condors will be retrofitted with raptor guards, flight diverters, and other anti-perching or anti-collision devices to minimize the potential for collision or electrocution of condors.
4. Landing deterrents, such as Daddi Long Legs or porcupine wire, will be attached to the walking beams on pumping units.
5. All surface structures, which are identified by the U.S. Fish and Wildlife Service or qualified biologists as a risk to California condors, will be modified (e.g., to include installation of raptor guards, anti-perching devices, etc.) or relocated to reduce or eliminate the risk.
6. All construction debris and other trash including micro-trash (e.g., small items as screws, nuts, washers, nails, coins, rags, small electrical components, small pieces of plastic, glass, or wire, and anything that is colorful or shiny) will be covered or otherwise removed from a project site at the end of each day or prior to periods when workers are not present at the site.
7. Wells pads will be inspected closely for micro-trash on a daily basis.
8. Informational signs describing the threat that micro-trash poses to condors, and the cleanup or avoidance measures being implemented, will be posted at the site.
9. All food items and associated trash will be placed in covered containers to preclude access or use by California condors. This will include small bits of trash and debris, such as aluminum can pull tabs, electrical connectors, broken glass, and pieces of rubber, plastic, and metal.
10. All equipment and work-related materials (including loose wires, open containers, rags, hoses, or other supplies or materials) will be contained in closed containers either in the work area or placed inside vehicles.
11. All hoses or cords that must be placed on the ground due to drilling operations that are outside of the primary work area (immediate vicinity of the drilling rig) will be covered to prevent California condor access. Covering will take the form of burying or covering with heavy mats, planks, or grating that will preclude access by California condors.

12. Poly chemical lines will be replaced with stainless steel lines to preclude condors from obtaining and ingesting pieces of poly line.
13. Ethylene glycol based anti-freeze or other ethylene glycol based liquid substances will be avoided, and propylene glycol based antifreeze will be encouraged. Equipment or vehicles that use ethylene glycol based anti-freeze or other ethylene glycol based liquid substances will be inspected daily for leaks. While at the site, areas below vehicles and equipment using ethylene glycol based substances will be checked for leaks and puddles. Standing fluid (e.g., a puddle of anti-freeze) will be remediated (e.g., cleaned-up, absorbed, or covered) without unnecessary delay. Vehicles using ethylene glycol based substances will be inspected before and after field use for obvious leaks and puddles. Leaks will be repaired before the vehicle is allowed back onsite. No changing of antifreeze of any type will be allowed onsite.
14. No open drilling mud, water, oil or other liquid storage or retention structures will be allowed. All such structures will be required to have netting or other covering that precludes entry or other use by condors or other listed avian species.
15. No dogs or other potential predatory domesticated animals will be allowed to run free at worksites.
16. No flaring sites for natural gas or other flammable gases or substances will be allowed without prior review by the U.S. Fish and Wildlife Service.
17. Prior to conducting work on-site, employees and contractors will be made aware of the California condor, and how to avoid impacts to them. Special emphasis will be placed on keeping the well pad site free of micro-trash and other hazards.
18. All construction equipment, staging areas, materials, and personnel will be restricted to previously disturbed areas to the extent possible.
19. The potential for human-caused wildfires will be minimized by use of shields, mats, or other fire-prevention methods when grinding or welding. Fire response equipment, including water, extinguishers, and shovels will be available for fire suppression.
20. Firearms will be prohibited.
21. No feeding of wildlife will be permitted.
22. If any California condor is observed on or near (perched or on the ground within approximately 1,000 feet of) an oil and gas facility, the U.S. Fish and Wildlife Service will be notified immediately and allowed to access the facility. Additionally, if the U.S. Fish and Wildlife Service has data to indicate that any California condor is in the vicinity, the U.S. Fish and Wildlife Service will be allowed access to the facility to confirm the presence of the bird(s). Measures to deter the birds from using the oil and gas facility may be deployed after review by the U.S. Fish and Wildlife Service.

23. Direct contact with California condors will be avoided.

*Implementation of these measures does not constitute authorization from the U.S. Fish and Wildlife Service (Service) to take federally listed species in any manner. Section 9 of the Endangered Species Act of 1973, as amended (Act), and its implementing regulations prohibit the taking of any federally listed endangered or threatened species. Section 3(19) of the Act defines take to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Service regulations (50 CFR 17.3) define harm to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species.

DATE: October 16, 1981

PLANNING DIVISION CONDITIONS:

That CUP- shall be subject to Conditions 1 through 11 listed in Section 8163-14 of the Ventura County Ordinance Code and those that appear thereafter:

1. Section 8163-14.1 - Soundproofing - Whenever the drilling or redrilling of any oil or gas well commenced after November 30, 1961, is situated within five hundred (500) feet of any dwelling not owned by the permittee, or if applicable, the lessor of the permittee, the derrick, portable rig and machinery or equipment used to operate in connection with drilling, shall be enclosed with fire resistant and soundproofing materials unless the Planning Director is furnished written consent to waiver such condition by all owners and tenants of said dwellings. If a noise nuisance develops after written consent has been given and if inspection under supervision of the Planning Director sustains the noise level constitutes a nuisance, the original provisions of soundproofing will prevail. Whenever drilling is by portable drilling rig and will be accomplished and said rig removed within a thirty (30) day period, soundproofing requirements shall not apply.
2. Section 8163-14.2 - That the exercise of any right granted by the permit shall conform in all respects to the regulations and requirements of the California State Regional Water Quality Control Board No. 4; and that all water, mud, oil or any other substances removed as waste material from the land for which the permit is issued shall be deposited in a disposal site approved by the Planning Commission and the California State Regional Water Quality Control Board. (AM. ORD. 2845 - 5/14/74)
3. Section 8163-14.3 - That no earthen sump shall be constructed or maintained within five hundred (500) feet, and no drilling shall be permitted within one hundred (100) feet of any natural channel in which there is or may be flowing water.
4. Section 8163-14.4 - That within ninety (90) days after a well is producing, the derrick, all boilers and all other drilling equipment shall be removed from the premises unless permission to store them on the premises is obtained from the Planning Commission. (AM. ORD. 2845 - 5/14/74)
5. Section 8163-14.5 - That all sumps, or debris basins, or any depressions, ravines, gullies, barrancas or the like which are used for the impounding or depositing of water, mud, oil, or any other fluid, semifluid, or any combination thereof shall be fenced. When any such place is located more than one-half (1/2) mile away from any school, playground or dwelling, it shall be enclosed by a cattle fence with wood or steel posts not less than four (4) feet above the ground with not less than three (3) strands of barb wire secured horizontally to posts. When any such place is located within one-half (1/2) mile of any school, playground or dwelling it shall be enclosed by a wire fence of a wire mesh type with a minimum of two (2) inches by four (4) inches opening and said fence shall be secured to steel posts not less than five (5) feet in height above the ground and said posts shall have forty-five degree (45°) arms attached to top of posts with three (3) strands of barb wire attached thereto.
6. Section 8163-14.6 - That no permanent buildings or structures shall be erected within one-hundred (100) feet of boundaries or right of way of any public street or highway.
7. Section 8163-14.7 - That the permittee shall at all times comply with the provisions of the Public Resources Code of the State of California relating to the protection of underground water supply and in connection with oil and gas extraction.
8. Section 8163-14.8 - That upon abandonment of any well or cessation of drilling operations, all earthen sumps or other depressions containing drilling mud, oil or other waste products from the drilling operation shall be cleaned up by removing such waste products or by consolidating all mud, oil, or other waste products into the land by disking, harrowing and leveling to restore the land to the condition existing prior to the issuance of this permit as nearly as practicable so to do.

DATE: October 16, 1981

9. Section 8163-14.9 - Transfer of Permit. Unless otherwise provided in the terms of a permit, the permit shall expire no later than when the permittee's ownership, lease or other right to develop the property in the manner described in the application is terminated. A permit may be transferred to another person only with the approval of the Planning Commission. A transfer shall be null and void unless and until (a) the Planning Commission has approved the transfer, (b) the Planning Commission has been furnished satisfactory evidence of the transfer, (c) the transferee files with the Planning Commission a statement in writing wherein he obligates himself to comply with every term and condition of the permit, and (d) the transferee has filed an approved bond. (AM. ORD. 2845 - 5/14/74)
10. Section 8163-14.10 - That no drilling or other uses for which this permit is granted shall be commenced or continued unless and until permittee has filed, and the Planning Commission has accepted, a bond in the penal amount of twenty-five hundred dollars (\$2,500.00) for each well that is drilled or to be drilled. Any operator may, in lieu of filing such bond for each well drilled, redrilled, produced or maintained, file a bond in the penal amount of ten thousand dollars (\$10,000.00) to cover all operations conducted in the County of Ventura, a political subdivision of the State of California, conditioned upon the permittee well and truly obeying, fulfilling and performing each and every term and provision in the permit, and that in case of any failure by the permittee to perform or comply with any term or provision thereof, the Planning Commission may, by resolution, declare the bond forfeited and the sureties and principal will be jointly and severally obligated to pay forthwith the full amount of the bond to the County of Ventura. The forfeiture of any bond shall not insulate the permittee from liability in excess of the sum of the bond for damages or injury or expense or liability suffered by the County of Ventura from any breach by permittee of any term or condition of said permit or of any applicable ordinance or of this bond. The transfer of this permit, as provided for in Section 8163-14.9, Ventura County Ordinance Code, shall not be effective unless and until the transferee has also complied with this condition for posting an approved bond. (AM. ORD. 2845 - 5/14/74)
11. Section 8163- 14.11 - That drilling and production operations shall be conducted in such a manner as to eliminate, as far as practicable, dust, noise, vibration or noxious odors, and shall be in accordance with the best accepted practices incident to drilling for and the production of oil, gas, and other hydrocarbon substances. Where economically feasible, generally accepted and used technological improvements for reducing factors of nuisance and annoyance shall be employed by permittee.
12. That the permit is granted for the spudding-in and drilling of a total of 36 oil and gas well(s) and the drilling and production operations, facilities, equipment and other appurtenances accessory thereto described on Plot Plans "B" and "C" situated on a drill pad graded in accordance with Plot Plan "D" and Plot Plan "F" and located on permit area described on Plot Plan "E".
13. That the permit is granted for a period of time of (50) years, ending June 11, 2031, or until production from the well(s) on the site ceases for more than one (1) year due to plugging or abandonment pursuant to the Division of Oil and Gas (DOG) regulations. The Planning Division shall review the site conditions of the permit at least once every 10 years during the life of the permit to ensure that full compliance with all conditions has been accomplished.
14. That within 60 days of revocation, expiration or surrender of this permit, or abandonment of the use, the premises shall be restored by the permittee to the conditions existing prior to the issuance of the permit as nearly as practicable.
15. That any minor changes may be approved by the Planning Director upon the filing of a Minor Modification application by the permittee, but any substantial changes will require the permittee to file a Major Modification application to be considered by the Planning Commission.

DATE: October 16, 1981

16. That upon filing a Major Modification application with the Planning Division and upon approval by the Planning Commission, additional wells may be drilled within the area for which the permit is issued, but such additional wells shall be subject to any conditions which may be specified at the time such approval for additional well or wells is granted.
17. That the design, maintenance, and operation of the permit area and facilities thereon shall comply with all applicable requirements and enactments of federal, state, and County authorities, and all such requirements and enactments shall by reference become conditions of this permit.
18. That no condition of this entitlement shall be interpreted as permitting or requiring any violation of law, or any lawful rules or regulations or orders of an authorized governmental agency. In instances where more than one set of rules apply, the stricter ones shall take precedence.
19. That if any of the conditions or limitations of this Conditional Use Permit are held to be invalid, that holding shall not invalidate any of the remaining conditions or limitations set forth.
20. That drilling, redrilling, and reworking of approved wells shall be conducted by the use of portable drilling equipment, and no permanent derricks shall be installed.
21. That all fluid or semi-fluid drilling discharge wastes shall be accumulated in steel tanks on the subject permit area and hauled away from the subject property for disposal at an approved disposal site, and such steel tanks shall be removed within 30 days after completion or abandonment of the subject wells. However, solid drilling waste materials may be temporarily deposited in an earthen depression with the final disposition of said solid waste materials to be accomplished in compliance with the rules and regulations of the California Regional Water Quality Control Board. Precautions shall be taken to ensure that storm water does not carry contaminants off-site.
22. That any spills of oil or other contaminants from pipes or other facilities or the well(s) shall be cleaned and corrected in accordance with the E.P.A.'s Spill Contingency Plan and shall be reported to the U. S. Fish and Wildlife Service within 48 hours of occurrence.
23. That any production tanks installed on the subject site(s) shall have a collective rated capacity of not more than 2000 barrels per site. However, upon review and approval by the U. S. Fish and Wildlife Service, the 6000 barrels of permitted collective rated capacity for the entire permit area may be aggregated on one site.
24. That no sign shall be constructed, erected or maintained on the property encompassed by this permit except those required by law or ordinance to be displayed in connection with the drilling or maintenance of the well(s). All signs shall be subject to the approval of the U. S. Fish and Wildlife Service.
25. That all roads or hauling routes located between the County right-of-way and the subject site and all roads located on the subject site shall be treated and maintained as necessary to prevent the emanation of dust and to keep erosion to a minimum.
26. That the permittee shall maintain on file with the Planning Division a certificate showing insurance of not less than Five Hundred Thousand Dollars for one person and One Million Dollars for all persons and Two Million Dollars for property damage.
27. That the permittee agrees as a condition of issuance (or renewal) and use of this permit to defend at his sole expense any action brought against the County because of issuance (or renewal) of this permit or, in the alternative, to relinquish this permit. Upon demand from the County, permittee will reimburse the County for any court costs and/or attorney's fees which the County may be required by a court to pay as a result of any such action. County may, at its sole discretion, participate in the defense of any such action, but such participation shall not relieve permittee of his obligations under this condition.

DATE: October 16, 1981

28. That the permittee's acceptance of this permit and/or commencement of construction and/or operations under this permit shall be deemed to be acceptance by permittee of all conditions of this permit.
29. That if the Trans World Oil Company crude oil truck transfer farm on Goodenough Road (CUP-3476) is relocated to Highway 126 or some other location which would not require the use of Goodenough Road as a means of access for oil tanker truck traffic, all crude oil production from the subject permit area shall be transmitted via pipeline from the subject permit area to the relocated Trans World Oil Company tank farm when said relocation occurs. However, if other truck transfer or pipeline facilities are available to the permittee, and if the location of said other facilities would not require the use of Goodenough Road for access for oil tanker truck traffic, the permittee may, in lieu of the above requirement, transport all crude oil production via pipeline to such other facilities.
30. That no drilling, redrilling, hydraulic fracturing, major maintenance, or construction shall be conducted from December 1 through March 31 of each year (the condor mating season) unless otherwise approved by the U. S. Fish and Wildlife Service.
31. That a security gate shall be installed and maintained across the access road into the wildlife refuge area, and fencing shall be installed between the security gate and the north boundary of the Hopper Mountain National Wildlife Refuge. A locking device shall be installed on the gate subject to the approval of the U. S. Fish and Wildlife Service, and the gate shall be maintained in a locked condition at all times except when entering and leaving the wildlife refuge area or as otherwise permitted by the U. S. Fish and Wildlife Service.
32. That following the clean-up of the drilling operations, normal vehicle trips to these sites shall be made in accordance with a schedule to be determined between the permittee and the U. S. Fish and Wildlife Service, so as not to disturb the condor management or research programs within the refuge.
33. That the permittee shall develop and follow a program in conjunction with the U. S. Fish and Wildlife Service in order to schedule hydraulic fracturing at a time when most condors are absent from the refuge area. Furthermore, no fracturing shall occur after dark.
34. That in the event that a drill site should become non-productive and abandoned, the access road to that site shall be blocked off to prevent vehicular travel along its route.
35. That a designated representative of the U. S. Fish and Wildlife Service shall be notified by the permittee prior to commencement of any drilling operations.
36. That prior to installation of any overhead electrical transmission lines within the Hopper Mountain National Wildlife Refuge, a plan for such transmission lines shall be submitted to the U. S. Fish and Wildlife Service for review and approval.
37. That except in emergencies, no venting of tank vapors to the atmosphere shall occur. Flaring of said tank vapors may be permitted, provided that the flaring device is shielded to reduce light emanation to insignificant levels, and further provided that the design and location of said flaring device is approved by the U. S. Fish and Wildlife Service, the County Fire Department, and APCD.
38. That the use, color, and location of the production office trailer shall be subject to the issuance of a Special Use Permit by the U. S. Fish and Wildlife Service. Said production office trailer shall only be used for oilfield support activities permitted by CUP-3470 and shall not be used for recreational activities.
39. That all activities permitted under CUP-3470 shall be confined to the approved drillsite pads, access roads and associated facilities and equipment. Any activities required off the above described areas shall be subject to approval by the U. S. Fish and Wildlife Service.

DATE: October 16, 1981

40. That the permittee shall post a bond or other surety in the amount of \$5,000.00 to guarantee compliance with the above-listed conditions pertaining to the security gate (Condition 31), the production office trailer (Condition 38), and confinement of activities to the approved drill sites and access roads (Condition 39). In case of failure to conform or comply with any term or provision of this agreement, the Planning Commission may, by resolution, declare said bond or surety forfeited. Said bond or surety may not be exonerated until all drilling and related activities within the Hopper Mountain National Wildlife Refuge conducted by the permittee have ceased and the sites have been restored by the permittee to conditions existing prior to issuance of the permit as nearly as practicable, or until the U. S. Fish and Wildlife Service has advised the Planning Division that said bond may be exonerated.
41. That no later than thirty (30) days after any change of property ownership or of lessee(s) or operator(s) of the subject use, the permittee shall file with the Planning Division and with the U. S. Fish and Wildlife Service the name(s) and address(es) of the new owner(s), lessee(s), or operator(s), together with a letter acknowledging, and agreeing to comply with all conditions of this permit and specifically agreeing to comply with the conditions pertaining to the security gate (Condition 31), the production office trailer (Condition 38), and confinement of activities to the approved drill sites and access roads (Condition 39).
42. That the permittee shall maintain a copy of the approved conditions and exhibits at the site at all times.
43. That as far as practicable, noise emanations shall be controlled so as not to interfere with Wildlife Refuge operations and programs. The permittee shall use the best available equipment to minimize noise emanation. If such equipment is not operating properly, it shall be repaired or replaced as soon as practicable upon notification by the U. S. Fish and Wildlife Service.

ENVIRONMENTAL HEALTH DIVISION CONDITIONS:

44. That suitable and adequate sanitary toilets and washing facilities approved by the Environmental Health Division shall be installed and maintained in a clean and sanitary condition at all times during periods of drilling.
45. That an adequate supply of safe potable water shall be supplied to the site as approved by the Environmental Health Division.
46. That disposal of all potentially hazardous wastes shall be by a means approved by the Ventura County Environmental Health Division.
47. That any abandoned water wells under the permittee's control and operation on the permittee's drilling or production equipment sites shall be destroyed in accordance with the Ventura County Well Ordinance.

AIR POLLUTION CONTROL DISTRICT (APCD) CONDITIONS:

48. That facilities shall be constructed and operated in accordance with the Rules and Regulations of the Ventura County Air Pollution Control District. An Authority to Construct shall be obtained for all equipment subject to permit, prior to construction or commencement of drilling operations.
49. That all new production, storage, transfer and processing equipment shall be constructed and operated consistent with APCD Rule 71 (Crude Oil and Organic Liquids).

COUNTY FIRE DEPARTMENT CONDITIONS:

50. That main access roads to drilling sites shall be maintained so as to allow all-weather access to drilling sites by emergency vehicles.
51. That water for fire protection shall be required during all drilling operations or during maintenance of hazardous nature. Unless an adequate

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- water supply source, such as a hydrant or reservoir, is otherwise available and approved by the County Fire Department, a 20,000 gallon water tank shall be installed for each 1000 barrels of oil storage capacity on the premises. The water supply and system shall be: 1) provided with a shutoff valve; 2) equipped with a four-inch National Standard Threaded male outlet; and 3) maintained by the applicant. The location of the outlet/supply shall be subject to approval of the local Engine Company, who shall be contacted prior to the preparation of the drilling site.
52. That when the production of oil or gas is attained at any drilling site, water for fire protection shall meet the fire flow requirements established by the Bureau of Fire Prevention, and shall be installed prior to construction of a tank farm at the drill site.
 53. That brush and other combustible materials surrounding the drilling site shall be cleared for 100 feet or as directed by the Fire Chief.
 54. That spark arresters shall be installed and maintained on all internal combustion engines used within the Wildlife Refuge Area. All internal combustion engines operated within the Refuge Area shall be subject to muffler and/or spark arrestor inspections by designated representatives of the U. S. Fish and Wildlife Service and the U. S. Forest Service.
 55. That no person shall drill, own, operate, or maintain an oil well without a Uniform Fire Code Permit, issued by the Ventura County Fire Prevention Bureau. The permit for any new oil well shall be issued only after it has been determined by a field inspection that the oil well site complies with the provisions of the Uniform Fire Code.
 56. That no storage tank or boiler, fired heater, open flame device or other source of ignition shall be located nearer than 25 feet to any oil well. Engines used in the drilling, production, and servicing of oil wells are exempt from the above provision.
 57. That no oil well shall be drilled within:
 - A. 75 feet of any dedicated public street, highway or railway;
 - B. 100 feet of any building not necessary to the operation of the well, and;
 - C. 300 feet of any building used as a place of public assemblage, institution or school.
 58. That no person shall permit or cause to be permitted any oil, waste oil, refuse or waste material to be on the surface of the ground under, around or near any oil well, pump boiler, oil storage tank or building except within an oil sump or tank.
 59. That adequate protection shall be provided to control and prevent the blowout of an oil well. Protection equipment shall meet the requirements as specified by Federal, State or other applicable jurisdictions.
 60. That where soundproofing material is required during oil field operations, such materials shall be noncombustible, provided that fire-retardant treated material may be used and maintained subject to the approval of the Chief.
 61. That smoking shall not be permitted at any oil well or tank location except at designated and posted areas approved by the Chief.
 62. That each oil well location shall have posted in a conspicuous place a legible sign with the name of the owner or operator, name or number of the lease, and number of the well printed thereon. Such signs shall be maintained on the premises from the time materials are delivered for drilling purposes until the well is abandoned.
 63. That a minimum of two fire extinguishers shall be maintained at well locations where drilling, servicing or repair work is being conducted. Each such extinguisher shall have a minimum classification of 20B as set forth in NFPA Standard No. 10, "Portable Fire Extinguishers."

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64. That the installation of any oil holding tanks shall be in accordance with National Fire Protection Association, Pamphlet #30, and the Uniform Fire Code.

PUBLIC WORKS AGENCY CONDITIONS:

65. That prior to initial drilling, the intersection of the access road with the County road shall be improved to Plate E-6 of the Ventura County Road Standards.
66. That the drill site(s) and access road(s) shall not obstruct natural drainage courses.
67. That during drilling operations, sealing of the annular well space from ground surface through the base of fresh water shall be performed to prevent degradation of groundwater quality.
68. That if archaeological or historical artifacts are uncovered, the site shall be preserved until the applicant can obtain a qualified archaeologist to recommend proper disposition of the site. Public Works Agency's written concurrence must be obtained for proper disposition of the site.
69. That prior to preparation of the access road and pad for Drill Site "E", a specific grading plan with provisions for drainage controls for the access roads and drill site pad shall be submitted to the U. S. Fish and Wildlife Service for review and approval. All access roads and drill site pads within the permit area shall be maintained to keep erosion to a minimum.
70. That prior to preparation of the access road and pad for Drill Site "E", a revegetation plan shall be submitted to the U. S. Fish and Wildlife Service for review and approval. Said plan shall indicate a program for revegetating the slopes above and below the access road to Drill Site "E" and for the screening of the production equipment on Drill Site "E". The approved revegetation program shall be implemented within 240 days of commencement of preparation of the access road and drilling site for Drill Site "E".

DH:jde/P70m

BOARD OF ZONING ADJUSTMENT
VENTURA COUNTY

Meeting of February 15, 1965

9
ERA MEMO:
Legibility of writing, typing or
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in portions of the document
when received.

RESOLUTION NO. 65-63

GRANTING SPECIAL USE PERMIT APPLICATION NO. 2250, EASTERN INTERIOR OIL CO.,
FOR OIL AND GAS PRODUCTION, ON LAND LOCATED ABOUT 4 MILES NORTHEAST OF THE
CITY OF FILLMORE.

In accordance with the provisions of the Ventura County Ordinance Code, an
application was filed on January 28, 1965, by Eastern Interior Oil Company,
Ventura, California, for a Special Use Permit for oil and gas production in
an "R-A Int." Rural Agricultural Interim Zone, on land located adjacent to
and south of the Los Padres National Forest, approximately 2 miles northeast
of the northerly terminus of Goodenough Road, about 4 miles northeast of the
City of Fillmore, and

The Planning Director has caused this matter to be investigated, with proper
publications and notifications made, and has submitted a report to the Board
of Zoning Adjustment; and, subsequent to the public hearing, it was found that
under certain conditions stated hereafter the production of oil and gas would
not constitute any material detriment to existing or probable surface uses of
other lands in the same zone and vicinity, and would conform to the general
purpose of Division 8, Ventura County Ordinance Code, and it was

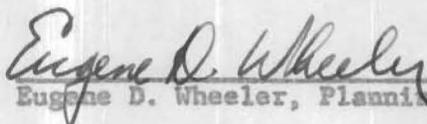
RESOLVED, that the Board of Zoning Adjustment grant Special Use Permit No.
2250, for the following purpose:

Drilling for and extraction of oil, gas and other hydrocarbon
substances and installing and using buildings, equipment and other
appurtenances accessory thereto, including pipelines, but specifi-
cally excluding processing, refining and packaging, bulk storage
and any other use specifically mentioned in Division 8, Ventura
County Ordinance Code, for that area of the permit as described in
the application,

subject to the following conditions:

All conditions (1 through 11) as listed in Section 8163.14 of the County of
Ventura Ordinance Code, and the attached conditions.

This is to certify that the foregoing is a true, full and correct copy of
Resolution No. 65-63.


Eugene D. Wheeler, Planning Director

EDW:FRK:ss

cc: Eastern Interior Oil Company
County Public Works Department (4)
County Health Department
County Fire Department
City of Fillmore
Regional Water Pollution Control Board
Forest Service
United Water Conservation District

RESOLUTION NO. 65-63 - Page Two

ERA MEMO:

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12. That unless a producing well is obtained by February 15, 1966 this permit will automatically expire on that date.
13. That fire fighting equipment, as required and approved by the Ventura County Fire Department, shall be maintained on the premises at all times.
14. That adequate mufflers with spark arrestors shall be installed on the machinery.
15. That an area one hundred (100) feet in width shall be cleared around the drill sites.
16. That any minor changes may be approved by the Planning Director but any substantial changes will require the filing of a modification application to be considered by the Board of Zoning Adjustment.
17. That all requirements of any law or agency of the State, Ventura County, and any other governmental entity shall be met, and necessary Zone Clearances and Building Permits for such use must be obtained from the proper County agency.

ERA MEMO:
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Excerpt from Ventura County Zoning Ordinance - Article 43

Sec. 8163.14 SPECIAL CONDITIONS FOR OIL AND GAS PERMITS HERETOFORE AND HEREAFTER ISSUED. It is declared to be in the interest of the public health, safety, welfare and the purpose and intent of this Chapter that the following conditions shall be and they are hereby automatically imposed and made a part of any permit for oil and gas drilling and extraction hereafter issued and as to any permit issued prior to December 7, 1961, shall apply to any drilling or other activity commenced after December 7, 1961.

- (1) Sound Proofing. Whenever the drilling or redrilling of any oil or gas well commenced after December 7, 1961, is situated within five hundred (500) feet of any dwelling not owned by the permittee, or if applicable, the lessor of the permittee, the derrick, portable drilling rig and machinery or equipment used to operate in connection with drilling, shall be enclosed with fire resistant and soundproofing material.
- (2) That the exercise of any right granted by the permit shall conform in all respects to the regulations and requirements of the California State Regional Water Pollution Control Board No. 4; and that all water, mud, oil or any other substances removed as waste material from the land for which the permit is issued shall be deposited in a disposal site approved by the Board of Zoning Adjustment and the California State Regional Water Pollution Control Board.
- (3) That no earthen sump shall be constructed or maintained within five hundred (500) feet, and no drilling shall be permitted within one hundred (100) feet of any natural channel in which there is or may be flowing water.
- (4) That within ninety (90) days after a well is producing, the derrick, all boilers and all other drilling equipment shall be removed from the premises unless permission to store them on the premises is obtained from the Board of Zoning Adjustment.
- (5) That all sumps, or debris basins, or any depressions, ravines, gullies, barrancas or the like which are used for the impounding or depositing of water, mud, oil, or any other fluid, semi-fluid, or any combination thereof, shall be fenced. When any such place is located more than one-half (1/2) mile away from any school, playground or dwelling, it shall be enclosed by a cattle fence with wood or steel posts not less than four (4) feet above the ground with not less than three (3) strands or barb wire secured horizontally to posts. When any such place is located within one-half (1/2) mile of any school, playground or dwelling it shall be enclosed by a wire fence of a wire mesh type with a maximum of two (2) inches by four (4) inches opening and said fence shall be secured to steel posts not less than five (5) feet in height above the ground and said posts shall have 45° arms attached to top of posts with three (3) strands of barbed wire attached thereto.
- (6) That no permanent buildings or structures shall be erected within one hundred (100) feet of boundaries or right of way of any public street or highway.
- (7) That the permittee shall at all times comply with the provisions of the Public Resources Code of the State of California, relating to the protection of underground water supply and in connection with oil and gas extraction.

ERA MEMO:
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Excerpt - page two

- (8) That upon abandonment of any well or cessation of drilling operations, all earthen sumps or other depressions containing drilling mud, oil or other waste products from the drilling operation shall be cleaned up by removing such waste products or by consolidating all mud, oil, or other waste products into the land by disking, harrowing and leveling to restore the land to the condition existing prior to the issuance of this permit as nearly as practicable so to do.
- (9) Transfer of Permit. Unless otherwise provided in the terms of a permit, the permit shall expire no later than when the permittee's ownership, lease or other right to develop the property in the manner described in the application is terminated. A permit may be transferred to another person only with the approval of the Board of Zoning Adjustment. A transfer shall be null and void unless and until (a) the Board of Zoning Adjustment has approved the transfer, (b) the Board of Zoning Adjustment has been furnished satisfactory evidence of the transfer, (c) the transferee files with the Board of Zoning Adjustment a writing wherein he obligates himself to comply with every term and condition of the permit, and (d) the transferee has filed an approved bond.
- (10) That no drilling or other uses for which this permit is granted shall be commenced or continued unless and until permittee has filed, and the Board of Zoning Adjustment has accepted, a bond in the penal amount of twenty-five hundred dollars (\$2500.00) for each well that is drilled or to be drilled. Any operator may, in lieu of filing such bond for each well drilled, re-drilled, produced or maintained file a bond in the penal amount of ten thousand dollars (\$10,000.00) to cover all operations conducted in the County of Ventura, a political sub-division of the State of California, conditioned upon the permittee well and truly obeying, fulfilling and performing each and every term and provision thereof, the Board of Zoning Adjustment may, by resolution, declare the bond forfeited and the sureties and principal will be jointly and severally obligated to pay for with the full amount of the bond to the County of Ventura. The forfeiture of any bond shall not insulate the permittee from liability in excess of the sum of the bond for damages or injury or expense or liability suffered by the County of Ventura from any breach by permittee of any term or condition of said permit or of any applicable ordinance or of this bond. The transfer of this permit, as provided for in Section 8163.14 (9), Ventura County Ordinance Code, shall not be effective unless and until the transferee has also complied with this condition for posting an approved bond.
- (11) That all drilling and production operations shall be conducted in such a manner as to eliminate, as far as practicable, dust, noise, vibration or noxious odors and shall be in accordance with the best accepted practices incident to drilling for and the production of oil, gas and other hydrocarbon substances. Where economically feasible, generally accepted and used technological improvements for reducing factors of nuisance and annoyance shall be employed by permittee.



DOCUMENTED IMPACTS OF OIL DEVELOPMENT ON ENDANGERED CALIFORNIA CONDORS

Prepared by Los Padres ForestWatch
December 14, 2015

Since 2007, ForestWatch has submitted several formal requests under the Freedom of Information Act for records pertaining to the impacts of oil drilling on endangered California condors. The records were produced by, or in the possession of, the U.S. Fish & Wildlife Service, the Bureau of Land Management, and the U.S. Forest Service. We also searched other sources, including various scientific journals, news articles, and the condor archives at the Santa Barbara Museum of Natural History.

Based on our review of thousands of page of historic and current records, we compiled the following chronology of records that document the impacts of oil drilling on condors. This is not an exhaustive list – many impacts to condors go unnoticed due to their expansive range and the limited ability of volunteers and agency staff to monitor them. This list will be supplemented with additional information as it becomes available.

Date: Prior to 1980

Location: Hopper Mountain National Wildlife Refuge

Operator: Argo Petroleum

Summary: Oil development has eliminated or restricted condor feeding across more than 80% of the suitable feeding areas on the Refuge.

In the 1970s, as pressure mounted to explore for oil on the Refuge, the U.S. Fish & Wildlife Service (FWS) assembled a Task Force to evaluate impacts to condors and explore the feasibility of acquiring the mineral rights beneath the Refuge. The Task Force prepared a memorandum in 1980 titled "Oil development vs. California condors at Hopper Mountain NWR, concluding: "The oil-related activity that has occurred to date has made approximately 250 acres of the feeding habitat unuseable because of actual physical conversion (to roads, well sites, pipelines, etc.) or because of regular human activity that precludes condor use.... Of the approximately 150 acres of feeding habitat remaining, almost half is so close to oil operations that condors must circle low over roads and well pads when approaching and leaving feeding sites. No supplemental feeding is done in that area when drilling is actually in progress. Consequently, less than 100 acres (less than 20% of the feeding habitat available in 1971) is actually available for condor feeding on an unrestricted basis."

Source: Hopper Mountain NWR Task Force (1980). Memorandum from S. Wilbur to Area Manager, USFWS regarding Oil development vs. California condors at Hopper Mountain NWR, dated March 27, 1980. 16pp.

Date: Prior to 1984

Location: Hopper Ridge, Sespe Condor Sanctuary

Operator: Unknown

Summary: Elimination of condor roosting sites due to proximity of oil wells.

In 1984, the FWS evaluated a proposal by the U.S. Forest Service to lease certain lands in the Los Padres National Forest for oil drilling. The agency published the results of its evaluation in a formal Biological Opinion, stating: "Condors apparently will tolerate more disturbance at a roost than at a nest, but there may be a limit to tolerable disturbance at roosts. This is suggested by the lack of recent condor roosting use on the southwestern portion of Hopper Ridge in the Sespe Condor Sanctuary. This area, known to be used by condors for roosting between 1939 and 1946, now has a large cluster of oil wells less than one kilometer away."

Source: U.S. Fish & Wildlife Service (1984). Formal Endangered Species Act Consultation on Part II Oil and Gas Leasing, Los Padres National Forest (1-1-84-F-5). Dated January 24, 1984. 19pp.

U.S. Fish & Wildlife Service (1979). California Condor Recovery Plan. 80pp.

Date: Prior to 1996

Location: Various

Operator: Various

Summary: Drowning in uncovered oil sumps contributed to the historic decline of condors.

"Other serious factors formerly contributing to the decline of the species were egg and specimen collecting, capture of live birds for sport or display, Indian ceremonial use, and drowning in uncovered oil sumps. These activities are no longer believed to represent threats to California condors." The prior version of the Recovery Plan lists one of the specific causes of condor mortality as "becoming fouled in oil sumps."

Source: U.S. Fish & Wildlife Service (1996). Recovery Plan for the California Condor. 74pp.

U.S. Fish & Wildlife Service (1984). Revised California Condor Recovery Plan. 116pp.

Date: April 23, 2002

Location: Freezer Pad

Operator: Seneca Resources

Summary: Condor tugging on oily rag, gets oil on face and wings, transfers it to its chick.

A FWS field monitor flushes a condor from the Freezer Pad near a newly-drilled well, where it was tugging at an oil rag stuffed into an old oily pipe. Then, after visiting the nearby Condor Canyon Pad, the

condor returned to its nest, where the monitor noted oil on its face and wings. An inspection of the Condor Canyon Pad reveals an old pipe with oily insulation wrapped around it, oily rags on the ground, and grates on the wells that were partially opened. "Those were the only two likely locations where WO could have come into contact with any oil. Both these oil pads are owned by Seneca."

Upon returning to its nest, the adult condor transferred the oil to its chick. This was the first chick to be hatched in the wild in 18 years, following an intensive captive breeding program.

Source: U.S. Fish & Wildlife Service (2002). Oil Exposure Incident Report. Prepared by Doug Wilm on April 26, 2002. 1pp.

Source: Kelly, David (2002). Condor chick is stained with oil. Los Angeles Times, April 27, 2002.

Date: 2002

Location: Unknown

Operator: Unknown

Summary: Nearly all condors in the wild are visiting oil pads on a daily basis, perching on structures and picking up and pulling manmade material. Historically, condors never closely interacted with humans or landed on human structures. Habituation is on a much greater scale than previously documented. Captive-reared birds are transmitting this behavior to the wild flock.

Recent evidence suggests that even re-released wild-bred condors from the historic population occasionally engage in behavior initiated by captive bred condors released to the wild. For example, on one occasion AC8 (SB #12), the last female trapped and brought into captivity from the wild in 1986 and released back to the wild in 2000, was observed landing on an active oil-pad near Hopper Mountain NWR in 2002 at a time when almost all the southern California population was visiting oil-pads on a daily basis (A. Mee pers. obs). Condors landing on oil-pads perched on structures and vehicles, and engaged in social "play," picking up and pulling on manmade material. However, AC8 was never observed engaging in such behavior. Likewise, male AC9 (SB #21), the last condor trapped and brought into captivity from the wild in 1987 and released in 2002, was recently documented visiting a site in the San Gabriel Mountains frequented by most of the southern California population where condors regularly land on human structures such as communications towers. Although only previously observed landing and roosting on trees at this site, in 2005 AC9 was seen to land on a vehicle with several other condors (USFWS unpubl. Data). This location is also believed to be the principal site where condors have picked up trash items in recent times (2002-2005). To our knowledge, apart from during nest visits (e.g., Finley 1906, Koford 1953), adults in the historic population never closely interacted with humans or landed on human structures, although there was at least one instance of an immature condor landing in a populated area (see Smith and Easton 1964) and a few cases of immature condors landing near humans or allowing humans to closely approach them (Condor Information System archive, Santa Barbara Museum of Natural History). While immature condors appear to be inherently curious about their environment, the consistency with which reintroduced condors in the southern California population land on human structures, and approach or allow close approach by humans, is on a much greater scale than previously documented. Without the influence of cultural transmission in the population, we believe it extremely unlikely than any of these wild-reared condors would have shown this behavior. Ironically, one of the main reasons for re-releasing adult, wild birds from the historic population back

into the southern California population was the potential benefit such birds might have on the existing reintroduced population.

Source: Mee, Allan et al. (2007). Low Nest Success in a Reintroduced Population of California Condors. 22pp.

Date: March 12-13, 2003

Location: Slide Oil Pad (“Condor Ridge Oil Pad”); Hopper Mountain Oil Pad (“Freezer Oil Pad”); White Star Oil Pad (“Koford’s Shack Oil Pad”)

Operator: Seneca Resources

Summary: Condors landing on oil pad, bathing in a puddle of water, tugging at a hose, ingesting unknown items, and fighting over a strip of plastic.

Field notes from condor biologist Jan Hamber. She observes six condors on an oil pad, bathing in a puddle of water. Some condors fly away before she reaches the pad, the others she tries to chase on foot and they don’t fly away until she’s five feet away. She suspects that the puddle was caused by a leak from an oil company water pipe. Puddle measures 24 feet long, 8 feet wide and 14 inches deep. She contacts FWS and suggests that they call the company to fix it. A couple of hours later, an oil worker arrives, opens a stormwater drainage valve, and dumps two buckets of dirt into the puddle. *Includes photos of condors on the oil pad next to the puddle.*

The following morning, a condor lands near the puddle again. Hamber runs down to flush the bird as APCD and Seneca workers approach. They’re upset that Hamber is flushing the bird, she lets them take a picture when the bird lands again.

In the afternoon, Hamber drives to the Freezer Pad and observes six condors fly away and land at another oil pad near Koford’s Cabin. Seneca worker said he saw the birds there earlier, tugging at a large blue hose. The worker moved the hose, but the condors continued to tug at it. One of the condors pick up a piece of something and swallow it. She flushes eight birds that are congregating around the blue hose, and picks up trash.

Then she drives to Green Tanks where she observes condors circling. When she arrives, the birds circle back to the Freezer Pad. An oil worker is chasing at least 10 condors, they don’t fly away until he approaches within 3-4 feet of them. The condors congregate downslope of the pad, fighting over a strip of plastic. Another FWS volunteer arrives, flushes condors and picks up piece of plastic and pieces of cloth. *Includes photo of birds perched on pipes.*

Source: Hamber, Jan. Field Notes dated March 12-13, 2003.

U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: August 28, 2003

Location: Hopper Mountain National Wildlife Refuge

Operator: Various

Summary: Congressional investigative report states that condors have been observed landing on oil pads, posing a safety threat to the birds and reducing their fear of humans. Furthermore, oil drilling on the Hopper Mountain National Wildlife Refuge has “eliminated about 63% of potential feeding habitat for condors.”

The U.S. General Accounting Office (GAO) is the audit, evaluation and investigative arm of Congress, and exists to help improve the performance and accountability of the federal government. It regularly publishes reports on its findings. A 2003 GAO report titled “National Wildlife Refuges: Opportunities to Improve the Management and Oversight of Oil and Gas Activities on Federal Lands” evaluated the extent of oil and gas activity on wildlife refuges across the country and assessed the FWS’s management and oversight of oil and gas activities. With respect to the Hopper Mountain NWR, the GAO report concludes:

“Fragmentation increases disturbances from human activities, provides pathways for predators, and helps spread nonnative plant species. For example, the endangered California condor is particularly susceptible to disturbances from human activities. Condors have been observed landing on oil pads on the refuge, which poses a safety risk to the birds and reduces their fear of humans. In addition, FWS estimated in 1980 that oil and gas activities at Hopper Mountain NWR eliminated about 63 percent of the potential feeding habitat for condors on the refuge.”

Source: U.S. General Accounting Office (2003). “National Wildlife Refuges: Opportunities to Improve the Management and Oversight of Oil and Gas Activities on Federal Lands.” GAO-03-517. Published August 28, 2003. 73pp.

Date: Prior to 2004

Location: Sespe Oil Field

Operator: Unknown

Summary: Condors found with oil on their heads.

In addition to the 2002 incident in which a condor’s head and wing became coated in oil, the FWS acknowledges that “others have been found with oil on their heads as well.”

Source: Mark Hall, Manager, Hopper Mountain National Wildlife Refuge (2004). Cited in U.S. Forest Service, 2005. Final Environmental Impact Statement for Oil and Gas Leasing, Los Padres National Forest. 550pp.

Date: May 15-16, 2004

Location: Slide Pad (“Condor Ridge Oil Pad”), Hopper Mountain Oil Pad (“Freezer Oil Pad”)

Operator: Seneca Resources

Summary: Condors appear anxious, flushed from nest, possibly due to noise from nearby fracking operation. Condors landing on oil pad.

Jan Hamber, a condor biologist, is monitoring a condor nest that is in full view of an oil pad. She notes significant oil worker activity at Condor Ridge Oil Pad, including a succession of very loud trucks – FWS reports that they are fracking the wells. A “huge noisy oil truck” arrives at the oil pad, followed by several others. The condor appears anxious and leaves the nest. “So the big question is – did the noise from all those trucks coming in one after the other disturb R111 and cause her to leave the nest?” Yesterday they were setting off explosives, so the condor monitors could not use their radios.” Hamber reports that the noise levels are “incredible.”

Shortly thereafter, two condors soar over a nearby ridge. Another truck arrives at the oil pad and the condor changes direction and leaves the area. Hamber writes, “Cause + effect? There is so much activity and so much noise at oil pad.” She observes eight large trucks, one pickup, and 14 workers at oil pad.

Another FWS volunteer flushes ten condors from the Freezer Pad. Later she flushes another condor from oil pad. Later in the afternoon – “Still much activity at the Condor Cyn oil pad – a motor that revs up constantly is very noisy.” As night falls, Hamber expresses concern that R111 hasn’t returned to nest.

The next morning, workers are present at the oil pad and “much clanking of metal” is noted.

Source: Hamber, Jan. Field Notes dated May 15, 2004 and accompanying photos.

U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: Prior to 2005

Location: Unknown

Operator: Unknown

Summary: Adult condor flies down to oil spill and dips his head in a pool of oil, eventually returning to his nest and contaminating his chick.

Source: U.S. Forest Service (2005). “Effects of the Leasing Decision on the California Condor and Other T&E Species.” Dated August 12, 2005. 5pp.

Date: Prior to 2005

Location: Hopper Mountain National Wildlife Refuge

Operator: Unknown

Summary: Six condors have collided with power lines on or near the Hopper Mountain NWR.

“Collisions with power lines has been one of the leading causes of recent California condor mortality, especially for young birds. Six immature condors have been recovered below power lines on or near the Hopper Mountain National Wildlife Refuge; others have collided with power lines in the northern

portion of their range near the Ventana Wilderness Area (M. Hall, Refuge Manager, Hopper National Wildlife Refuge, per. comm. 2004). California condors can also be electrocuted by power lines if the lines are spaced too closely.”

Source: U.S. Forest Service (2005). "Effects of the Leasing Decision on the California Condor and Other T&E Species." Dated August 12, 2005. 5pp.

Date: November 6, 2006

Location: Topa Topa Oil Pad, Hopper Mountain NWR

Operator: Unknown

Summary: Intense oil drilling activity, much trash and debris.

Source: U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: January 31, 2007

Location: Tar Creek, Sespe Condor Sanctuary

Operator: Vintage Petroleum

Summary: Spill of oil and wastewater potentially contaminates drinking and bathing site frequently used by condors.

A large oil spill enters Tar Creek and travels 3 miles. Wastewater enters condor drinking and bathing site. “A California condor drinking and bathing site 3 miles further down stream near the confluence of Tar Creek and Sespe Creek could be potentially impacted by the spill. Two California condors have been consistently roosting on steep cliff faces near this area. In the past week there have been four other transient condors that have also roosted in this area. With the progress of clean up, U.S. Fish and Wildlife biologists predict minimal impact to the California condor.

Source: U.S. Fish & Wildlife Service (2007). Memorandum from Mark Hall, Hopper Mountain National Wildlife Refuge Manager

Date: March-July 2007

Location: Sespe Oil Field

Operator: Seneca Resources, Vintage Petroleum

Summary: Condors landing on oil pads.

Condors landed on four different oil pads in the Sespe Oil Field, totaling 8 incidents and involving 66 condors (including as many as 17 in one incident). Specific details include:

Date	Location	Number of Birds
3/6/2007	White Star (Koford’s Shack “I”)	3
6/5/2007	Slide (Koford’s Oil Pad “A”)	1
6/6/2007	Hopper Mountain (Freezer Pad “Facility 4”)	17

6/6/2007	Rossi (Upper Pad "D")	13
6/18/2007	Rossi (Upper Pad "D")	14
6/26/2007	White Star (Koford's Shack "I")	6
7/2/2007	Rossi (Upper Pad "D")	8
7/8/2007	Hopper Mountain (Freezer Pad "Facility 4")	4

Source: U.S. Fish & Wildlife Service (undated). "Data on Condors Flushed from Oil Pads 2007."

U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: June 2007

Location: Hopper Mountain NWR

Operator: Seneca Resources

Summary: Oily rags found on oil pad.

Fish & Wildlife Service finds oily rags on Seneca's Rossi well pad. Several days later, the FWS and BLM meet with Seneca and Vintage for "Sespe Condor Meeting #1." The purpose of the meeting is to discuss "well site with 13 birds and trash issue." Condors are frequenting four oil pads – A, D, I, and Frankel B.

Source: Bureau of Land Management (2007). Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management to Jesse Grantham, Field Coordinator, California Condor Recovery Program, U.S. Fish & Wildlife Service.

Seneca Resources Corp (2007). Email from Fariba M. Neese, Manager – Asset Development, West Coast, Seneca Resources Corp to Jesse Grantham, Field Coordinator, California Condor Recovery Program, U.S. Fish & Wildlife Service.

Bureau of Land Management (2007). Agenda for Sespe Condor Meeting #1, June 28, 2007.

Date: June 26, 2007

Location: Topa Topa Oil Pad ("Middle Pad"), White Star ("Koford's Cabin Pad")

Operator: Seneca Resources

Summary: Large amount of trash observed on pad. Condors observed on oil pad, nibbling holes in cardboard boxes. One condor appears to be gagging on a piece of cloth.

Condor biologist Jan Hamber stops at Middle Pad on way to the Refuge ranch house. She picks up a "large amount of trash" including "rags, gloves, food containers with food, plastic bits, cigarette butts, shattered plastic pipe – a mess."

Later, Hamber observes several condors at Koford's Cabin oil pad – she chases them off. Then she observes several condors near pipes nibbling on the ground. She walks over to where the condors were and finds cardboard boxes with holes in them "that appeared to have been bitten by condors." Also observes some fabric strips. "B161 most reluctant to leave – appeared to be gagging."

Source: Hamber, Jan. Field Notes dated June 26, 2007 and accompanying photos.

U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: July 2007

Location: Hopper Mountain NWR

Operator: Various

Summary: All condor feeding sites moved 45 miles away to Bitter Creek NWR to lessen the interactions of condors and oil pads in the Sespe Oil Field.

“We realize that condors are attracted to the human activity in the Hopper Mountain area from oil pads and oil field workers. The presence of both, condors and oil pads, creates a difficult and frustrating management challenge for the Recovery Program. In an attempt to lessen the interactions of condors and oil pads, the Service has put tremendous effort into attempting to move all condor feeding activity 45 miles to the northwest, to Bittercreek National Wildlife Refuge. In July of 2007 all feeding sites at Hopper Mountain National Wildlife Refuge were shut down and food was only-provided at the Bittercreek National Wildlife Refuge. All condors in the southern California population would then need to fly 45 miles to Bittercreek Refuge from the Hopper Mountain Refuge to obtain food, thus lessening their presence in the Hopper/Sespe area. This has put additional strain on budgets and staff, as the Sespe area is the most important and most highly used nesting area in southern California. Monitoring two to three separate feeding sites, in addition to all nest sites and roosting sites, is a logistical challenge for Service biologists. Whether all the sites can continue to be monitored is questionable; however, all condors now travel to Bittercreek Refuge, greatly reducing condor presence at Hopper Mountain National Wildlife Refuge and the Sespe area.... Nesting activity, however, will remain in the area, which will continue to cause concern for newly fledged chicks and possible interactions with oil workers and oil pads.”

Source: U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: September 5, 2007

Location: Hopper Mountain Oil Pad

Operator: Seneca Resources

Summary: Broken glass and miscellaneous trash found.

Condor biologist Jan Hamber finds broken glass and miscellaneous trash.

Source: U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: September 6, 2007

Location: Topa Topa Oil Pad ("Middle Pad")

Operator: Vaquero Energy (Vaquero Grande Lease, Well No. 1)

Summary: Trash and possible soil contamination and exposed oil droplets from spill of fracking fluid.

On her way to the Hopper Mountain NWR ranch house, Hamber stops at the Middle pad and picks up trash. She also observes a large area of discolored soil and oil droplets on the pad and wonders if a spill occurred there recently. *Photos include trash, potential spill site, and open well cellar grates with exposed pools of oil.*

Source: Hamber, Jan. Field Notes dated September 6, 2007.

U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: Unknown (Prior to 2008)

Location: Unknown

Operator: Unknown

Summary: Condors perched on oil pumps, landing on pad.

One photo of a condor on a well pad approaching a pumping unit.

One photo of five condors perched on an oil pump, with another condor coming in for a landing.

One photo of two condors perched on an oil pump.

Source: U.S. Fish & Wildlife Service.

Date: January 8-10, 2008

Location: Sespe Oil Field, Road between Sites B and D

Operator: Unknown

Summary: Road grading equipment repeatedly causes anxiety for condors attempting to feed, hampering biologists' ability to capture birds for lead testing.

"General human activity associated with oil and gas extraction could discourage condor use of habitat that may otherwise be suitable for nesting, perching, roosting, or foraging. As an example, on January 8, 9, and 10 of 2008, road grading equipment between sites "D" and "B" repeatedly caused anxiety for condors attempting to feed at the LPR Feeding Site (See Table 1). On these particular days biologists with the US Fish and Wildlife Service were attempting to trap condors for lead testing, and eventually had to call off the activity because of the disturbance to the birds."

Also refers to Seneca's prior "inattention" to microtrash.

Source: U.S. Fish & Wildlife Service (2009). Biological Opinion for the Proposed Leasing of Two Drilling Sites on Well Pads in the Sespe Oil Field, Ventura County, California, dated September 28, 2009. 28pp.

Date: Prior to August 2008

Location: Sespe Oil Field

Operator: Unknown

Summary: Oil platforms are one of primary areas of microtrash abundance.

Cites oil platforms as one of the primary areas of microtrash abundance. "While areas with abundant trash (e.g., oil platforms, visitor overlooks) that are frequented by adult condors are being identified and cleaned up, it seems unlikely that this effort alone will solve the trash ingestion problem due to the scale and diversity of these sites (Mee et al. 2007a; Grantham, pers. comm.)."

"Microtrash ingestion has been especially common in the southern California release population where trash ingestion has caused chick mortality (Mee et al. 2007a;b) in contrast to Arizona where trash ingestion by chicks is rare and has not contributed to chick mortality (Woods et al. 2007). Some of the site differences in frequency of trash ingestion by chicks are attributable to differences in availability of trash – the southern California site has an abundance of trash (especially along roadsides and oil drilling pads) in the vicinity of nest sites in contrast to the more pristine environment of northern Arizona."

Source: Walters, J.R. et al. (2010). Status of the California Condor and Efforts to Achieve its Recovery. Prepared by the AOU Committee on Conservation, California Condor Blue Ribbon Panel, A Joint Initiative of The American Ornithologists' Union and Audubon California. The Auk 127(4):969-1001.

Date: January 26, 2010

Location: Sespe Oil Field

Operator: Seneca Resources

Summary: BLM inspection finds several items posing risks to condors at various well pads.

BLM inspects several locations in the Sespe Oil Field. Observes large amount of oil/water in the well cellars of all the wells "to the extent that they are overflowing." The Rossi 8 well cellar is accessible to condors, giving them access to oil/water. Rossi 9 had a broken and decaying hose. Frankel B21 has several exposed wires with peeling black tape. Small gobs of oil observed on the Slide Pad. Frankel B40 has broken fencing, and the berm around the Rossi pad appeared to be deteriorating.

Source: Email from Tia Adams, Natural Resource Specialist, Bureau of Land Management to Tim Alburger, EHS Manager, Seneca Resources, dated January 26, 2010 and accompanying photos.

Date: July 21, 2008

Location: Slide Pad

Operator: Seneca Resources

Summary: Bag of microtrash found on pad.

FWS biologist inspects Slide Pad. Finds well pumps without perching deterrents, plastic tubing (instead of the recommended steel), and picks up a bag of microtrash.

Source: Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management to Tim Alburger, EHS Manager, Seneca Resources, dated July 25, 2008.

Date: November 10, 2008

Location: Slide Pad, Rossi Pad, White Star Pad, and Hopper Mountain Pad

Operator: Seneca Resources

Summary: Various items observed that pose risks to condors.

BLM visits four well pads frequented by condors. Notes some missing fencing and grates on well cellars. Also observes “open buckets, exposed insulation, pool of oil below pump and tank 3 leaking” at the Frankel B Test Facility #5.

Source: Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management to Tim Alburger, EHS Manager, Seneca Resource, dated November 14, 2008.

Date: 2011

Location: Sespe Oil Field

Operator: Various

Summary: Oil wells pose a “difficult management challenge” for condor biologists.

The combination of condors and well pads creates a difficult management challenge for the California Condor Recovery Program.

Source: U.S. Fish & Wildlife Service, 2011.

Date: May 2011 – September 2012

Location: Temescal Oil Field

Operator: DCOR LLC

Summary: 19 condors land on a newly-constructed oil pad on 57 separate occasions.

Between 2009 and 2011, DCOR LLC graded a series of new oil pads on a ridgeline just west of Lake Piru in the Temescal Oil Field. Another large pad was constructed between April 2011 and August 2012. In May 2011, condors repeatedly visited this site on a near daily basis, and continued to visit the site several times a month. After a few visits in the first half of 2012, visitation increased again in May and June 2012, and then declined to a handful of visits the rest of the year.

Source: U.S. Fish & Wildlife Service GIS data, Google Earth.

Date: October 15-17, 2011

Location: Slide Pad, Sespe Oil Field

Operator: Seneca Resources

Summary: 7 condors land on the oil pad.

Over the course of three days, seven condors perch on the oil pad adjacent to the Hopper Mountain National Wildlife Refuge.

Source: U.S. Fish & Wildlife Service GIS data, Google Earth.

Date: June 6, 2012

Location: Two oil pads on way to HMNWR before GTOF

Operator: Unknown

Summary: Condor lands on oil pad.

FWS biologist notes that condor 180 landed on an oil pad on 5/29 and 6/2.

Source: Email from Josh Felch, Biological Science Technician, Hopper Mountain National Wildlife Refuge to Joseph Brandt, FWS et al. dated June 6, 2012.

Date: January 23, 2013

Location: Ron's Pad, Hopper Mountain NWR

Operator: Vaquero Energy

Summary: Bucket of kerosene and other dangerous items found on oil pad.

FWS observes a bucket of kerosene and other items posing risk to condors on an oil pad.

Source: Email from Dan Tappe, Manager, Hopper Mountain National Wildlife Refuge to Joseph Brandt, FWS dated January 23, 2013.

Date: February 23 – March 4, 2013

Location: Temescal Oil Field

Operator: DCOR LLC

Summary: Significant condor activity on oil pad.

Lots of condor activity noted on an oil pad near Lake Piru.

Source: Email and map from Laura Mendenhall to Joseph Brandt et al. dated March 4, 2013.

Date: April 11, 2013

Location: Sespe Oil Field

Operator: Seneca Resources

Summary: Condors perching on storage tank.

BLM intern observes several condors perched on an oil field storage tank.

Source: Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management to Joseph Brandt, FWS dated May 9, 2013.

Date: Prior to June 2013

Location: Various

Operator: Various

Summary: Oil and gas extraction has eliminated some condor foraging habitat.

FWS conducted a formal status review of California condors, concluding that the species should remain classified as “endangered.” The accompanying report concluded: “Activities such as urban development, oil and gas extraction, farming, and wind energy development have transformed formerly suitable foraging habitat into areas that may not be compatible with California condor recovery.”

Source: U.S. Fish & Wildlife Service (2013). California Condor 5-Year Review: Status and Evaluation. 64pp.

Date: Prior to September 17, 2013

Location: Temescal Oil Field

Operator: DCOR LLC

Summary: Numerous reports of condors perching on oil pad.

FWS has received numerous reports of condors perching on and around an oil drilling site on Temescal Ranch SW of Lake Piru (34.463668 -118.764661).

Source: Email and map from Laura Mendenhall, Wildlife Biologist, Hopper Mountain National Wildlife Refuge to Colleen Draguesku, Fish and Wildlife Biologist, U.S. Fish & Wildlife Service dated September 17, 2013. Attached map dated March 10-18, 2013.

Date: 2011-2013

Location: Bonebrake A and Chodar Pads, Sespe Oil Field

Operator: Seneca Resources

Summary: Condors have landed on the two pads at least seven times during this period.

USFWS radio-telemetry data indicate that condors have landed four times on the Bonebrake 'A' Pad and three times on the Chodar Pad during the period 2011 - 2013. Seneca's staff has observed condors perching on boulders and rock outcroppings in the vicinity during the same period.

Source: Bureau of Land Management, 2014. Environmental Assessment, Seneca Resources Environmental Safety Equipment Installation on the Chodar and “Bonebrake A” Well Pads (DOI-BLM-CA-C060-2014-0240-EA). Dated December 2014. 26pp.

Date: Prior to September 25, 2013

Location: Green Water Tanks, Sespe Oil Field

Operator: Seneca Resources & Vintage Production

Summary: Condors perching on power pole and communications pole.

Condors have been perching on a power pole near the green water tanks on one of Seneca's oil pads above Fillmore. (34.469687 -118.883754). They have also been perching on a communications pole in the immediate vicinity.

Source: Email from Josh Felch, to Kara Donahue, Southern California Edison dated September 25, 2013 and accompanying photos.

Date: September-October 2013

Location: Sespe Oil Field

Operator: Seneca Resources

Summary: Survey of 12 oil pads finds widespread trash posing a risk to condors.

Los Padres ForestWatch field inspectors conducted visits to twelve pads in the Sespe Oil Field between August 20, 2013 and September 18, 2013. Inspections revealed significant amounts of microtrash at all twelve pads visited, along with numerous violations of other condor protection measures. ForestWatch inspectors collected a total of 1,756 pieces of trash from all twelve pads, for an average of 146 pieces per pad. Inspectors also observed open containers of hazardous fluids, strangulation hazards, and fragments of solder possibly containing lead, which is toxic to condors and other wildlife. The report concludes that all, or nearly all, of the pads in the Sespe Oil Field contain significant amounts of microtrash and other hazards that can be harmful or fatal to condors and other wildlife.

Source: Los Padres ForestWatch, 2013. "Trashing the Sespe: How the Oil Industry is Littering Our Public Lands and Endangering Wildlife." 57pp.

Date: October 22, 2013

Location: Various sites in the Sespe Oil Field

Operator: Seneca Resources

Summary: Forest Service surveys 10 well sites in the Sespe Oil Field, finding microtrash at each site consisting of common items related to oil development – glass fragments, wire ties, zip ties, pieces of rubber or plastic, and metal cable fragments.

Forest Service inspects 10 well sites in the Sespe Oil Field. "We found approximately 2-3 handfuls of material at each site which qualified as micro-trash. These included: glass fragments, wire ties, zip ties, pieces of rubber or plastic, fragments of cable (metal). The primary source for most of the debris found on the well sites was common items related to the operation and management of the oil wells. Items such as wire ties and zip ties are used to secure pieces of mesh wire fencing around the equipment. These occasionally break or fall off due to wind stress. The most commonly found item was pieces of rubber. Rubber belts on the machinery occasionally break and fragment, dispersing material around the landing. Small pieces of metal break off of frayed cable and were also found around well pads and on the landing. Other larger pieces of metal such as belt shrouds and large bolts were present at some of the sites visited, but not viewed as micro-trash due to their size."

Source: U.S. Forest Service, 2013. Field Notes October 22, 2013, Sespe Oilfields Microtrash Inspections.

Date: March 18, 2014

Location: Sespe Oil Field

Operator:

Summary: There are now 11 oil pads frequented by California condors.

The pads include Orcutt Pad (Private), Holton Pad (Private), Facility 5, Chodar Battery (BLM), Upper Hansen Pad (USFS), White Star 45 Pad (Private), Orcutt Pad - Burns (Private), Bonebrake A Tank Battery (BLM), Whitestar Water Flood Pad (Private), Top Pad (USFS), and Slide Pad (Private).

Bureau of Land Management, 2014. Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management to Various Agencies dated March 18, 2014. Includes untitled map as an attachment.

Date: March 20, 2014

Location: Hopper Mountain NWR, 34°27'52.79"N, 118°51'50.28"W

Operator: Vaquero Energy

Summary: Seven condors land on oil pad. Road construction in the oil field may be attracting the birds.

FWS biologist flushes the condors from the pad. "This increased activity may relate to the construction underway along the roads in that area (the condors are curious)." Laura Mendenhall, Wildlife Biologist, California Condor Recovery Program, U.S. Fish & Wildlife Service.

Source: Email from Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management dated March 31, 2014. Email from Laura Mendenhall, Wildlife Biologist, Hopper Mountain National Wildlife Refuge to Amy Kuritsubo, Wildlife Biologist, Bureau of Land Management dated March 24, 2014.

Date: April 2014

Location: Slide Pad, Sespe Oil Field

Operator: Seneca Resources

Summary: Condors frequently land on the oil pad.

Between April 4 and 27, 11 incidents are recorded where condors land on the oil pad. Five different condors are involved. Visits last from 6 minutes to more than 5 hours, with six of the visits lasting more than an hour.

Source: U.S. Fish & Wildlife Service GIS data, Google Earth.

Date: December 2014

Location: Bonebrake A & Chodar Oil Pads, Sespe Oil Field

Operator: Seneca Resources

Summary: Condors landing on many oil pads.

"USFWS radio-telemetry records and Seneca staff observations show that endangered California condors have landed on the Bonebrake 'A' and Chodar well pads (as well as at many other pads located

on private or Forest Service lands in the Sespe Mountains). Condors are very inquisitive birds and often investigate human structures which they have not encountered before and chew on wires and small objects; shards/objects of metal or plastic ("microtrash") left lying in plain sight may be ingested if they are small enough. It is desirable to keep the condors out of the Bonebrake 'A' and Chodar well pads in order to minimize their exposure to human equipment and industrial products and vehicles. Seneca's employees have observed that the condors will not land on well pads surrounded by fences. Apparently the condors (being very large, heavy birds) understand that they will not be able to take off from inside a fenced work area, and therefore, avoid entering fenced well pads in the local area. To discourage condors from landing on the Bonebrake 'A' and Chodar well pads, BLM has asked Seneca to fence off those two well pads."

Source: Bureau of Land Management, 2014. Environmental Assessment, Seneca Resources Environmental Safety Equipment Installation on the Chodar and "Bonebrake A" Well Pads (DOI-BLM-CA-C060-2014-0240-EA). Dated December 2014. 26pp.

Date: April – June 2015

Location: Temescal Oil Field

Operator: DCOR LLC

Summary: Condors repeatedly land on oil pads near Lake Piru.

From April 1 through at least June 28, ten condors visit three oil pads along a ridgeline just west of Lake Piru.

Source: U.S. Fish & Wildlife Service GIS data, Google Earth.

Date: May – June 2015

Location: Merchants Pad, Sespe Oil Field

Operator: Orchard Exploration & Production LLC; TB Properties

Summary: Two condors visit the pad over the course of ten days.

Source: U.S. Fish & Wildlife Service GIS data, Google Earth.

Date: June 2015

Location: Hamp Lease, Ojai Oil Field, Santa Paula Canyon

Operator: California Resources Corporation

Summary: A condor lands on an oil pad.

A pair of condors is nesting in Santa Paula Canyon this year, the first time in more than a half-century. The nest is located approximately two miles from the Hamp Lease, which includes several oil pads and associated facilities. One of the condors landed on an oil pad.

Source: U.S. Fish & Wildlife Service GIS data.



February 9, 2016

VIA Federal eRulemaking Portal:

<http://www.regulations.gov>

Public Comments Processing
ATTN: FWS-HQ-NWRS-2012-0086
Division of Policy, Performance, and Management Programs
U.S. Fish and Wildlife Service
MS: BPHC
5275 Leesburg Pike
Falls Church, VA 22041-3803

Re: Comments on Proposed Rule and DEIS for Management of Non-Federal Oil and Gas Rights on National Wildlife Refuges

To Whom It May Concern:

This letter provides the comments of the American Petroleum Institute (“API”) and the Independent Petroleum Association of America (“IPAA”) (the “Associations”) in response to the U.S. Fish and Wildlife Service’s (the “Service”) proposed rule and associated draft environmental impact statement (“DEIS”) addressing the management of non-federal oil and gas rights on National Wildlife Refuge System (“NWRS”) lands and waters. *See* 80 Fed. Reg. 77,200 (Dec. 11, 2015) (“Proposed Rule”). The Associations appreciate the Service’s consideration of these comments.

I. INTRODUCTION

API is a national trade association representing over 625 member companies involved in all aspects of the oil and natural gas industry. API’s members include producers, refiners, suppliers, pipeline operators, and marine transporters, as well as service and supply companies that support all segments of the industry. API and its members are dedicated to meeting environmental requirements, while economically developing and supplying energy resources for consumers.

IPAA represents thousands of independent oil and natural gas producers and service

companies across the United States. Independent producers develop 95 percent of domestic oil and gas wells, produce 54 percent of domestic oil, and produce 85 percent of domestic natural gas. IPAA is dedicated to ensuring a strong, viable domestic oil and natural gas industry, recognizing that an adequate and secure supply of energy is essential to the national economy.

The Proposed Rule, if promulgated in final, would mark a sea change in the management of non-federal oil and gas activities on NWRS lands. However, as explained below, the authority claimed by the Service to promulgate the proposed regulations is not as broad as the Service assumes. Although a mineral interest owner's use of surface NWRS lands must be reasonable and provide due regard for federal interests, the Service may not condition access upon a permitting system containing burdensome requirements. We respectfully recommend that the Service instead perform a genuine assessment of the effectiveness of recent guidelines administered through a program that is sufficiently funded and staffed. Such an assessment may demonstrate that a new regulatory program is unnecessary or, alternatively, that narrowly targeted regulatory modifications are needed. Should the Service nevertheless proceed with the regulatory program it currently proposes, we provide specific comments on certain aspects of the Proposed Rule in Section II.D below, notwithstanding our general objections to the Proposed Rule.

II. COMMENTS

A. **The Service's authority to regulate holders of subsurface mineral interests is limited.**

The Proposed Rule states that the Service has authority to require permits for, and to regulate, the access and use of NWRS lands by mineral interest holders. However, the Proposed Rule overlooks applicable law that is not consistent with the scope of authority assumed by the Service. NWRS lands are primarily acquired by the United States pursuant to the Migratory Bird Conservation Act ("MBCA"). With respect to acquisitions of land from private parties, the MBCA provides:

[R]ights-of-way, easements, and reservations retained by the grantor or lessor from whom the United States receives title under this or any other Act for the acquisition by the Secretary of Interior of areas for wildlife refuges shall be subject to rules and regulations prescribed by the Secretary of Interior for the occupation, use, operation, protection, and administration of such areas as inviolate sanctuaries for migratory birds or as refuges for wildlife; and *it shall be expressed in the deed or lease that the use, occupation, and operation of such rights-of-way, easements and reservations shall be subordinate to and subject to such rules and regulations as are set out in such deed or lease or, if deemed necessary by the Secretary of Interior, to such rules and regulations as may be prescribed by him from time to time.*

16 U.S.C. § 715e (emphasis added). The Supreme Court has confirmed that Congress included this provision “to require the Secretary either to include his rules or regulations in the contract itself or to state in the contract that the reservation or easement would be subject to regulations promulgated ‘from time to time.’” *United States v. Little Lake Misere Land Co.*, 412 U.S. 580, 597-98 (1973); see *Minard Run Oil Co. v. U.S. Forest Serv.*, 2009 U.S. Dist. LEXIS 116520, *76 (W.D. Pa. Dec. 15, 2009) (“a federal agency’s authority to regulate in a split-estate context is properly determined by the terms of the specific statute pursuant to which the federal estate was acquired”).

In addition, Congress explicitly decided to eliminate an amendment to the National Wildlife Refuge System Administration Act (“NWRSA”) in 1966 that would have specifically provided the Secretary of Interior with regulatory authority over the surface use of NWR lands by holders of mineral interests. See *Caire v. Fulton*, 1986 U.S. Dist. LEXIS 31049, *17-18 (W.D. La. 1986). Although the NWRSA was substantially amended in 1997 by the National Wildlife Refuge System Improvement Act (“Improvement Act”), the Improvement Act did not include specific authority addressing mineral rights and it retained, in similar form, the original provisions of the NWRSA that generally allow the Secretary to permit certain uses and prescribe regulations. Compare 16 U.S.C. § 668dd(d) with Public Law 89-669, Oct. 15, 1966. In other words, Congress took no action in the Improvement Act to alter the balance it struck in 1966 when it expressly chose not to regulate the surface use of NWR lands by mineral interest holders. Consistent with this legislative history, the Service has long interpreted its authority over holders of subsurface mineral rights to be limited.¹

We recognize, as explained in the Proposed Rule, that some courts have construed the NWRSA to generally provide the Service with authority to require permits for, and to regulate, uses of NWR lands pursuant to the sovereign police power of the United States. See *School Bd. of Avoyelles Parish v. U.S. Dept. of Int.*, 647 F.3d 570 (5th Cir. 2011); *Burlison v. U.S.*, 533 F.3d 419 (6th Cir. 2008). However, neither *Avoyelles Parish* nor *Burlison* involved split estates

¹ See Memorandum from Gale Norton, Assoc. Solicitor, Conservation and Wildlife, to the Assistant Sec’y, Fish and Wildlife and Parks (Dec. 22, 1986); FWS Service Manual pt. 612; see also *Caire*, 1986 U.S. Dist. LEXIS at *36 (holding that United States “forfeited by statutory exception and stipulation its authority to require entry permits and impose regulatory schemes on owners and their assigns of specifically reserved mineral interests”). The General Accounting Office has also taken the position that the current version of the NWRSA does not address the Service’s authority over subsurface mineral interest holders. See GAO, *U.S. Fish & Wildlife Serv.: Opportunities Remain to Improve Oversight & Mgmt. of Oil & Gas Activities on Nat’l Wildlife Refuges*, GAO-07-829R (Wash., D.C. June 29, 2007) (“We continue to believe that such information is necessary for DOI to adequately inform the Congress regarding the need for additional authority. Moreover, we believe it is for Congress, not DOI, to weigh the needs of the refuge lands and the interests of mineral owners and, ultimately, to determine what oversight authority would be appropriate.”). See also 80 Fed. Reg. at 77,213 (“OIRA has determined that this proposed rule is significant, because it may raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the Executive order.”).

involving subsurface mineral interest holders and, therefore, do not address the lack of legislative authority regarding the use of surface lands by mineral interest holders. Moreover, the Third Circuit recently held that the U.S. Forest Service does not have the authority to require subsurface mineral interest holders to obtain a permit to access those rights on Forest Service lands. *Minard Run Oil Co. v. U.S. Forest Serv.*, 670 F.3d 236 (3rd Cir. 2011). The court's holding in *Minard Run* is premised on the statutory authority for the purchase of Forest Service lands (the Weeks Act), which states that "rights of way, easements, and reservations retained by the owner from whom the United States receives title are subject to the regulations expressed in and made part of the written instrument conveying title to the lands to the United States." *Id.* at 251 (internal quotation marks omitted; emphasis added). The Weeks Act and the MBCA use almost identical language in mandating that any regulations applicable to reserved rights in a deed (such as subsurface mineral rights) must be referenced in the deed itself.²

Accordingly, unless otherwise expressly conditioned in a deed in which a subsurface mineral right is reserved, the "mineral owner need not obtain consent or approval before entering land to mine for minerals." *Minard Run*, 670 F.3d at 244. However, the mineral interest holder must show "due regard" to the surface owner and may only "use as much of the surface as reasonably necessary to extract and produce the minerals," as long that use is "reasonable." *Id.* at 242, 244; *Merriman v. XTO Energy, Inc.*, 407 S.W.3d 244, 248-49 (Tex. 2013); *see also Gerrity Oil & Gas Corp. v. Magness*, 946 P.2d 913, 926-27 (Colo. 1997); *DuLaney v. Okla. State Dep't of Health*, 868 P.2d 676, 680 (Okla. 1993). Under this framework, it may be reasonable for the Service to require advance notice of entry onto NWRS lands and to impose "minor restrictions which . . . should not seriously hamper the extraction of oil and gas." *Minard Run*, 670 F.3d at 244 (quoting *United States v. Minard Run Oil Co.*, 1980 U.S. Dist. LEXIS 9570, *13 (W.D. Pa. Dec. 16, 1980)).

The Service appears to recognize the importance of deed language, stating that it "will respect any applicable deed conditions" and that the proposed regulatory requirements "apply to the extent that they do not conflict with deed conditions...." 80 Fed. Reg. at 77,202. However, under the authorities outlined above, the question is not whether the regulations conflict with deed conditions, but rather whether the deed explicitly makes reserved rights subject to federal

² *See* Jonathan Thrope, *Case Comment: Minard Run Oil Co. v. United States Forest Service*, 36 Harv. Envtl. L. Rev. 567, 590-91 (2012) ("There is no relevant difference between section 9 of the Weeks Act and the post-1935 section e of the MBCA. Both permit acquisitions of land encumbered by private reservations only after the relevant Secretary determines that the private use will not interfere with the purposes of the act and both require that regulations pertaining to reserved mineral rights be stated within the deed. Additionally, each contain an alternative section—section 11 in the case of the Weeks Act and section i in the case of the MBCA—that grants the respective agency very broad authority over all other private acts within the acquired land, aside from those reserved by private owners. Thus, arguments that subsequent statutes granting broad authority to the FWS have changed the status quo can likely be defeated; without explicitly referring to privately owned mineral rights, these statutes do not change the division of regulatory authority established by the MBCA.") (emphasis added).

rules and regulations. Therefore, it is not enough to include a provision stating that the regulations shall not “contravene or nullify rights vested in holders of mineral interests on refuge lands.” 50 C.F.R. § 29.32(b) (as proposed). The regulations must include an additional provision that expressly applies the regulations only to NWRS lands for which the applicable deed explicitly makes subsurface mineral interests subject to federal regulation. Without such a deed restriction, the respective rights of the Service and the mineral interest holder are governed by common law.

B. Notwithstanding the Service’s limited authority, a “one size fits all” approach is not appropriate.

NWRS lands are unique. Each Refuge has a different acquisition history, and the nature of the federal government’s interests in Refuges varies significantly. For example, the Lower Hatchie National Wildlife Refuge in Tennessee was acquired by deeded conveyance from a private owner and subject to existing easements for pipelines, public highways, and roads at the time of the government’s acquisition. *See Burlison*, 533 F.3d 419. Conversely, the Reelfoot National Wildlife Refuge comprises 2,300 acres that the Service owns outright and 7,860 acres that the State of Tennessee leases to the United States. *See Bunch v. Hodel*, 793 F.2d 129 (6th Cir. 1986). Additionally, certain Refuges are subject to unique management mandates, such as the statutory regime applicable to Alaska Refuges under the Alaska National Interest Lands Conservation Act of 1980 (“ANILCA”). Refuges are also subject to specifically tailored conservation plans, and each Refuge must have its own comprehensive conservation plan (“CCP”). 16 U.S.C. § 668dd(e)(1)(A). Congress directed the Service to manage each Refuge in a manner consistent with the CCP and to revise the plan if significant relevant changes occur. *Id.* § 668dd(e)(1)(E). For several Refuges, the CCP also requires adoption of an additional management plan.

In short, NWRS lands have different easement and access exceptions, different mineral extraction rights, different management plans, and different obligations to facilitate oil and gas development. Moreover, mineral rights law varies among states, and the interpretation of a deed or land sale contract between a private party and the government will also vary by state. *See, e.g., Petro-Hunt, LLC v. United States*, 365 F.3d 385, 393 (5th Cir. 2004). One set of rigid, generally applicable regulations, as has been proposed by the Service, is not practical and does not take into account the substantial legal and factual variations across NWRS lands. At a minimum, should the Service proceed with its proposal, the regulations should allow for, and incentivize, site-specific agreements between operators and the Service to more efficiently and effectively address the management of surface-use activities.

C. The Proposed Rule is inefficient, overbroad, and duplicative of existing requirements.

The stated premise for the Proposed Rule is that current regulations have been “ineffective at protecting refuge resources or providing operators explicit requirements for operating on refuge lands.” 80 Fed. Reg. at 77,201. However, the Service does not provide sufficient information to support that claim. The Proposed Rule cites a 2015 report by the Office

of the Inspector General, but that report addresses certain instances involving reclamation of oil and gas operations on Refuges and does not document any systematic problems with pre-reclamation activities.³

The Inspector General's report also finds that Service-related administrative issues, such as understaffing, the failure to monitor, and the failure to train employees are a significant part of the problem the Service perceives. These issues are not remedied by more regulations, but rather by the sufficient staffing of Service field offices and the provision of adequate training so that the Service has the capacity and expertise to work with oil and gas operators. A more prudent approach would be for the Service to continue to manage oil and gas activities under the guidelines it issued in 2012—"Management of Oil and Gas Activities on National Wildlife Refuge System Lands"—for a sufficient period of time, and with necessary staffing, resources, and training, to accurately determine the areas in which those guidelines are effective and the areas in which they are not, if any. At that time, if the Service believes formal regulations are necessary to manage oil and gas activities, it can do so in an informed and targeted manner, consistent with applicable law.

The Proposed Rule is also duplicative of existing state and federal laws and regulations. For example, the Environmental Protection Agency may have authority to regulate certain aspects of operations (either directly or through a state agency) pursuant to the Clean Water Act, the Clean Air Act, or the Resource Conservation and Recovery Act. The proposed regulations are duplicative of, and potentially inconsistent with, these federal laws. *See, e.g.*, 50 C.F.R. §§ 29.111, 29.113, 29.114, and 29.117 (as proposed). The Service also incorrectly suggests that additional regulation is necessary because state laws do not adequately address environmental concerns. In every state in which the Service has identified active and inactive wells (see Attachment), state oil and gas commissions have adopted regulations that protect the environment through comprehensive drilling, development, and production standards; setbacks; ground water protection measures; financial assurance requirements; spill reporting; and reclamation requirements. *See, e.g.*, La. Admin. Code tit. 43: IX, XI, XIII, XVIII, XIX (2013); Okla. Admin. Code §§ 165:10-1-1 (2013), *et seq.*

In sum, the Service proposes to imprudently embark on a broadly applicable set of stringent regulations that (i) are duplicative of, and inconsistent with, other federal and state laws; (ii) will demand even more federal staffing and resources to administer an unfamiliar and confusing new regulatory program; and (iii) that is of questionable legal authority and practical need. We respectfully urge the Service to consider a different, more efficient approach, such as we recommend above.

³ Final Evaluation Report—U.S. Fish and Wildlife Service's Management of Oil and Gas Activities on Refuges, Office of the Inspector General, Report No. CR-EV-FWS-0002-2014.

D. Notwithstanding the objections stated above, the proposed regulations should be modified before they are promulgated.

Should the Service proceed to promulgate new regulations, there are a number of areas in which the proposed regulations should be modified. Without conceding our positions stated above, we offer the following comments on certain aspects of the Service's proposed regulations.

1. Geographic scope

We agree that the regulations cannot “apply to operations on neighboring private lands or non-Federal surface estates within refuge boundaries.” 80 Fed. Reg. at 77,206. As addressed above, the Service's authority, if any, to regulate surface use by a subsurface mineral interest holder derives from the language of the deed to the NWRS land. Moreover, the NWRSAA addresses NWRS land, not non-federal land. The Service therefore has no authority under the NWRSAA or the MBCA to regulate activities on non-federal land.⁴ For the same reasons, we agree that the regulations cannot apply to aircraft that do not land on a Refuge or to pipelines located within a Refuge under a separate deed or right-of-way. *See* 50 C.F.R. §§ 29.40, 29.50 (as proposed).⁵

2. Existing operations

We agree that the regulations should not apply to operations being conducted under existing permits or under no permit if operating in accordance with applicable laws before the final regulations are promulgated. *See* 50 C.F.R. §§ 29.43, 29.44. However, the Service must delete the phrases “subject to the provisions of this subpart” and “subject to applicable requirements of this subpart” from proposed subsections 29.43 and 29.44, respectively. The effect of these phrases is to make pre-existing operations subject to the new regulations and to apply the regulations retroactively without a legal basis for doing so. Similarly, the language subjecting pre-existing operations to the new regulations in proposed subsections 29.60, 29.61, and 29.64 must also be eliminated.⁶ The only proposed regulations that can reasonably apply to pre-existing operations are those addressing the operational modifications and operator changes.

⁴ In this light, the Service should insert the phrase “located or occurring within a refuge” after “and all other activities” at the end of the definition of “operations” in 50 C.F.R. § 29.50 (as proposed). This would appropriately clarify that only incidental activities occurring within a Refuge are covered by the regulations.

⁵ Additionally, we agree that access to oil and gas rights on NWRS lands in Alaska is governed by ANILCA and its implementing regulations. 16 U.S.C. § 410hh; 16 U.S.C. § 3101 *et seq.*; 43 U.S.C. § 1601 *et seq.*; 43 C.F.R. part 36; 50 C.F.R. part 29 subpart B.

⁶ The reference to the applicability to 50 C.F.R. § 29.120 (as proposed) is particularly troubling because that subsection requires compliance with all operating standards in 50 C.F.R. §§29.111-119 (as proposed), which are precisely the provisions that should not apply to pre-existing operations.

3. Timing and appeals

The proposed period of 180 days for the processing of permit applications is unreasonably long and unduly burdens the rights of mineral interest holders. The contemplated 180-day time period is longer than those considered reasonable in existing case law. *See Minard Run*, 670 F.3d 236 (60 days); *Duncan Energy Co. v. U.S. Forest Serv.*, 109 F.3d 497, 499 (8th Cir. 1997) (considering processing times of 60 days, 74 days, and 91 days; “[t]he Forest Service has only limited authority to regulate use of the subservient surface estate by the dominant mineral estate, and its processing time must be reasonable, expeditious, and as brief as possible”). In addition to shortening the processing time for applications, we recommend that the Service include in the regulations a categorical exclusion from National Environmental Policy Act requirements and a provision stating that operations conducted in compliance with the terms of a permit are deemed to be not likely to adversely affect any species listed under the federal Endangered Species Act.

Additionally, the two-tiered appeals process proposed in the regulations is unreasonable and unduly burdensome. There should be a single, expedited administrative appeal available for challenges to actions taken by the Service under the proposed regulations. This administrative decision should be directly appealable in federal court.

4. Information requests

The proposed information requirements for permit applications are extraordinarily extensive and unduly burdensome. *See* 50 C.F.R. §§ 29.94-29.97. These requirements, particularly including proposed subsection 29.121(f), also unlawfully require the disclosure of confidential and/or proprietary information. The information requirements must be significantly scaled down so that they request only the basic information needed for the Service to assess the location and type of operations that will be undertaken. All provisions requesting confidential or proprietary information must be eliminated.

5. Access

The Service should modify the proposed regulations to make clear that the Service cannot place conditions on operations in a permit that only allows an operator to access and traverse federal lands (*i.e.*, in order to access its operations on non-federal lands). In addition, we agree that fees cannot be required for access that is already within the scope of the operator’s oil and gas right or other right provided by law and that there should be no fees for emergency access. *See* 50 C.F.R. §§ 29.141, 142 (as proposed). If an access fee can be applied, then it must be reasonable and cannot burden the underlying oil and gas right or otherwise diminish the value of the mineral estate.

6. Financial assurances

We request that the Service modify proposed subsection 29.150 to provide that a bond is not required to the extent that a sufficient bond, applicable to the operation, has already been

lodged with a state authority or another federal authority. Adding a duplicative layer of bonding requirements is unfair and unreasonable, particularly for operators that have a history of full compliance. Any additional bonding should only be required on a case-by-case basis and only to the extent necessary to supplement bonds that have already been lodged.

7. Operational restrictions

The Proposed Rule states that it “contains performance-based standards that provide flexibility to resource managers and operators to use various and evolving technologies within different environments to achieve the standards.” 80 Fed. Reg. at 77,203. However, the text of the proposed operational requirements is, in many instances, not faithful to this “flexible” approach. For example, the proposed regulations requiring the installation and maintenance of secondary containment, applying seasonable buffers, and specifying the location, type, and design of facilities are unreasonable and unduly burden and unlawfully diminish the value of the mineral estate. *See* 50 C.F.R. §§ 29.111-29.119 (as proposed). These requirements should be eliminated and replaced with recommended operational methods, general goals to be achieved to the extent technologically and economically feasible, and a requirement to use best management practices.

In a similar vein, the Service does not have the authority to permit only the “least-damaging” operational methods. The Service may recommend the “least damaging” methods, but the mineral interest owner is not required to modify its operations in a manner that is not economically or technologically feasible in order to access its mineral rights. Accordingly, the term “technologically feasible, least damaging methods” (as proposed) is not appropriate and should be replaced with “feasible methods.” “Feasible methods” should be defined as those methods that are technologically and economically feasible, as determined by the best industry practices available.

Finally, the operational restrictions set forth in the Proposed Rule in many instances are duplicative of, or conflict with, applicable state regulations. This will inevitably result in confusion for both operators and regulatory agencies.

8. Mitigation

The Service does not have the authority to require mitigation for impacts by mandating that operators provide for “habitat creation, habitat restoration, land purchase, or other compensation.” 50 C.F.R. § 29.120(g) (as proposed). This broad provision should be eliminated from the regulations as it amounts to an access fee that unreasonably and unlawfully restricts access to mineral rights.

9. Modifications

We recommend two changes to the regulations addressing modification of existing operations. First, the word “significant” should be inserted before “additional impacts” in the definition for “modifying” (proposed subsection 29.50). This would clarify that modified

permits are not (and should not be) required for minor modifications to operations that do not result in significant changes in effects to the environment. Second, proposed subsection 29.160 should be modified to clarify that the Service may amend a permit only when there is a “significant” or “substantial” modification to the permitted operation.

E. Alternative C in the DEIS must be rejected.

Alternative C, as set forth in the DEIS, would “expand” the jurisdiction of the Service to “regulate non-Federal oil and gas operations that occur on private surfaces within the boundary of a refuge (*i.e.*, inholdings) and to operations on non-Federal surface locations that use directional drilling to access non-Federal oil and gas underneath the surface of a refuge.” DEIS at v. For the reasons explained in Section II.D.1 *supra*, the Service has no authority under the NWRSA or the MBCA to regulate activities on non-federal land.⁷ Accordingly, Alternative C is not “reasonable” and must be rejected. *See* 40 C.F.R. § 1502.14.

III. CONCLUSION

The legal and practical bases for the proposed regulations are, at best, questionable. As described above, the most prudent approach would be for the Service to continue to manage oil and gas activities under its 2012 guidelines for a sufficient period of time, and with adequate staffing, resources, and training, to accurately determine the areas in which those guidelines are effective and the areas in which they are not. Should the Service nonetheless proceed with this rulemaking, and notwithstanding our objections to the scope of the Service’s claimed authority, we sincerely request that the Service modify the regulations as recommended above.

The Associations and our members appreciate your consideration of these comments. If you have any questions, or would like us to provide any additional information on the topics addressed in this letter, please do not hesitate to contact the undersigned.

Sincerely,



Richard Ranger
Senior Policy Advisor
Director, Upstream and Industry Operations
American Petroleum Institute



Dan Naatz
Vice President of Federal Resources
Independent Petroleum Association of America

Attachment

⁷ Relatedly, we recommend that the Service insert the phrase “located or occurring within a refuge” after “and all other activities” at the end of the definition of “operations” in 50 C.F.R. § 29.50 (as proposed). This would clarify that only incidental activities occurring within a Refuge are covered by the regulations.

ATTACHMENT

State	Refuge	Active Wells	Inactive Wells	Status Not Available
Alabama	Cahaba River NWR	14		
Alaska	Kenai NWR	80	5	
Arkansas	Bald Knob NWR			3
	Cache River NWR			2
	Felsenthal NWR			57
	Overflow NWR			1
	White River NWR			2
California	Hopper Mountain NWR	13	3	
	Guadalupe-Nipomo Dunes NWR		2	
	North Central Valley Wildlife Mgmt. Area	1	2	
	Seal Beach NWR	11	18	
	Delevan NWR		1	
Indiana	Patoka River NWR	15	72	
	Big Oaks NWR		5	
	Muscatatuck NWR		1	
Kansas	Quivira NWR	6	21	
Louisiana	Atchafalaya NWR	4	42	
	Bayou Cocodrie NWR		49	
	Bayou Sauvage NWR		4	
	Bayou Teche NWR	1	34	
	Big Branch Marsh NWR		4	
	Black Bayou Lake NWR	60	25	
	Breton NWR		3	
	Cameron Prairie NWR		14	
	Cat Island NWR		5	
	Catahoula NWR	6	69	
	D'Arbonne NWR	100	183	
	Delta NWR	21	342	
	Grand Cote NWR		2	
	Lacassine NWR	5	75	
	Lake Ophelia NWR	1	55	
	Mandalay NWR	1	42	
	Red River NWR	2	55	
	Sabine NWR	17	81	
	St. Catherine Creek NWR		6	
	Tensas River NWR	4	108	
	Upper Ouachita NWR	928	482	

Michigan	Kirtlands Warbler Wildlife Mgmt. Area	1	1	
Mississippi	St. Catherine Creek NWR	13	20	
Missouri	Big Muddy Nat'l Fish and Wildlife Refuge		4	
Montana	Benton Lake NWR		2	
	Benton Lake Wetland Mgmt. Dist.	3	8	
	Bowdoin NWR	1	1	
	Bowdoin Wetland Mgmt. Dist.	18	5	
	Hailstone NWR		1	
	Halfbreed Lake NWR		5	
	Hewitt Lake NWR	9	5	
	Lake Mason NWR		2	
	Medicine Lake NWR	2	3	
	Northeast Montana Wetland Mgmt. Dist.	2	16	
New Mexico	Bitter Lake NWR	13		
North Dakota	Lake Ilo NWR	1		
Oklahoma	Deep Fork NWR	149	60	
	Little River NWR	1		
	Optima NWR	4	3	
	Salt Plains NWR	3	1	
	Tishomingo NWR	1		
	Washita NWR		1	
Texas	Anahuac NWR	4	7	
	Aransas NWR	8	56	
	Attwater Prairie Chicken NWR	10	10	
	Big Boggy NWR		1	
	Brazoria NWR	3	16	
	Caddo Lake NWR	4		
	Hagerman NWR	50	43	
	Laguna Atascosa NWR	1	7	
	Lower Rio Grande Valley NWR	68	91	
	McFaddin NWR	6	14	
	San Bernard NWR	13	14	
	Texas Point NWR		2	
	Trinity River NWR		2	
Utah	Colorado River Wildlife Mgmt. Area	1	1	



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February 9, 2016

Public Comments Processing
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RE: Comments on Management of Non-Federal Oil and Gas Rights Proposed Rule and Draft Environmental Impact Statement [Docket No. FWS-HQ-NWRS-2012-0086]

Submitted electronically via Federal e-Rulemaking portal: <http://www.regulations.gov>

Our duty to the whole, including the unborn generations, bids us restrain an unprincipled present-day minority from wasting the heritage of these unborn generations. The movement for the conservation of wild life and the larger movement for the conservation of all our natural resources are essentially democratic in spirit, purpose, and method. – Theodore Roosevelt

Dear Mr. Covington,

We are happy to submit our timely filed comments on the proposed rule by the Fish and Wildlife Service (FWS) regarding management of non-federal oil and gas interests on National Wildlife Refuges (NWRs) and the accompanying Draft Environmental Impact Statement (DEIS). The deadline for comments is February 9, 2016.

The Conservation Law Center (CLC) is a not-for-profit public interest law firm located in Bloomington, Indiana and operates the Conservation Law Clinic under agreements with the Indiana University Maurer School of Law and Indiana University McKinney School of Law. The CLC represents non-profit environmental organizations and governmental entities in conservation matters and works to improve conservation law and policy.

The American Bird Conservancy (ABC) is a not-for-profit membership organization whose mission is to conserve native birds and their habitats throughout the Americas. ABC acts

across the full spectrum of threats to birds to safeguard the rarest bird species, restore habitats, and reduce threats, unifying and strengthening the bird conservation movement.

Since President Theodore Roosevelt declared the Pelican Island National Wildlife Refuge protected in 1903, the National Wildlife Refuge System has grown into the world's largest land system dedicated to wildlife conservation.¹ Initially created as safehavens for migratory birds and waterfowl threatened by market hunters, the System now encompasses a wide range of conservation goals including protecting endangered species, conserving wetlands, enhancing biodiversity, and preserving ecosystems. FWS may permit other uses of refuge land, but the agency's first priority in the management and planning of the Refuge System is conserving these unique aspects of America's heritage.

FWS' proposed rule governing non-federal oil and gas management is an essential update that mostly meets Congress' conservation mandate. The rule requires all new and modified operations on federally-owned lands within refuges to receive a permit and utilize "technologically feasible, least-damaging methods" to minimize damage to refuge resources.² The strong performance-based standards for new operations on federally-owned land, if properly enforced, will allow the agency to tailor regulations to the diverse ecosystems in the Refuge System.

However, there are two important issues with the proposed rule. First, the proposed rule exempts new and modified oil and gas operations conducted on the surface of private lands even though such operations can significantly harm refuge lands and wildlife. Second, the proposed rule exempts existing operations on federally owned land that continue to have significant effects on refuges even though regulation is technically and economically feasible. FWS must rectify

¹ Robert L. Fischman and Robert S. Adamcik, *Beyond Trust Species: The Conservation Potential of the National Wildlife Refuge System in the Wake of Climate Change* 51 Nat. Res. J. 1, 26 (2011).

² Proposed 50 C.F.R. § 29.50.

these exemptions in the final rule to comply with the NWR Organic Act's conservation mandate. We propose alternative rules that would meet FWS' stewardship responsibilities while avoiding any constitutional takings issues. We also propose additions to the Service's DEIS to fully reflect the environmental effects of the proposed action.

I. The Proposed Rule Unlawfully Exempts New and Modified Operations Commencing on Private Lands From Regulation Even if They Would Significantly Impair Refuge Resources.

FWS proposes to exempt wells drilled outside refuge boundaries or on privately-owned inholdings from any regulation.³ These operations would require federal oversight only if they require access on, across, or through a NWR, in which case the operators would have to pay an access fee.⁴ This exemption ignores the significant impacts that oil and gas operations on privately owned land have on nearby refuge lands and wildlife. Toxic spills, harmful emissions, light, and noise do not stop at property boundaries. FWS should use the full extent of its delegated authority under the Property Clause to regulate operations on private land that may impair refuge resources. Congress' conservation mandate requires such regulations to protect refuges.

A. Threats to Refuges and Wildlife From Oil and Gas Operations on Private Land.

As FWS has acknowledged, oil and gas operations can significantly threaten wildlife and wildlife habitat in refuges. Impacts include surface water quality degradation, soil and groundwater contamination, air quality degradation, increased noise, disruption of wildlife migration routes, night sky intrusion, and wildlife mortality.⁵ Studies confirm that species

³ Proposed 50 C.F.R. § 29.40.

⁴ *Id.*

⁵ Management of Non-Federal Oil and Gas Rights, 80 Fed. Reg. 77200, 77202–203 (Dec. 11, 2015).

richness and abundance decline near oil and gas operations.⁶ Open pits associated with oil and gas operations can entrap and kill birds and other wildlife.⁷ Fracking operations can contaminate groundwater and surface water, consume large amounts of water that may exceed natural flows of source rivers, and induce earthquakes.⁸

Many NWR Comprehensive Conservation Plans (CCPs) acknowledge that operations on private land threaten refuges. The Catahoula NWR CCP notes that off-refuge oil operations in the surrounding watershed threaten the refuge:

Saltwater releases in the area are virtually constant, with numerous oil spills. By the time these contaminants reach the lake, they are well entrained into the water column and generally not visible at the surface, thus not posing a direct acute threat to waterfowl and water birds from oiling, but posing a considerable concern for water quality and chronic impacts to the supporting ecosystems for refuge trust resources.⁹

Likewise, at the Patoka River NWR, discharge of salt brine and “inadequate storage tank containment, open pits of oil, and irresponsible spills or overflowages of crude oil from some of the 82 operating wells/storage tanks within or adjacent to the [refuge] have contaminated surface waters and adversely impacted the area’s plant and wildlife resources in the past.”¹⁰ The CCP for the Central Arkansas NWR Complex warns that “illegal dumping of saltwater, toxins, chemicals, sludge, and drilling mud, resulting from oil and gas operations upstream of the refuge...could

⁶ M.M. Gilbert and A.D. Chalfoun, *Energy Development Affects Populations of Sagebrush Songbirds in Wyoming*, 75 J. Wildlife Management 816–824 (2011) (increasing density of oil and natural gas wells associated with decreased numbers of sparrows); S.M. Harju et al., *Thresholds and Time Lags in Effects of Energy Development on Greater Sage-Grouse Populations*, 74 J. Wildlife Management 437–448 (2011) (presence of oil and gas wells adjacent to grouse leks resulted in lower male lek attendance in 5 of 7 study areas); Jessie J. Green, G.L. Adams, and R. Adams, *Examining Community Level Variable of Fishes in Relation to Natural Gas Development*, Southeastern Fishes Council, Annual Meeting Program, November 8–9, 2012, New Orleans, Louisiana (proportional abundance of sensitive fish taxa and darters negatively correlated with gas well density).

⁷ A.W. Maki, *Of Measured Risks: The Environmental Impacts of the Prudhoe Bay, Alaska Oil Field*, 11 *Envtl. Toxicology and Chemistry* 1691–1707 (1992); R. Stephenson, *Effects of Oil and Other Surface-Active Organic Pollutants on Aquatic Birds*, 24 *Envtl. Conservation* 121–129 (1997).

⁸ Avner Vengosh, et al., *A Critical Review of the Risks to Water Resources From Unconventional Shale Gas Development and Hydraulic Fracturing in the United States*, 48 *Envtl. Sci. Technol.* 8334–8348 (2014).

⁹ U.S. FWS, *Catahoula National Wildlife Refuge Comprehensive Conservation Plan* 78–79 (Sept. 2007).

¹⁰ U.S. FWS, *Patoka River National Wildlife Refuge and Management Area Comprehensive Conservation Plan Approval* 54 (Aug. 2008).

become a problem in the future” and that “potential pollution and excessive water usage associated with drilling in nearby shale formations” pose a threat to habitats and wildlife.¹¹ The Texas Chenier Plain NWR Complex is at risk for oil spills from offshore production in the Gulf of Mexico.¹² FWS’ continued acknowledgment of threats to refuges from oil and gas operations on private land makes its refusal to regulate these operations surprising and irresponsible.

B. Failing to Regulate Operations on Private Land That Impair Refuges Violates the NWR Organic Act and FWS Policy.

The Federal Government enjoys broad authority under the Property Clause to regulate private activity that affects Federal property.¹³ The Property Clause allows the Government to regulate activities on private lands to the extent they interfere with the designated purpose of federal lands.¹⁴ FWS properly recognized its authority to regulate non-federal oil and gas operations on federally-owned lands,¹⁵ but declined to regulate operations occurring on private land. The National Wildlife Refuge System Administration Act¹⁶ (NWRSA), as amended by the National Wildlife Refuge System Improvement Act¹⁷ (NWRRIA), and agency policy require FWS to regulate operations on private land if they would impair the mission of the National Wildlife Refuge System or the designated purposes of individual refuges.

The requirement to regulate operations on private lands that affect refuge resources has two aspects when applied to the proposed rule. First, FWS declined to regulate operations on privately owned inholdings within Refuge System boundaries. Oil and gas operations within

¹¹ U.S. FWS, Central Arkansas National Wildlife Refuge Complex Draft Comprehensive Conservation Plan and Environmental Assessment 86, 172 (July 2009).

¹² U.S. FWS, Texas Chenier Plain Refuge Complex Final Environmental Impact Statement, Comprehensive Conservation Plan, and Land Protection Plan 21 (May 2008).

¹³ U.S. CONST. art. IV, § 3.

¹⁴ *See, e.g., Minnesota v. Block*, 660 F.2d 1240 (8th Cir. 1981) (finding that the Federal government could regulate lands owned by the State of Minnesota to protect a national forest).

¹⁵ 80 Fed. Reg. at 77201–02.

¹⁶ 16 U.S.C. § 668dd.

¹⁷ National Wildlife Refuge System Improvement Act Pub. Law 105-57 (1997).

federal boundaries have the potential to damage federal lands, as the National Park Service noted in proposed revisions to its own non-federal oil and gas regulations. Operations outside the Refuge System also can have surface and subsurface effects on refuge resources. Regulating operations on both inholdings and adjacent lands is necessary to comply with the conservation mandate that Congress set for the Refuge System.

i. Federal law requires FWS to regulate oil and gas operations on private land that would harm the refuge system and its mission.

The NWRSA, as amended by the NWRSA, imposes a number of requirements for FWS' management of refuges. The Service must:

- a) Provide for the conservation of fish, wildlife, and plants, and their habitats within the System;
- b) Ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans;
- c) Plan and direct the continued growth of the System in a manner that is best designed to accomplish the mission of the System [and] to contribute to the conservation of the ecosystems of the United States...;
- d) Ensure that the mission of the System...and the purposes of each refuge are carried out...;
- e) Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges;
- f) Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the System and the purposes of each refuge.¹⁸

These directives underline Congress' intent for the Refuge System: "wildlife and wildlife conservation must come first."¹⁹ FWS must regulate oil and gas operations on private land to comply with these six mandates.

First, regulating oil and gas operations on private land is required by Sections 668dd(a)-(b)'s mandates to conserve refuge lands and wildlife and ensure the biological integrity, diversity, and health of refuges. FWS has acknowledged that operations on private land threaten

¹⁸ 16 U.S.C. § 668dd(a)(4)(A)-(F).

¹⁹ H.R. Rep. No. 105-106 (1997), *reprinted in* 1997 U.S.C.C.A.N. 1798-5, 1798-13.

refuges: “events occurring off refuge lands or waters may injure or destroy the biological integrity, diversity, and environmental health of a refuge.”²⁰ Accordingly, the Service states that it “manage[s] for environmental health by preventing chemical contamination of air, water, and soils that may interfere with reproductive physiology or stimulate high rates of mutation. Such contamination includes carcinogens and other toxic substances that are released within or *outside* refuges.”²¹ Despite recognizing these threats, the proposed rule exposes refuges and their wildlife to damage from oil and gas operations on private land. Failure to take reasonable actions to minimize toxic spills, harmful air emissions, and other threats to refuges and refuges resources would violate FWS’s conservation mandate and the agency’s own policy.

Second, regulating oil and gas operations on private lands within and near refuges is required by Congress’ direction to plan and direct the future growth of the Refuge System to accomplish the System’s mission and conserve ecosystems.²² Private inholdings and lands bordering refuges are often targets for future acquisition. Allowing surface and subsurface contamination of waters and destruction of important habitat would negatively impact the Service’s ability to acquire property with high conservation values within and near refuge boundaries, constraining the growth of the system.

Third, regulating operations on private lands is required by FWS’ duty to assist in the maintenance of adequate water quality and quantity to fulfill the mission of the Refuge System and individual refuges. Operations on inholdings or adjacent land can contaminate refuge surface waters through spills and discharges. Fracking operations on private land may contaminate groundwater. Fracking operations also use vast quantities of water, which could leave refuges

²⁰ U.S. FWS, National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health 601 FW 3.20 (Apr. 16, 2001).

²¹ *Id.* at 601 FW 3.10(C)(2) (emphasis added).

²² 16 U.S.C. § 668dd(a)(4)(C).

without enough water to achieve their designated purposes. The final rule must ensure that oil and gas operations on and near refuges do not compromise water quality or quantity for refuges.

Fourth, regulating operations on private lands is required by FWS' duty to conserve and protect migratory birds and waterfowl. One of FWS's goals for the Refuge System is to "develop and maintain a network of habitats for migratory birds...that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges."²³ Indeed, over 200 refuges were established with the purpose of bird conservation²⁴ and nearly all refuges are Important Bird Areas. Refusing to regulate operations on private land that may harm refuges threatens these birds and violates the purposes of those 200 refuges individually and the Refuge System as a whole. FWS should revise the proposed rule to ensure that migratory birds within refuges are protected from oil and gas operations occurring on private land.

ii. The National Park System shares a similar mission with the Refuge System and the Park Service proposes to regulate oil and gas operations on private land.

The Refuge System's sibling, the National Park System (NPS), regulates the management of private oil and gas rights beneath NPS lands and currently is revising its regulations to better protect parks from operations commencing on private lands. The existing 9B regulations, as they are commonly called, are designed to ensure that private oil and gas operations are conducted in a manner consistent with the purposes of the Park System and each unit thereof, to "prevent or minimize damage to the environment and other resource values," and "to insure to the extent feasible that all units of the National Park System are left unimpaired for the enjoyment of future generations."²⁵ Like FWS' proposed rule, the regulations are not intended to result in the taking

²³ U.S. FWS, National Wildlife Refuge System Mission and Goals and Refuge Purposes, 601 FW 1.8 (July 26, 2006).

²⁴ *Id.* at 601 FW 1.9B.

²⁵ 36 C.F.R. § 9.30(a).

of a private property interest²⁶ and require the use of technologically feasible, least-damaging methods.²⁷ NPS' proposed 9B regulations delete a regulatory exemption for oil and gas operations on private land in recognition of the serious harms operations on inholdings pose to park resources. Existing and proposed 9B regulations also govern downpipe standards from some operations commencing outside NPS boundaries. FWS should follow its sister agency's example given the similar missions and authorities the agencies have in managing their respective land systems.

NPS proposes to change the 9B regulations because existing Park System regulations do not allow the agency to regulate an oil or gas well on a private inholding unless the operator requires access across federal land. The Park Service found "at least 10 instances of sites with oil spills or leaks resulting in contamination of soils and water" within park boundaries that operated without regulation.²⁸ For example, an operation on private land within the Big Thicket National Preserve is currently exempt from regulation, despite contaminating adjacent federally owned land with storm water runoff, and a large compressor on a private inholding in the Big South Fork National River and Recreation Area causes unabated noise that the Park Service cannot stop under existing regulations.²⁹ FWS' proposed regulations, which exempt oil and gas operations on inholdings from regulation, would expose wildlife refuges to similar harms. FWS should instead use the National Parks Service's proposed approach for inholdings within federal boundaries: all operators within NPS boundaries must be subject to permitting standards and requirements.³⁰

Existing and proposed NPS regulations have some provisions for oil and gas operations outside federal boundaries. An operator on a site outside the boundaries of a Park unit must

²⁶ *Id.*

²⁷ 36 C.F.R. § 9.37(a)(1).

²⁸ General Provisions and Non-Federal Oil and Gas Rights, 80 Fed. Reg. 65572, 65575 (Oct. 26, 2015).

²⁹ *Id.* at 66575.

³⁰ *Id.* at 66575.

comply with the 9B regulations if he uses directional drilling to pass “under any land or water the surface of which is owned by the United States.”³¹ However, the operator does not need to comply with regulations if the Park Service Regional Director determines “that such operations pose no significant threat of damage to park resources, both surface and subsurface, resulting from surface subsidence, fracture of geological formations with resultant fresh water aquifer contamination, or natural gas escape, or the like.”³² The Park Service’s proposed rule still requires operators to obtain a permit if downhole activities would cause a significant threat of damage to federally owned lands, waters, or resources within park boundaries, visitor uses or experiences, or visitor or employee health and safety.³³ Again, FWS should follow the Park Service’s example and regulate oil and gas operations accessing minerals beneath refuge properties from land outside refuge boundaries. FWS should go even further than NPS’ existing and proposed 9B regulations by regulating both surface and subsurface effects from operations outside refuges to the extent they harm refuge resources.

FWS must regulate at least as strenuously as NPS because they share similar missions, responsibilities, and powers for their respective land systems. The Park Service’s mission is to “conserve the scenery, natural and historic objects, and wild life in the System units and to provide for [their] enjoyment...in such manner and by such means as will leave them unimpaired for future generations.”³⁴ Similarly, FWS’ mission for the Refuge System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for

³¹ 36 C.F.R. § 9.32(e).

³² *Id.*

³³ Proposed 36 C.F.R. § 9.70.

³⁴ 54 U.S.C. § 100101(a).

the benefit of present and future generations of Americans.”³⁵ FWS’ mission in managing the Refuge System is substantially similar to that of the National Parks and requires putting refuge resources and wildlife first. Nothing in either agency’s Organic Act places special limitations on the regulation of private and gas operations that would restrict fulfillment of these missions.

FWS acknowledged these similarities, saying that the agency developed the proposed rule “in coordination with the NPS,” that the rule “is consistent with [NPS’s] proposed rule,” and that “an operator working on both NWRS and NPS lands would experience little difference in [regulation].”³⁶ The substantial differences in regulation for operations on private land show these claims are false. FWS claimed that any variations were necessitated by “differing authorities and missions and the scope of the two agencies’ non-Federal oil and gas programs.” The NPS and FWS do not have different missions when it comes to managing their respective land systems. Both must conserve their charges for the benefit of future generations. Likewise, both agencies enjoy broad authority to regulate operations that would impair the missions of their land systems. The only difference in the scope of each agency’s non-Federal oil and gas programs is each agency’s willingness to protect its land system. By all relevant measures, the agencies are the same with regards to their non-federal oil and gas programs. In order to meet its conservation mandate and be consistent with the Park Service, FWS must regulate oil and gas operations on private land that impact refuges.

C. Our Suggested Changes to the Proposed Rule for Oil and Gas Wells on Private Lands That Would Impair Refuges and Refuge Resources.

FWS’ justification for exempting operations on private land, although laudable, exposes refuges to the threats outlined above. FWS believes the proposed rule will incentivize developers

³⁵ 16 U.S.C. § 668dd(a)(2).

³⁶ 80 Fed. Reg. at 77203.

to drill off refuge land, thereby avoiding surface impacts to refuge resources.³⁷ This justification anticipates the rare situation where an operator could not feasibly drill off-site and comply with regulations needed to protect refuges, so the operator is forced to drill on refuge land, causing more surface impacts while being subject to the proposed rule. Although motivated by a goal to reduce impacts to refuges, FWS' exemption actually puts refuges at risk from operations on private inholdings and outside refuge boundaries and incentivizes companies to negotiate for outcomes that threaten refuges. To obtain the same, if not greater, benefits as the proposed rule, FWS should adopt the following three step rule for new and modified non-federal oil and gas operations on or near refuges.

First, FWS should require all individuals seeking to access privately-owned oil and gas interests under refuge land to access these minerals from outside refuge boundaries. Nothing restricts FWS from requiring that operators access privately owned mineral rights in a manner that minimizes impacts to refuges; indeed, the Organic Act mandates this approach to conserve refuge resources. This will ensure that the maximum number of operations are located off refuge lands, minimizing surface effects just as effectively as the proposed rule.

As part of the first step, FWS should impose those regulations on off-refuge operations that are necessary to ensure that the refuge experiences minimal harm from oil and gas operations, both individually and cumulatively. For example, a proposed drilling site located upstream of a refuge would require spill prevention and mitigation regulations that a site downstream of a refuge would not. An operation located a half mile away from a refuge containing migratory birds would likely require noise dampening regulations while an operation located five miles away may not. The specific regulations for each off-site oil and gas operation will vary depending on the proposed operation, its location, and the impacted refuge. Similarly

³⁷ 80 Fed. Reg. at 77204.

tailored regulations are necessary for operations near refuges that do not access oil and gas beneath refuge lands but still affect refuge resources.

Second, if off-site drilling with regulations is not feasible for the applicant, FWS should examine the feasibility of purchasing the private mineral interest. Purchasing the mineral interest avoids all impacts to refuges and ensures that private parties receive fair value for their property. Partnerships with other landowners, States, and conservation organizations may assist in acquiring private mineral interests under refuges. The Park Service sometimes uses this strategy if employing the full range of necessary regulations on private oil or gas operations would constitute a taking of private property.³⁸

Third, if neither of the above options is feasible, FWS should allow operations on the refuge itself if the applicant employs technologically feasible, least-damaging methods, pursuant to the proposed rule. Placing this option last avoids concerns about effecting a taking of the private mineral interest while allowing FWS to comply with its statutory mandate to do as much as possible to conserve refuge resources. Our proposed rule, unlike FWS' proposed rule, puts wildlife and wildlife conservation first, as Congress intended.

II. The Proposed Rule Unlawfully Exempts Existing Operations From Regulation Despite Significant Impacts Posed by These Operations and Practicable Means to Reduce Those Impacts.

FWS also proposes to exempt existing oil and gas operations on federally-owned refuge lands from the updated regulations.³⁹ This exemption applies to existing operations with and without FWS permits.⁴⁰ Approximately 4,000 wells on refuges, both active and inactive, are not subject to permits at this time.⁴¹ FWS believes that regulation of these operations is not necessary

³⁸ 36 C.F.R. § 9.37(a)(3)

³⁹ Proposed 50 C.F.R. §§ 29.43–29.44.

⁴⁰ *Id.*

⁴¹ DEIS at 1-6.

because existing state and federal regulations will be sufficient to protect refuges from existing operations.⁴² This strategy improperly delegates FWS' duty to protect refuge resources to other State and Federal agencies. Furthermore, enforcement of existing State and Federal laws is insufficient to meet the standards for refuge protection under the NWR Organic Act. Although it is not always possible to regulate existing oil and gas wells exactly the same way as new operations, FWS should impose reasonable regulations that will protect refuge resources from continuing damage.

FWS mistakenly states that the administrative and operational costs of regulation on the Service and operators could be disproportionate to the environmental benefits of regulating existing operations.⁴³ The environmental benefits of bringing existing operations with outdated technology into compliance are significant. Forcing operators to cover open pits will reduce mortality of birds and other wildlife. Establishing noise controls or buffers will enhance the quality of habitat, especially for colonial nesting birds whose populations can be impacted by noise near nesting areas. Congress' conservation mandate for the Refuge System requires regulating existing operations on federally-owned land within refuges.

A. Threats to Refuges From Existing Operations.

The threats to refuges from existing operations are similar to those threats from new operations outlined in Section I.A. above. However, the magnitude of these impacts is likely more severe because these operations occur on refuge lands. Any spills would directly impact refuge resources. For example, existing oil and gas operations on the Catahoula NWR are "often associated with oil spills; dust/erosion/hydrological alteration/loss of habitat from oil field roads; loss of habitat; erosion on pipeline rights-of-way; and air, water, soil, sediment, and biota

⁴² 80 Fed. Reg. at 77204.

⁴³ 80 Fed. Reg. at 77204.

pollution.⁴⁴ Operations with open pits on refuges threaten the migratory birds and waterfowl that many refuges were created to protect.

FWS believes companies will do the right thing because protecting refuges is in their best interest.⁴⁵ The opposite is more likely to be true. Companies have an incentive to operate under the fewest regulations they can to maximize the return on their operations. FWS must assert its authority to protect refuges and ensure that wildlife come first in refuges.

B. Other State and Federal Laws Are Insufficient to Meet FWS' Conservation Mandate For NWRs.

FWS incorrectly believes that implementation of existing State and Federal laws will adequately protect refuges from existing oil and gas operations.⁴⁶ If existing laws adequately protected refuges the proposed rule would not be necessary. Instead, existing Federal and State laws have gaps that allow existing oil and gas operations to threaten wildlife and wildlife habitat as well as compromise the mission of individual refuges and the Refuge System as a whole. Moreover, other State and Federal laws applicable to oil and gas operations do not set standards based on wildlife conservation and are insufficient on their own to protect refuges and refuge resources.

Existing federal air pollution laws are insufficient to comply with the Organic Act's conservation mandate. For example, the New Source Performance Standards (NSPS) under the Clean Air Act apply only to operations that were constructed or modified after August 2011.⁴⁷ All existing oil and gas operations on refuges constructed before 2011 would not have to comply with the NSPS' restrictions. If existing oil and gas operations are covered by NSPS regulations, they may emit up to six tons per year of volatile organic compounds from storage pools without

⁴⁴ Catahoula CCP at 53.

⁴⁵ *See, e.g.*, DEIS at ix.

⁴⁶ 80 Fed. Reg. at 77204.

⁴⁷ 40 C.F.R. § 60.5365.

regulation.⁴⁸ This amount of pollution allowed under the NSPS could harm wildlife in refuges or interfere with wildlife-dependent recreation. More generally, the Clean Air Act rarely distinguishes between the quality of the environment receiving pollution. The Prevention of Significant Deterioration (PSD) program provides for extra environmental standards in Class I areas, but only twenty-one NWRs fall into that more protective designation.⁴⁹ Relying solely on Clean Air Act requirements to protect refuges from existing oil and gas operations does not meet the Organic Act's conservation mandate.

The Clean Water Act is also insufficient to meet the NWR Organic Act's conservation mandate. The NPDES stormwater permitting program, which limits runoff of pollutants from industrial sites, exempts many oil and gas drilling facilities from any regulation.⁵⁰ A stormwater permit is necessary only when the oil or gas facility discharges a "reportable quantity" of oil.⁵¹ A reportable quantity is that amount of pollution that violates a water quality standard, causes a film, sheen, or discoloration of surface water, or causes a sludge or emulsion to be deposited beneath the surface of the water or on the shoreline.⁵² Using this standard as the trigger for regulation precludes oversight until damage to a refuge has occurred, instead of preventing that damage in the first place. The NPDES stormwater permitting program for oil and gas operations also ignores the harmful effects that low level discharges of oil and other pollutants can have on ecosystems. Relying on the Clean Water Act to protect refuges from existing oil and gas operations will lead to continued contamination on refuges that violates the Organic Act.

⁴⁸ 40 C.F.R. § 60.5365(e).

⁴⁹ DEIS at 3-6.

⁵⁰ 40 C.F.R. § 122.26(a)(2)(ii).

⁵¹ 40 C.F.R. § 122.26(c)(1)(iii).

⁵² 40 C.F.R. § 110.3.

As FWS recognized in the proposed rule, few state regulations on oil and gas operations address “protections necessary for wildlife and its habitat.”⁵³ Only 33% of states’ oil and gas regulations meet the State Review of Oil and Natural Gas Environmental Regulations’ guidelines for wildlife and environmental impacts.⁵⁴ Twenty-eight states allow the use of open pits that pose risks to wildlife.⁵⁵ In its DEIS, FWS noted that the proposed “requirements pertaining to non-Federal oil and gas development in refuges would often be complementary to *and beyond* State requirements.”⁵⁶ If FWS believes it is necessary to go beyond State law requirements for new operations that will use state of the art technology, then it is certainly necessary to go beyond State regulations for existing oil and gas wells that likely use outdated and potentially hazardous methods.

Relying on a patchwork of state laws violates FWS’ duty to conserve the Refuge System as a whole. As FWS acknowledges, state laws and regulations vary considerably, “particularly in addressing impacts to surface owners and wildlife.”⁵⁷ FWS plans to assimilate those parts of each State’s laws that do not conflict with the proposed regulation.⁵⁸ Applying the proposed rule in states with less protective oil and gas operations would hold back achievement of system-wide missions, such as providing migratory pathways for birds. Congress created many refuges along migration corridors, such as the Mississippi River, to give migratory birds resting stops and habitat along their travels. Poor oil and gas regulation at one stop on a migration corridor puts the entire system of refuges along that corridor at risk. Strong regulations on existing operations that

⁵³ 80 Fed. Reg. at 77205.

⁵⁴ DEIS Appendix B. U.S. FWS, *An Assessment of State Oil and Gas Regulations* B-20 (Aug 2013).

⁵⁵ DEIS Appendix B-14.

⁵⁶ DEIS at 1-21 (emphasis added).

⁵⁷ DEIS at 4-6.

⁵⁸ 80 Fed. Reg. at 77204.

apply throughout the U.S. are necessary to minimize impacts of existing oil and gas operations on wildlife refuges and the wildlife that depend upon them.

C. The NPS Recognized That Existing Operations Harm National Parks and Proposed Rules to Regulate Existing Operations.

The Park Service has acknowledged that grandfathered operations can cause problems on Park lands and interfere with the management goals set by Congress. Currently, 45% of active wells within National Park boundaries are exempt from regulation as existing operations. These existing operations have caused “20 instances of hydrocarbon spills and leaks, 3 instances of gas venting, 2 instances of notable noise issues, and 3 instances of notable hydrocarbon odors emanating from the well site.”⁵⁹ In response to the threats posed by existing operations, NPS’s proposed rule on non-federal oil and gas management requires previously exempt operators on federally-owned Park lands to obtain an Operations Permit to continue drilling.⁶⁰

FWS should regulate existing operations on federal lands like the NPS has done. As noted in Section I.B.ii., the NPS and FWS share similar missions for managing their respective land systems. NPS’ response to the threats has been further regulation. In contrast, FWS’ response to ongoing threats posed by existing operations is to fall back on existing regulations, which the agency acknowledges are generally not protective of wildlife and wildlife habitat.

D. Our Suggested Changes to FWS’ Proposed Rule for Existing Oil and Gas Operations in Refuges.

Although it is impossible to regulate the siting of existing operations because wells have already been drilled, FWS can still ensure that remaining impacts are minimized to meet the proposed rule’s least damaging, technologically feasible standard. Proposed Park Service regulations on existing operations provide a good template for the rules FWS should adopt to

⁵⁹ 80 Fed. Reg. at 65577.

⁶⁰ 80 Fed. Reg. at 65577.

protect refuges.⁶¹ FWS must ensure that existing operations minimize spills, noise, air emissions, flaring, stormwater runoff, fugitive dust, and artificial dust. Existing operations must cover open-topped tanks or ponds containing oil or drilling wastes and byproducts to prevent mortality of birds and other wildlife. Although not every operation may be able to fully meet modern standards, FWS should ensure that existing operations meet the proposed rule’s technologically feasible, least damaging standard for oil and gas operations.

III. Comments on the Draft Environmental Impact Statement.

NEPA is “our basic national charter for the protection for the protection of the environment.”⁶² The Act has two purposes: to ensure that federal agencies carefully consider the environmental consequences of their actions and to guarantee that the relevant decisionmaking information is available to the public.⁶³ As the U.S. Supreme Court has explained, “by focusing the agency’s attention on the environmental consequences of a proposed project, NEPA ensures that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast.”⁶⁴

FWS correctly analyzed regulating new and modified operations on privately-owned land and regulating existing operations on federal land, but failed to choose this rule as its preferred alternative. The DEIS carried three alternatives forward for detailed study. Alternative A, the no-action alternative, would continue regulating private oil and gas operations under existing regulations. Alternative B is the proposed rule. Alternative C, the environmentally preferred

⁶¹ See Proposed 36 C.F.R. §§ 9.50–9.53.

⁶² 40 C.F.R. § 1500.1(a).

⁶³ See, e.g., *Nat’l Parks Conservation Ass’n v. Jewell*, 965 F.Supp.2d 67, 74 (D.D.C. 2013).

⁶⁴ *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989).

alternative, would regulate new and modified oil and gas operations on private land inside and outside refuge boundaries, as well as regulate existing operations on refuges.⁶⁵

FWS should make Alternative C its preferred alternative, with some modifications. As explained above, Alternative B, the proposed rule, violates the NWRSAA by failing to protect refuges from existing oil and gas operations on federal land and new oil and gas operations on private land. FWS states that Alternative B is preferable mainly because Alternative C, which would regulate existing operations and new operations on private land, would lead to instances of operators locating new wells on refuge lands. FWS should insist that all operators drill off the refuge if feasible. Additionally, Alternative C provides that the Service would waive the regulations if the agency did not “reasonably expect that operational requirements are needed” to protect refuges from operations on inholdings.⁶⁶ Instead, operators should be required to get a permit for all operations on inholdings, unless the operator can show that her operation will not cause more than minimal impacts, both individually and cumulatively, on refuge resources.

The DEIS does not contain enough information to support FWS’ conclusion that the administrative and operational costs of regulating existing operations within refuges outweigh the environmental benefit. FWS justifies its exemption for existing operations by claiming that most negative environmental impacts from existing operations have already happened, so applying the proposed regulations would not produce many environmental benefits.⁶⁷ The EIS does not contain information on what the impacts from existing operations are or whether those impacts are difficult to avoid. Without this information, FWS’ conclusion that the costs of regulation outweigh the benefits to refuges is conclusory.

⁶⁵ DEIS at iii–v.

⁶⁶ DEIS at 2-13.

⁶⁷ 80 Fed. Reg. at 77204.

The DEIS also fails to acknowledge how individual refuges have been impacted by oil and gas operations on private land and operations on federal land within refuges. By failing to include this information, FWS has not taken a hard look at the environmental effects of its decision to exempt new oil and gas operations on private land and existing operations on federal land from regulation. FWS should include relevant information from CCPs for refuges, such as the Catahoula and Patoka River NWR CCPs referenced above, that experience ongoing harms from oil and gas operations within and outside their boundaries.

CONCLUSION

Most of the proposed rule will protect migratory birds, waterfowl, and other wildlife that call the National Wildlife Refuge System home. But FWS must do more to put wildlife and wildlife conservation first and conserve refuges for current and future generations of Americans. The proposed rule would exempt new and modified oil and gas operations on private land, both within and outside refuge boundaries, from all regulation. Likewise, existing operations within refuge boundaries would be exempt. FWS should follow the example of its sister agency the National Park Service and regulate new oil and gas operations on inholdings within refuge boundaries and lands outside refuge boundaries and existing oil and gas operations. In order to meet the conservation mandate set by Congress, FWS must go further than NPS' proposed rules and regulate all operations on land outside refuge boundaries that have more than a minimal surface or subsurface effect on refuge resources. Doing any less violates FWS' responsibilities under the NWR Organic Act and elevates private energy extraction over conservation, recreation, and the other priority uses Congress envisioned for this public resource.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter Murrey". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Peter Murrey
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A handwritten signature in black ink, appearing to read "Darin Schroeder". The signature is cursive and includes a small "AM" mark below the first letter.

Darin Schroeder
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Cook Inletkeeper
Northern Alaska Environmental Center
The Wilderness Society

February 9, 2016

Public Comments Processing

Attn: FWS–HQ–NWRS–2012–0086

Division of Policy, Performance, and Management Programs

U.S. Fish and Wildlife Service, MS: BPHC

5275 Leesburg Pike

Falls Church, VA 22041-3803

Submitted via: www.regulations.gov

Re: Comments on the Proposed Rule on Management of Non-Federal Oil and Gas Rights, 50 CFR Part 29 [Docket No. FWS–HQ–NWRS–2012–0086; FXRS12610900000–156–FF09R24000] RIN 1018–AX36, 80 Fed. Reg. 77200-77229 (Dec. 11, 2015)

Dear Sir or Madam:

Thank you for the opportunity to submit comments on this proposed rule on managing non-Federal oil and gas development on the lands and waters of the National Wildlife Refuge System (“NWRS” or “System”) and the associated draft Environmental Impact Statement (EIS).¹ This letter builds on the comments that the Northern Alaska Environmental Center and The Wilderness Society submitted on April 25, 2014 on the Advance Notice of Proposed Rulemaking; we feel that many of that letter’s technical points were insufficiently incorporated into this proposed rule. We ask that those previous comments be incorporated into the record for this rule, and we sincerely hope the U.S. Fish and Wildlife Service (FWS or the Service) will incorporate many of that letter’s technical suggestions into the final rule.

In this letter we address the integral importance of refuges in Alaska within the nationwide System, their unique values, and the applicability of the proposed regulations to these Refuges; climate change impacts by and to refuges; the impacts of directional drilling and our opposition to the proposed exemption in the proposed rule; and needed, additional operational standards based on our experience with oil and gas operations in Alaska and across the nation.

¹ Draft Environmental Impact Statement on National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Activities, <http://www.fws.gov/refuges/oil-and-gas/pdfs/Draft-EIS-NWRS-Revision-of-Regulations-Governing-Non-Federal-Oil-and-Gas-Activities-12-4-15.pdf>, Nov. 2015.

Introduction and Background

These regulations should ensure that all refuges are protected to the fullest extent for their intended and mandated purpose—conservation. Here in Alaska, where refuges harbor some of the last intact ecosystems in North America, protections for these fragile landscapes in their natural diversity of fish, wildlife, and habitats are critically important.

Congress specifically gave the FWS the authority to administer the NWRS through the National Wildlife Refuge System Administration Act of 1966 (NWRSA). This act gave the FWS the responsibility to carry out the mission for the System, as amended by the National Wildlife Refuge System Improvement Act of 1997 (NWRISA), i.e., to “administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”

Congress also required the Secretary to “ensure that the biological integrity, diversity and environmental health of the System are maintained for the benefit of present and future generations of Americans,” (16 USC §668dd(a)(4)), and to maintain adequate water quality and quantity to fulfill the purposes of the System (NWRISA), as well as a range of purposes for individual refuges including those established through original withdrawals and as specified through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA).

The Service should emphasize in the final rule that federal statutes and case law have reserved dominant authority for managing national wildlife refuges to the Service, which extends to oil and gas development (*see* National Wildlife Refuge Administration Act, as amended by the Game Range Act (Pub. Law 94-223); National Wildlife Refuge System Improvement Act (16 U.S.C. §§ 668dd-668ee); *Trustees for Alaska v. Watt*, 524 F. Supp. 1303 (D. AK 1981), *aff’d* 690 F. 2nd 1279 (9th Cir. 1982).

The Service also should clearly establish in the regulations its authority to manage all federal lands, waters, and interests in lands and waters within the National Wildlife Refuge System as Congress defined in the NWRISA as including “waters, or an interest in land and waters,” at 16 USC 668ee(11). We agree with the Service’s scope of the proposed regulations in § 29.40(b) “that these regulations apply on and within waters subject to the jurisdiction of the United States within that unit, including navigable waters and areas within their ordinary reach... irrespective of ownership of submerged lands, tidelands or lowlands, and jurisdictional status” (80 FR 77206).

Fundamentally, oil and gas exploration, development, and production are incompatible with the purposes of the System. Commercial operations are prohibited in refuges unless they support the

purposes of refuges and the System, and are found to be compatible through a Refuge Comprehensive Conservation Plan. Oil and gas activities have no place in Wilderness Areas, Wilderness Study Areas, and recommended or proposed Wilderness areas within refuges, and the Service should use its full legal authorities to prevent such operations.

The Government Accountability Office and others have documented since 2003 that oil and gas activities – whether grandfathered into refuges or associated with unregulated non-Federal interests – have had negative impacts in direct conflict with the mission and goals of the System and may be incompatible with the purposes of individual refuges.² In Alaska, we have seen significant negative impacts of oil and gas seismic exploration and development.³ In the Kenai National Wildlife Refuge for example, there has been fragmentation of wildlife habitats for brown bears and other wildlife,⁴ disturbance of denning bears, wolves, and lynx during seismic exploration,⁵ and contamination of soils and groundwater.⁶

The Service must do more than “avoid or minimize” non-Federal oil and gas operations on System lands and waters. It must provide sufficient protections to uphold the purposes of refuges and the System. *The agency must sufficiently consider adverse impacts to fish and wildlife, plants, hydrologic values, water quality and quantity, scenic values, wilderness values such as solitude, remoteness and naturalness, resiliency in the face of climate change, and in Alaska, subsistence resources and uses.*

We recognize that land ownership patterns in Refuges are complex and agree that the rulemaking is necessary for the Service to create a consistent and reasonable set of regulatory and management controls for non-Federal oil and gas operations, including in Alaska. This letter provides a number of recommendations for improvements in the proposed rule, and we also endorse the comments made in the February 9, 2016 letter submitted by Defenders of Wildlife and others.

² GAO 2003. <http://www.gao.gov/products/GAO-03-517>.

³ The Wilderness Society 2003, [Broken Promises: The reality of big oil in America’s Arctic](#); The Wilderness Society 2009, [Broken Promises: The reality of oil development in America’s Arctic, 2nd Edition](#).

⁴ Suring, L.H., K.R. Barber, C.H. Schwartz, T.N. Bailey, W.C. Shuster, and M.D. Tetreau. Analysis of cumulative effects on brown bears on the Kenai Peninsula, Southcentral Alaska. Int. Conf. Bear Res. Manage. 10.

⁵ Staples, W.R. and T.N. Bailey. 1998. Disturbance of and a human fatality related to brown bears in dens during winter seismic exploration on the Kenai National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service. Kenai National Wildlife Refuge, Alaska.

⁶ Tiffany S.A. Parson, 2001, Kenai National Wildlife Refuge contaminant assessment, U.S. Fish and Wildlife Service, Anchorage, Alaska, 73 pp. http://www.fws.gov/alaska/fisheries/contaminants/pdf/cap_kenai.pdf
National Audubon Society and Defenders of Wildlife 2002, [Toxic tundra: oil drilling in an Alaskan Wildlife Refuge leaves a toxic legacy of oil spills and pollution](#), 7 pp.

Special Values of Refuges in Alaska

From the Arctic Refuge to Alaska Maritime, the sixteen Refuges across Alaska support a wide variety of fish and wildlife habitats and populations in their natural diversity, and have a long history of supporting traditional subsistence ways of life and cultural values for Alaska Native peoples.

Refuges in Alaska are managed as integral parts of the System but also as units of the landmark conservation system established by ANILCA. The overarching purposes of ANILCA are to preserve nationally significant lands and waters for their unrivaled scenic values of natural landscapes, extensive unaltered ecosystems, and wilderness resource values, among many other purposes, for the benefit, use, education, and inspiration of present and future generations.⁷

In Alaska, Congress has afforded special protections by designating Wild and Scenic Rivers in seven Refuges and Wilderness in ten Refuges. Additionally, The Arctic Refuge is the only refuge established specifically to “preserve unique... wilderness values.” Congress designated the largest area as Wilderness of any Refuge (Mollie Beattie Wilderness), and Service-proposed Wilderness areas including the Coastal Plain were sent to Congress by President Obama in 2015. Oil and gas leasing, exploration, development and production are prohibited in the Arctic Refuge by law. The final rule needs to explicitly mention that Sections 1002-1003 in ANILCA (16 USC §§ 3142-3143) prohibit oil and gas leasing, exploration, development, and production in the Arctic Refuge.

Seven Refuges were established prior to the Alaska Native Claims Settlement Act of 1971 (ANCSA) and nine new refuges were added by ANILCA. Subsistence is an important consideration for refuges in Alaska.⁸ In each of the nine Refuges created by ANILCA, and most Refuges expanded by ANILCA, Congress explicitly identified subsistence as a purpose.⁹ The Kenai Refuge, where many oil and gas activities take place due to unique historical factors and complex land ownership, is the only refuge that does not provide for continued subsistence uses by local residents as a specified refuge purpose,¹⁰ although its fish and wildlife resources support subsistence activities in the broader region’s lands and waters.

Oil and gas exploration and development has had a significant adverse impact on subsistence resources and opportunities for continued subsistence use in Alaska, particularly from industrial

⁷ See ANILCA § 101(a)-(c); see also, The Wilderness Society, Native American Rights Fund, and Trustees for Alaska, 2001, ANILCA Citizen’s Guide, 87 pp.

⁸ 16 U.S.C. § 3101, § 3114.

⁹ See, e.g., ANILCA § 302(1) (“The purposes for which the Alaska Peninsula National Wildlife Refuge is established and shall be managed include...to provide ... the opportunity for continued subsistence uses by local residents”).

¹⁰ ANILCA § 303(4).

activities on Alaska's North Slope and due to the *Exxon Valdez* oil spill.¹¹ Subsistence should be addressed in the Final EIS as a vital purpose of refuges in Alaska and as a cultural resource which has significant socioeconomic values¹² that could be impacted by oil and gas activities and infrastructure. Subsistence resources and use also should be addressed in the final rule, including in the informational and operational requirements. For example, proposed Section 29.94(f) should require subsistence resource and use area information, maps, and reports included in applications and proposed Section 29.94(o)(1-3) should add subsistence resources in the list after cultural resources so that mitigation actions and alternatives are addressed for all refuges in Alaska.

Other important purposes of refuges in Alaska are to fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats, and to ensure adequate water quality and necessary water quantity within refuges to conserve the fish and wildlife populations and habitats in their natural diversity. Protection of federally-reserved water rights and other interests in lands and waters is critical for refuges in Alaska. The full application of the Public Trust Doctrine for refuge lands, waters, and interests in these should inform the nature of the duties of the Service to manage these lands.¹³ The final regulations should adequately address impacts to all Refuge purposes.

Applying the Regulations to Alaska Refuges

Title XI of ANILCA and its implementing regulations (43 CFR 36) establish a streamlined permitting process for granting access to rights-of-way for transportation and utility corridors across federal lands in Alaska, including national wildlife refuges (Pub. Law 96-487 §§ 1101-1113). The title states that owners of property interests (including both inholdings and subsurface rights underlying public lands) that are within or are effectively surrounded by a federal conservation system unit shall be granted "adequate and feasible access" to those property interests for economic or other purposes (Pub. Law 96-487 § 1110(b)). Such rights are subject to reasonable regulations issued by the Secretary, however, to protect the natural and other values of such lands. While the Title XI regulations control access to private properties, they do not (nor were they intended to) control activities on those lands that may affect surrounding public lands and resources.

¹¹ National Research Council. 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. <http://www.nap.edu/catalog/10639/cumulative-environmental-effects-of-oil-and-gas-activities-on-alaskas-north-slope>; Exxon Valdez Trustees Council. 2014. *Exxon Valdez Oil Spill Restoration Plan 2014 Update Injured Resources and Services, Adopted November 19, 2014* <http://www.evostc.state.ak.us/static/PDFs/2014IRSUpdate.pdf>

¹² <http://ankn.uaf.edu/Curriculum/Books/DoesOneWay/SUBSISTENCE%20AND%20ECONOMIC.html>

¹³ Pamela Baldwin, 2003, Legal issues related to proposed drilling for oil and gas in the Arctic National Wildlife Refuge, CRS RL31115, http://digital.library.unt.edu/ark:/67531/metacrs10023/m1/1/high_res_d/RL31115_2003Apr22.pdf

The preamble to the proposed rule states that wherever there is not a conflict with ANILCA Title XI regulations, the new regulations will apply to non-federal oil and gas operations on national wildlife refuges in Alaska (80 FR 77206). The proposed rule itself identifies where it will defer to Title XI regulations on NWRS units in Alaska, including access fees (proposed 50 CFR § 29.140(b)), certain penalties (proposed 50 CFR § 29.190(f)), and appeals (proposed 50 CFR § 29.200).

The proposed rule makes an error, however, by referencing ANILCA Title XI/Access to inholdings and implementing regulations under procedures for operations permit application review (proposed 50 CFR § 29.101(c)), creating uncertainty and confusion over where and when the Title XI regulations preempt the Service's new non-Federal oil and gas regulations. It is essential that the final rule mark with clarity the distinction between access permitting (covered by Title XI regulations for refuges in Alaska) and operational permitting (covered by the Service's new oil and gas regulations). The Service also should avoid citing as examples only some of the new operational regulations as applying to NWRS units in Alaska (e.g., 80 FR 77206), raising doubt about the application of the rest.

Section 29.101 of the proposed rule explains how the Service will conduct the initial application review process for obtaining an oil and gas operations permit. Unfortunately, proposed Section 29.101(c) states in overly broad language, “[w]hen ANILCA title XI/Access to inholdings applies, 43 CFR 36.5 governs the review.” While the Title XI regulations provide a streamlined permitting process for granting access to rights-of-way and control the development of terms and conditions for granting access to property interests within refuges, they were never intended to address, nor do they cover, operational activities once access had been granted. It is imperative that the final rule state that all operational activities on refuges in Alaska beyond the purview of Title XI in ANILCA will be governed under the new regulations.

Furthermore in proposed Section 29.42(c), the final rule should explicitly mention that Sections 1002-1003 in ANILCA (16 USC §§ 3142-3143) prohibit oil and gas leasing, exploration, development, and production in the Arctic National Wildlife Refuge.

The Service acknowledges in the regulations that certain provisions apply to geological and geophysical exploration for oil and gas within the coastal plain of the Arctic National Wildlife Refuge (“§ 29.118 (e) For geological and geophysical exploration for oil and gas within the coastal plain of the Arctic National Wildlife Refuge, the regulations at 50 CFR part 37 apply,” 80 FR 77225-77226). However, the statutory authority and obligation to review and approve geological and geophysical exploration plans per Section 1002 of ANILCA (16 USC § 3142) (and associated regulations at 50 CFR part 37) has expired, see Judge Sharon L. Gleason, Memorandum Decision and Order, U.S. District Court for the District of Alaska (State of Alaska v. Jewell, et al. Case No. 3:14-cv-00048-SLG). The final rule should clarify that the Service

cannot accept further applications for geological or geophysical exploration for oil and gas on the coastal plain of the Arctic Refuge.

The ANILCA Sec. 1002 (16 USC 3142) and 1003 (16 USC 3143) prohibitions on oil and gas in the Arctic National Wildlife Refuge also should be explicitly mentioned in the regulations in § 29.190 “What Acts are prohibited under this subpart” and in other relevant sections.

Climate Change

The Service has stated that “climate change affects every national wildlife refuge. One of the most prevalent and challenging issues for the Refuge System is sea-level rise, affecting 173 refuges.”¹⁴ The proposed regulations and the accompanying Draft EIS, however, fail to provide adequate consideration of the effects of climate change on Refuges, and the increasing stresses to fish, wildlife and habitats posed by oil and gas development.

While the Draft EIS evaluated climate change effects on refuge resources in Chapter 3, Affected Environment, it failed to adequately address the environmental consequences and alternative steps that could be taken in the proposed regulations including the operational standards. The Service failed to provide sufficient analysis of the direct, indirect, and cumulative effects of greenhouse gas emissions of non-Federal and Federal oil and gas operations on refuges, and failed to provide a comprehensive plan for managing these increasing risks to refuge resources across the System, by merely considering to do it piecemeal on a permit by permit basis (Draft EIS 1-16, 1-17). Note our recommendations in the Operating Standards section, below, for additions to Proposed Sections 29.111(f-g) to address greenhouse gas emissions from wells and other oil and gas infrastructure located on refuges.

Additionally, climate change-caused river and coastal erosion, permafrost melt, increased severity and frequency of storms and flooding, etc., will have impacts on refuge oil and gas facilities and operations. These events will have increasingly serious effects on refuge lands, waters, and resources. The informational and operational requirements for permits for existing, modified, and new oil and gas infrastructure need to address these likely climate change impacts.

Directional Drilling

The Service should regulate oil and gas operations from non-Federal lands that are directionally drilled under the Service-administered surface estate, as was discussed in Alternative C. Exempting such drilling from regulation is likely to result in significant, adverse environmental consequences to refuge resources. The presumed benefits of keeping such drilling outside Refuges are greatly exaggerated, as discussed below.

¹⁴ <http://www.fws.gov/refuges/planning/ClimateChangePlanning.html> (accessed 7 Feb 2016)

Concentrating oil and gas activities and major infrastructure along refuge boundaries – often rivers, lakes or coasts– will impact refuge resources, public enjoyment, and subsistence uses. Typically, there is pressure for seismic surveys to take place within refuges in advance of directional drilling, and again later on during the life of the oil and gas fields. A directional drilling exemption invites the oil and gas industry to get a “foot in the door” of refuges with less agency and public scrutiny, but without assurance that future wells to tap into known or potential resources would not be proposed within the refuge boundaries, thereby compounding adverse impacts over time.

Additionally, the value of a directional drilling exemption in reducing refuge impacts is not based on evidence. While the Service calls the directional drilling exemption to be an “incentive” for FWS to not exercise its jurisdiction (80 FR77204), factual evidence was not provided to evaluate this statement, nor to evaluate the direct, indirect and cumulative effects to refuge purposes and resources from such an exemption.

In the preamble of the proposed rule, the Service explains its proposal not to require permits or impose conditions on directional drilling through the federally-owned subsurface stating that oil and gas operators thus would have a strong incentive to locate surface operations outside of refuge areas, which would reduce the impacts of surface activities on the refuge (80 FR 77204). This rationale is unconvincing. The environmental effects of surface spills and blowouts, which are among the most common and most devastating forms of harm from oil and gas activities, would not necessarily be less devastating because they originate at the margin of a refuge rather than within a refuge. In addition, subsurface contamination resulting from improperly cased wells, uncontrolled propagation of fractures, or long-term degradation of casing materials may have serious impacts to groundwater resources, and hydrologically connected surface waters within refuge boundaries, regardless of whether a well enters the aquifer from a surface location within or at the margins of a refuge.

Additionally, directional drilling would be preceded by seismic exploration activities, which are conducted using convoys of bulldozers and “thumper trucks” that travel over extensive areas of the tundra. These activities, which could take place throughout the life of an oil or gas field, can cause severe and long lasting damage to the land and must take place over (i.e., within refuge boundaries)—not outside—the area to be drilled. The extent to which seismic surveys both pre-drilling and throughout the life of oil fields are avoided within refuge boundaries, if wells were drilled from outside them, is not recognized by this exemption and clearly undermines its value.

FWS should fully evaluate the impacts of directional drilling that may take place adjacent to refuge boundaries, including air pollution and chemical spills; the effects on hydrology including groundwater, taliks, and springs and federally-reserved water rights; the impacts to refuge visual resources; noise impacts to fish, wildlife, recreation, and subsistence resources and uses; impacts

on wilderness values, etc.. Directional drilling should not be allowed into Wilderness Areas or Wilderness Study Areas because it is a commercial activity which is prohibited in the National Wilderness Preservation System.

The final rule also needs to regulate oil and gas operations that directionally drill under the Service-administered surface estate from non-Federal lands. The proposed rule exempts directional drilling from non-Federal lands outside refuges or from non-Federal inholdings to access minerals underneath the Service-administered surface estate (80 FR77204; proposed 50 CFR § 29.80). These operations outside NWRs boundaries could still damage resources and disturb wildlife inside refuges, both through surface development near refuges, and impacts from directional drilling on public resources beneath the refuge surface.

The NWRsIA both requires and authorizes the Service to extend these regulations to directional drilling underneath NWRs units from non-Federal surface locations. The NWRsIA authorizes the Service to incorporate protective conditions on oil and gas activities occurring from a non-Federal surface location which involves subsurface directional drilling under refuges. First, to the extent that surface operations outside refuge boundaries or from non-Federal inholdings require access through federally-owned subsurface areas, the Act imposes a permit requirement, even for those who have pre-existing rights to access the oil and gas held in the subsurface (see 16 USC § 668dd(c); *Avoyelles*, 647 F.3d at 581, 581 n.4; *Burlison*, 533 F.3d at 434–35). Consequently, in many cases, directional drilling will physically invade subsurface areas that are Federally-owned as the augur and well casing will pass through layers of rock, including groundwater-bearing aquifers that are not part of an operator's mineral right and therefore this entry and physical occupation of the federally-owned subsurface requires a permit under 16 USC § 668dd(c).

As an important illustration of the likely impacts of nearby directional drilling, the Corps of Engineers commissioned noise and visual resources studies to assess the potential impacts of a proposed oil and gas project on State of Alaska lands near the Arctic Refuge as part of an EIS and permitting review of ExxonMobil's Point Thomson gas condensate development. The proposed project included three production well sites along the Beaufort Sea coast, with one drill site within two miles of the Arctic Refuge boundary comprised of the Canning River delta. This is an area rich in migratory birds, fish, and polar bear denning, as well as a popular recreationally-floated river, and a key subsistence resource and use area.

The Corps' important research reported negative impacts from all proposed alternatives to the refuge's wildlife and wilderness values in the Coastal Plain, as well as within designated Wilderness due to the close proximity of the oil drilling. The Draft EIS predicted moderate impacts to subsistence and traditional land use, moderate effects to wilderness values that would be essentially irreversible, and major effects to wilderness-quality recreation particularly along Canning River. The new industrial facilities (drill rigs, towers, flare stacks, support facilities, air

traffic and lighted facilities) would be seen across a long viewshed with maximum visibility exceeding 100 miles from ridges and peaks in the Sadlerochit Mountains and Brooks Range within designated Wilderness of the Arctic Refuge.¹⁵ The noise study reported that increased noise levels could be heard 21 miles away and into the Arctic Refuge.¹⁶

Finally, there are no circumstances where the Service should allow the use of directional drilling as a justification to open Arctic National Wildlife Refuge to oil and gas exploration, development, or production.

Operating Standards

The Service wrote the proposed operating standards, Sections 29.110-29.119, as “performance standards” rather than providing “prescriptive standards.” The problem with relying on performance standards is that they can be very difficult – or even impossible – to enforce. Prescriptive standards, in contrast, would “[e]nsure use of technologically feasible, least-damaging methods,” as required by proposed Section 29.110. To ensure compliance with this key purpose of the Operating Standards, our organizations believe there is the need in at least the following instances to require prescriptive standards:

- The secondary containment rules, Section 29.111(b), should state that containment must be 110% of the largest container, as is required in many states. The language in the proposed rule, “sufficient storage capacity to contain, at a minimum, *the largest potential spill incident*” (emphasis added), could be subject to interpretation by operators who might say that it is unlikely that the largest container would be fully discharged into the secondary containment system when, in fact, that is a definite possibility. There is no reason for FWS to spend time arguing with operators as to what is “the largest potential spill incident” when issuing operating permits.
- An expanded Section 29.111(c) should have prescriptive requirements for disposal of wastewater and drilling wastes. These contaminated liquids (including produced water) and solids should be required to be reinjected at drilling sites for disposal unless such reinjection is shown to be feasible due to the local geology. Contaminated or treated wastewaters should not be allowed to be discharged to refuge waters, as such discharges would necessarily degrade refuge resources.
- Proposed Section 29.111(d) needs prescriptive requirements to minimize noise, air emissions, and the fuel spill potential in refuges. As currently written, the proposed section states that permittees must “[u]se engines that adhere to current Federal and State emission standards.” This section instead should state that all engines used must be

¹⁵ Visual Resource Assessment, Appendix N, DEIS, p. 94. The primary study radius was only 20 miles.

¹⁶ (ES-57) This soundscape study acknowledged natural quiet as a resource. It had some limitations, e.g. due to equipment failure, audio recordings at the Canning River takeout site – the closest refuge area used often by recreational visitors - were unavailable. Furthermore, the maximum distance within the Refuge that noise from the project could be heard was not determined due to the limited number of study locations.

powered by natural gas or electricity unless the permittee explicitly shows the infeasibility of such energy sources.

- Proposed Section 29.111(e) on roads and fugitive dust emissions needs to be expanded to include a requirement to minimize the footprint of oil and gas operations including roads. The requirements should ensure that wells, pipelines, and roads – even those with different operators and users – are clustered so that habitat degradation is minimized.
- Proposed Sections 29.111(f-g) are far too limited and non-specific in their prevention of releases to air, including greenhouse gases like natural gas/methane. Added provisions need to include:
 - i. a requirement to stop all well venting except for emergency situations.
 - ii. mandatory use of leak detection and repair, a well-known technology to identify leaking components, to ensure that any released air pollutants are accounted for and that leaking components are repaired.
 - iii. a requirement for industry to collect data in order to accurately calculate the amount of methane that is vented, flared, and leaked from operations on refuge lands.
- Section 29.111 should contain additional provisions covering flowline, gathering, and transmission pipeline requirements. These requirements should address at a minimum corrosion prevention, leak detection including performance standards (a deficiency in federal regulations and in most states), and shut-off valve location requirements to limit the size of oil releases to federal lands and waters.
- To minimize the use of toxic chemicals in refuges, Section 29.111 needs to require the use only of water-based drilling fluids (i.e., disallowing diesel-based or hydrocarbon based drilling muds and fracturing fluids).
- Section 29.112 needs to be expanded to require development of a Wildlife Interaction Avoidance Plan to ensure that workers associated with oil and gas operations minimize their interactions with wildlife and utilize non-lethal means and other best practices to address wildlife concerns whenever possible (e.g., covering interacting with bears, not operating near wildlife dens or animal kills, reporting of dead birds, etc.).
- Proposed Section 29.113 needs to ensure that water use protects the purposes of refuges for fish-bearing and non-fish-bearing waterbodies. This means that there needs to be good biologic and hydrologic information on waterbodies prior to withdrawals. Additionally, as we stated in The Northern Alaska Environmental Center/The Wilderness Society's April 25, 2014 comments, FWS should establish well setbacks from sensitive areas and water resources. For instance, wells should be at least 4,000 feet from fish-bearing water bodies, and 660 feet (1/8 mile) from other water resources.
- Proposed Section 29.116 on noise should specify that operators should utilize steel sound barriers around engines, pumps, compressors, and other noise-generating facilities; mufflers on vans and exhausts; and remote monitoring systems designed to reduce vehicle visits to a site. FWS should set maximum noise levels for oil and gas operators,

allowing increases of no more than a few decibels, at most, outside of well sites and compressor stations. In the Kenai National Wildlife Refuge, for example, generator noise can be heard many miles away, diminishing the experience of visitors to the Refuge.

- As discussed in the April 25, 2014 comments, to the extent practicable, all oil and gas operations (vehicles and equipment) should be required to be powered by natural gas or electric power rather than diesel fuel. Any vehicles and equipment that use diesel fuels must be required use “ultra-low sulfur” diesel.
- Our organizations urge FWS to prohibit in-situ waste disposal, as would be allowed under proposed Section 29.117(d)(3) which states that contaminating substances can be “neutraliz[ed]” in place.
- If hydraulic fracturing will be used on wells, in addition to reporting chemical use (proposed Section 29.121(f)), operators should be required to conduct water sampling of nearby water wells prior to and after fracturing. The results of this testing should be available to the public.
- Additionally, to prevent groundwater contamination during and after hydraulic fracturing operations, FWS should require the operator to model fracture extent prior to fracturing and to perform mechanical integrity testing of wells prior to fracturing or refracturing.

Thank you very much for your consideration and addressing these important points in the final regulations.

Sincerely,

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February 9, 2016

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Re: *FWS–HQ–NWRS–2012–0086 Fish and Wildlife Service – National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Activities and Draft Environmental Impact Statement (DEIS)*

Dear Mr. Covington:

The Center for Biological Diversity (“Center”) writes to submit the following comments on the U.S. Fish and Wildlife Service’s (“the Service” or “FWS”) proposed rule to govern non-federal oil and gas development on National Wildlife Refuge System (“NWRS” or “refuge”) lands.

The Center is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over 991,000 members and activists, including those who have visited many of the refuge lands in which non-federal oil and gas rights could be developed. The Center’s members enjoy refuges for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed rule.

We strongly support the Service’s goal to tighten regulations governing non-Federal oil and gas operations and to improve the effectiveness of the regulations in protecting fish, wildlife, and plant resources on refuges from the adverse effects of these operations. Many of the proposed changes to the regulations would fill regulatory gaps in the existing rules and significantly reduce the impacts of oil and gas operations on refuge lands. Changes that are long overdue include requiring new operations on refuge lands to obtain a permit and comply with updated environmental standards; requiring oil and gas operators to pay for the full cost of properly closing wells and cleanup and reclamation of drilling sites; and charging a fair market

fee to oil and gas operators to use federal lands or roads including for building pipelines, to access oil and gas.

The proposed rule, however, falls far short in ensuring that the Service fulfills its mandate under the National Wildlife Refuge System Administration Act of 1966 (“NWRSA”), amended by the National Wildlife Refuge System Improvement Act of 1997 (“NWRISA”), hereinafter collectively referred to as “the Refuge Act,” to “provide for the conservation of fish, wildlife, and plants, and their habitats within the System” and “ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.” 16 U.S.C.S. § 668dd(a)(4)(A)-(B). As detailed in the Center and other groups’ collective February 9 comments on the proposed rulemaking, the proposed rule irrationally exempts from permitting and regulation existing operations within refuges, drilling on private inholdings within a refuge, and directional drilling accessing minerals underlying a refuge unit from outside the refuge, among many other shortcomings.

In addition to the deficiencies discussed in the collective group comments, the proposed rule is inadequate in three major respects.

First, the proposed rule must ban hydraulic fracturing or “fracking” and other unconventional drilling and stimulation techniques, given the significant potential for fracking to degrade and impair refuge resources. In the alternative, the Service should prohibit these activities until such time as it can be shown with certainty that they are completely safe for public health, the environment, and wildlife refuge resources.

Rather than prioritizing accommodation of oil and gas operators’ access to their non-federal oil and gas rights, the Service must rigorously observe its mandate “to ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans,” and adopt rules sufficient to minimize risks from non-federal fossil fuel development affecting the lands that it administers. Fracking poses significant risks to water resources, air quality, climate change, wildlife, and seismicity. The EIS fails to study a “no fracking alternative” and these significant risks.

To the extent that this failure results from the Service’s assumption that a fracking ban or moratorium could somehow infringe on property rights, this assumption is incorrect. The Service has ample authority to ensure that non-federal oil and gas activities on its lands do not undermine the conservation of refuge resources and compliance with its duties to conserve and maintain refuge resources for future generations. Reasonable regulation of the means of exploiting a mineral right is in no way an uncompensated “taking” of property.

Second, the Service should require the public disclosure of fracking chemicals used in non-federal oil and gas operations. Its proposal to allow operators to withhold disclosure of fracking chemicals is contrary to the Service’s statutory duties and serves no valid purpose. The Service cannot make an informed decision regarding the risks posed by a proposed fracking operation unless and until it knows the chemicals used and in what quantities. A regulatory agency without knowledge of the risks involved does not constitute “oversight” in any meaningful way. Allowing the inherently dangerous practice to continue without such basic

information violates the Service's duty under the Refuge Act to conserve, manage, and restore the fish, wildlife, and plant resources and their habitats in such manner for the benefit of present and future generations.

Finally, the Service's EIS is flawed in its analysis of the proposed rulemaking's environmental consequences. The EIS concludes that Alternative B—which exempts existing operations with or without a Service-issued permit, non-Federal operations that occur on private surface within a refuge, and directional drilling operations that access minerals within a refuge from a surface location outside the refuge—is the preferred alternative. However, the EIS fails to assess the significant impact potentially arising from the Service's failure to regulate these exempted operations.

I. The Service Should Prohibit Fracking of All Non-Federal Minerals.

The Service has the authority and the duty to ban hydraulic fracturing and other unconventional well stimulation techniques¹, including, but not limited to, fracking, acidization, acid fracking, and gravel packing, (collectively, “fracking”) that could be used on or around NWRS lands and affect the health of the System. The Refuge Act mandates the Service to administer the System to “provide for the conservation of fish, wildlife, and plants, and their habitats within the System” and to “ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.” 16 U.S.C. § 668dd(a)(4)(A),(B). Fully meeting these purposes requires the Service to promulgate regulations prohibiting fracking and other unconventional stimulation techniques on refuge lands, or, at a minimum, temporarily barring the use of such techniques until such time as they can conclusively be proven to minimize risk to the Service's statutory duties. Prohibiting fracking on or affecting NWRS lands is a reasonable alternative that should have been subject to detailed analysis under NEPA.

A. The Service Has Broad Powers Under the Refuge Act to Protect National Wildlife Refuges by Banning Hydraulic Fracturing

The Refuge Act establishes a National Wildlife Refuge System, with the mission of “administer[ing] a national network of lands and waters for the conservation, management, and where appropriate, restoration, of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” 16 U.S.C. § 668dd(a)(2); *Audubon Soc'y of Portland v. Jewell*, 104 F. Supp. 3d 1099, 1101 (D. Or. 2015). The Refuge Act directs the Service to manage each refuge “to fulfill the mission of the System, as well as the specific purposes for which that refuge was established.” 16 U.S.C. § 668dd(a)(3)(A). Accordingly, the Service is charged with “administer[ing] the System to provide for the conservation of fish, wildlife, and plants, and their habitats within the System, and “ensur[ing] that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.” 16 U.S.C.S. § 668dd(a)(4)(A)-(B).

¹ Unconventional well stimulation refers to any activities that extract natural gas and oil from rock formations.

The Service has broad powers to fulfill this mission and these duties. This power is derived from the Property Clause of the U.S. Constitution, which entrusts Congress with “power over the public land . . . without limitations.” *Kleppe v. New Mexico*, 426 U.S. 529, 539 (1976); U.S. Const. art. VI, sec. 3, cl. 2 (Congress shall have power to “make all needful Rules and Regulations respecting the . . . Property belonging to the United States”). Congress’s exercise of such powers reaches to activities “occurring both on or off public land, which affects federal land,” *Duncan Energy Co. v. U.S. Forest Serv.*, 50 F.3d 584 (8th Cir. 1995) (citing *Kleppe*, 426 U.S. at 539), and is paramount where conflicting state laws exist. *Kleppe*, 426 at 546. Through the Refuge Act, Congress, in turn, delegated the regulatory powers of the federal government to the Secretary of the Interior (and the Service) to manage and protect refuge lands, consistent with the Refuge System’s mission. 16 U.S.C. § 668dd(b)(5); see *Wyoming v. United States*, 279 F.3d 1214, 1228 (10th Cir. 2002) (Refuge Act “plainly vests the [Service] with authority to administer the Act and manage the NWRs”). Moreover, the Refuge Act authorizes the Service, “under such regulations as [the Secretary] may prescribe, to permit the use of any area within the System for any purpose . . . whenever he determines that such uses are compatible with the major purposes for which such areas were established.” 16 U.S.C.S. § 668dd(d)(1)(A).

This power and responsibility necessarily includes regulation over all mineral development activities that affect NWRS lands. It includes the duty to limit and prevent mineral development activities that would interfere with fulfillment of the mission of the System or the purposes of individual refuges, notwithstanding conflicting state laws that would otherwise permit them. See *Kleppe*, 426 U.S. at 546. In its proposed rule, the Service correctly cites to several recent circuit court decisions that have held that the Service’s regulatory authority extends to non-Federal property interests within refuges. See, 80 Fed. Reg. at 77,201 (quoting *Burlison v. United States*, 533 F.3d 419 (6th Cir. 2008) (holding that, under the powers authorized by the Refuge Act Service may impose reasonable regulations on a private easement)).

Unlike other statutes that require a balancing of competing uses, the Refuge Act does not require the Service to balance a variety of competing environmental interests and commercial uses in its management of refuge resources. For example, under the Multiple-Use-Sustained-Yield Act of 1960 (“MUSYA”), “it is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.” 16 U.S.C. § 528; see also *Trout Unlimited v. USDA*, 320 F. Supp. 2d 1090, 1104 (D. Colo. 2004). MUSYA references resources management principles of “multiple use”² and “sustained yield,”³ and directs the Secretary of Agriculture (via the Forest Service) “to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therefrom.” *Id.* § 529. In 1976, Congress enacted NFMA, which expressly adopts the statutory purposes laid out in the MUSYA and establishes a detailed land and resource management scheme that the Forest Service must

² The MUSYA defines the term “multiple use” as the “management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people.” 16 U.S.C. § 531(b).

³ The MUSYA defines “sustained yield” as “the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land.” *Id.*

follow in order to further those purposes. *Fed. Forest Res. Coal. v. Vilsack*, 100 F. Supp. 3d 21, 27 (D.D.C. 2015). NFMA, which seeks “to balance the protection of natural ecosystems on public lands with the industrial and recreational uses of those lands,” was Congress’s attempt to “address the conflicting interests that often vie for priority when forest resources are at stake.” *Id.* (citing Vanessa Wishart, Before Beginning, Plan Carefully: A Call for Public Comment on the New Forest Planning Rule, 2010 Wis. L. Rev. 1537, 1540.). FLPMA similarly requires the Secretary via the Forest Service to manage the public rangelands for “multiple use and sustained yield” and “in a manner that will protect the quality of scientific, scenic, historical, ecological, air and atmospheric, water resource, and archeological values.” 43 U.S.C. §§ 1701(a)(7) and (8). *See also* 43 U.S.C. § 1712(c) (directing Secretary of Interior in developing and revising land use plans, to “observe the principles of multiple use and sustained yield”).

The Refuge Act, on the other hand, does not permit the balancing of competing commercial and environmental interests, nor does it set forth multiple-use planning obligations. Rather, the Refuge Act is similar in structure and language to the National Park Service Organic Act of 1916 (“Organic Act”), which directs the Park Service to “promote and regulate the use of the National Park System by means and measures that conform to the fundamental purpose of the System units, which purpose is to conserve the scenery, natural and historic objects, and wild life in the System units and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” 54 U.S.C. § 100101(a). The express language of the Park Service Organic Act does not mandate that the Park Service equally balance preservation with other uses in making its management decision. *See S. Utah Wilderness All. v. Nat’l Park Serv.*, 387 F. Supp. 2d 1178, 1190 (D. Utah 2005) (rejecting contention that Park Service equally balance preservation with “public use”).

The Refuge Act, like the Organic Act, does not permit balancing between multiple uses. Its mission – “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” – is solely focused on the protection of refuge resources. 16 U.S.C. § 668dd(a)(2). In fact, if any uses are not “compatible with the major purposes” for which a refuge was established, the Service may not allow those uses, *see* 16 U.S.C. § 668dd(d)(1)(A), and the Service is empowered to prohibit and limit them. *See* 16 U.S.C. § 668dd(d)(1)(A); *see also Niobrara River Ranch, L.L.C v. Huber*, 277 F. Supp. 2d 1020 (D. Neb. 2003) (Fish and Wildlife Service moratorium prohibiting commercial canoe operations did not violate Refuge Act in light of “evidence of rapidly increasing canoe usage and its potential for devastation of nesting birds”); *Stevens Cty. v. United States DOI*, 507 F. Supp. 2d 1127, 1135 (E.D. Wash. 2007) (upholding Service’s decision to limit livestock grazing on refuge, where Service’s non-compatibility determination was consistent with the principles of sound fish and wildlife management and available science).

In sum, the Service is entrusted with broad powers to permit or forbid activities affecting NWRS lands, in order to carry out its conservation mandate. These powers necessarily include the duty and authority to regulate mineral exploration and development located within refuge units. Under its single-purpose statutory mission, the Service is required to limit such activities to

the extent they are not “compatible the major purposes” for which a refuge was established. 16 U.S.C. § 668dd(d)(1)(A). Further, to the extent non-federal oil and gas extraction undermines the Service’s mandate to “ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans,” 16 U.S.C. § 668dd(a)(4)(B), the Service must prohibit these activities.

B. Fracking Materially Interferes With or Detracts from the Fulfillment of the Mission of the System or the Purposes of the Refuge

The Service cannot reasonably maintain that hydraulic fracturing is compatible with the major purposes for which its refuges were established or with its conservation mandate, in light of the grave dangers that fracking presents to the biological integrity, diversity, and environmental health of refuge resources, and the many unknown and unresolved risks of fracking. The Refuge Act allows the Service to “permit the use of any area within the System for any purpose...whenever [it] determines that such uses are compatible with the major purposes for which such areas were established.” 16 U.S.C. § 668dd(d)(1)(A). The Refuge Act describes “compatible use” as “a wildlife-dependent recreational use”⁴ or any other use of a refuge that “will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge.” 16 U.S.C. § 668ee(1). This “compatible use” determination must be made by “sound professional judgment,” which means that such conclusion must be “consistent with principles of sound fish and wildlife management and administration, [and] available science and resources.” 16 U.S.C. § 668ee(3).

As previously mentioned, the mission of the NWRS is to administer a national network of lands and waters for the conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats. 16 U.S.C. § 668dd(a)(2). Unconventional oil and gas extraction methods such as fracking pose significant threats to refuge resources, as detailed in the section below, and could result in significant impairment, fragmentation, and pollution of lands and water that countless species rely on, not to mention the impairment of their recreational uses and the health and safety of visitors. To allow fracking and similarly harmful unconventional oil and gas extraction on NWRS lands does not comport with the Service’s conservation mandate. Further, given the significant threat of harm that hydraulic fracturing and similar unconventional oil and gas extraction methods pose upon the biological integrity, diversity, and environmental health of the Refuge System, the Service cannot rationally determine that fracking operations are compatible with the protection of refuge resources. The Service would be well within its authority to determine that such oil and gas extraction methods is not a “compatible use” of refuge lands, and prohibit all hydraulic fracturing within a refuge (including on inholdings), as well as extra-refuge fracking operations that access minerals underlying a refuge.⁵

⁴ The terms “wildlife-dependent recreation” and “wildlife dependent recreational use” are defined to mean a “use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental interpretation.” 16 U.S.C. 668ee(2).

⁵ As explained in our scoping comment regarding the proposed rule, the Service has erroneously determined that the compatibility standard does not apply to non-federal oil and gas extraction. *See* NRDC et al. Scoping Comment (April 25, 2014). The proposed rulemaking, however, is silent on this issue.

The EIS must study the significant impacts of fracking under the proposed rule and compare the proposed rule's impacts to a no-fracking alternative. The use of hydraulic fracturing within the NWRS lands is both readily foreseeable and already occurring with significant environmental consequences. It is evident that fracking, including fracking with the most recent techniques that have been associated with serious adverse impacts in other areas of the country, is poised to expand; it is further evident that the oil and gas industry is still exploring new locations to develop, and the nation has not yet seen the full extent of fracking's impact on oil and gas development and production. In large part through the use of fracking, the oil and gas sector is now producing huge amounts of oil and gas throughout the United States, rapidly transforming the domestic energy outlook. As further described below, hydraulic fracturing brings with it all of the harms to water quality, air quality, the climate, species, and communities associated with traditional oil and gas development.

Fracking also brings increased risks in many refuges that have previously been untouched by oil and gas development or fracking, but could be subject to new drilling and fracking due to their location above developable shale plays.⁶ The EIS must study the environmental consequences of opening up these new areas to fracking, as well as expansion of fracking in refuges already being fracked. These considerations include the specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the refuge lands potentially to be fracked.

1. Overview of Dangers of Fracking.

Hydraulic fracturing, a dangerous practice in which operators inject toxic fluid underground under extreme pressure to release oil and gas, has greatly increased industry interest in developing tightly held oil and gas deposits such as those in the refuges. The first aspect of this technique is the hydraulic fracturing of the rock. When the rock is fractured, the resulting cracks in the rock serve as passages through which gas and liquids can flow, increasing the permeability of the fractured area. To fracture the rock, the well operator injects hydraulic fracturing fluid at tremendous pressure. The composition of fracturing fluid has changed over time. Halliburton developed the practice of injecting fluids into wells under high pressure in the late 1940s;⁷ however, companies now use permutations of "slick-water" fracturing fluid developed in the mid-1990s.⁸ The main ingredient in modern fracturing fluid (or "frack fluid") is generally water, although liquefied petroleum has also been used as a base fluid for modern fracking.⁹ The second ingredient is a "proppant," typically sand, that becomes wedged in the

⁶ See, e.g., Fish & Wildlife Service spreadsheet of areas that do not have existing oil and gas development, but which could be subject to new drilling and fracking ("FWS Spreadsheet 2016") (listing many refuge units within North Dakota in the Bakken shale play).

⁷ Tompkins, How will High-Volume (Slick-water) Hydraulic Fracturing of the Marcellus (or Utica) Shale Differ from Traditional Hydraulic Fracturing? Marcellus Accountability Project at 1 (Feb. 2011).

⁸ New York State Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* (2015) ("NYDEC SGEIS") at 5-5.

⁹ *Id.*; Arthur at 10; United States House of Representatives, Committee on Energy and Commerce, Minority Staff, *Chemicals Used in Hydraulic Fracturing* (Apr. 2011) ("Waxman 2011b").

fractures and holds them open so that passages remain after pressure is relieved.¹⁰ In addition to the base fluid and proppant, a mixture of chemicals are used, for purposes such as increasing the viscosity of the fluid, keeping proppants suspended, impeding bacterial growth or mineral deposition.¹¹

Frack fluid is hazardous to human health, although industry's resistance to disclosing the full list of ingredients formulation of frack fluid makes it difficult for the public to know exactly how dangerous.¹² A congressional report sampling incomplete industry self-reports found that "[t]he oil and gas service companies used hydraulic fracturing products containing 29 chemicals that are (1) known or possible human carcinogens, (2) regulated under the Safe Drinking Water Act for their risks to human health, or (3) listed as hazardous air pollutants under the Clean Air Act."¹³ Recently published scientific papers also describe the harmfulness of the chemicals often in fracking fluid. One study reviewed a list of 944 fracking fluid products containing 632 chemicals, 353 of which could be identified with Chemical Abstract Service numbers.¹⁴ The study concluded that more than 75 percent of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems; approximately 40 to 50 percent could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.¹⁵

The impacts associated with the fracking-induced oil and gas development boom has caused some jurisdictions to place a moratorium or ban on fracking. For instance, in 2011 France became the first country to ban the practice.¹⁶ In May, Vermont became the first state to ban fracking. Vermont's governor called the ban "a big deal" and stated that the bill "will ensure that we do not inject chemicals into groundwater in a desperate pursuit for energy."¹⁷ New York State halted fracking within its borders in 2008, continued the moratorium in 2014 and banned the practice in 2015. The state's seven-year review concluded that fracking posed risks to land, water, natural resources and public health.¹⁸ ¹⁹ Also, New Jersey's legislature recently passed a bill that would prevent fracking waste, like toxic wastewater and drill cuttings, from entering its borders,²⁰ and Pennsylvania, ground zero for the fracking debate, has banned "natural-gas

¹⁰ Arthur at 10.

¹¹ Arthur at 10.

¹² Waxman 2011b; *see also* Colborn, Theo et al., Natural Gas Operations for a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie, Lisa et al., Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources, *Sci Total Environ* (2012), doi:10.1016/j.scitotenv.2012.02.018 ("McKenzie 2012").

¹³ Waxman 2011b at 8.

¹⁴ Colborn 2011 at 1.

¹⁵ Colborn 2011 at 1.

¹⁶ Castelvechi, Davide, *France becomes first country to ban extraction of natural gas by fracking*, *Scientific American* (Jun. 30, 2011).

¹⁷ CNN Staff Writer, *Vermont first state to ban fracking*, CNN U.S. (May 17, 2012).

¹⁸ Public News Service - NY, *Cuomo Declares: No Fracking for Now in NY*. See: <http://www.publicnewsservice.org/2014-12-18/health-issues/cuomo-declares-no-fracking-for-now-in-ny/a43579-1> .

¹⁹ RT Network. June 30, 2015. *It's official: New York bans fracking*. <https://www.rt.com/usa/270562-new-york-fracking-ban/> .

²⁰ Tittel, Jeff, *Opinion: Stop fracking waste from entering New Jersey's borders* (Jul 14, 2012) available at http://www.nj.com/times-opinion/index.ssf/2012/07/opinion_stop_fracking_waste_fr.html .

exploration across a swath of suburban Philadelphia”²¹ Numerous cities and communities, like Buffalo, Pittsburgh, Raleigh, Woodstock, and Morgantown have banned fracking.²²

Separate from hydraulic fracturing, the second technological development underlying the recent shale boom is the use of horizontal drilling. Shale oil and shale gas formations are typically located far below the surface, and as such, the cost of drilling a vertical well to access the layer is high.²³ The shale formation itself is typically a thin layer; however, such that a vertical well only provides access to a small volume of shale—the cylinder of permeability surrounding the well bore.²⁴ Although hydraulic fracturing increases the radius of this cylinder of shale, this effect is often itself insufficient to allow profitable extraction of shale resources.²⁵ Horizontal drilling solves this economic problem: by drilling sideways along the shale formation once it is reached, a company can extract resources from a much higher volume of shale for the same amount of drilling through the overburden, drastically increasing the fraction of total well length that passes through producing zones.²⁶ The practice of combining horizontal drilling with hydraulic fracturing was developed in the early 1990s.²⁷

A third technological development is the use of “multi-stage” fracking. In the 1990s industry began drilling longer and longer horizontal well segments. The difficulty of hydraulic fracturing increases with the length of the well bore to be fractured, however, both because longer well segments are more likely to pass through varied conditions in the rock and because it becomes difficult to create the high pressures required in a larger volume.²⁸ In 2002 industry began to address these problems by employing multi-stage fracking. In multi-stage fracking, the operator treats only part of the wellbore at a time, typically 300 to 500 feet.²⁹ Each stage “may require 300,000 to 600,000 gallons of water,” and consequently, a frack job that is two or more stages can contaminate and pump into the ground over a million gallons of water.³⁰ In discussing water budgets for fracking operations, the EPA’s Draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources: Executive Summary states at ES-9:

²¹ Philly.com, *Fracking ban is about our water*, *The Inquirer* (Jul. 11, 2012).

²² CBS, *Pittsburgh Bans Natural Gas Drilling*, CBS/AP (Dec 8, 2010); Wooten, Michael *City of Buffalo Bans Fracking* (Feb. 9, 2011); *The Raleigh Telegram*, *Raleigh City Council Bans Fracking Within City Limits* (Jul. 11, 2012); Kemble, William, *Woodstock bans activities tied to fracking*, *Daily Freeman* (Jul. 19, 2012); MetroNews.com, *Morgantown Bans Fracking* (June 22, 2011), available at <http://www.wvmetronews.com/news.cfm?func=displayfullstory&storyid=46214>.

²³ CITI, *Resurging North American Oil Production and the Death of the Peak Oil Hypothesis* at 9 (Feb.15, 2012) (“CITI”); United States Energy Information Administration, *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays* at 4 (Jul. 2011) (“USEIA 2011”); Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) (“Orszag”).

²⁴ *Id.*

²⁵ *Id.*; Arthur at 8 (Figure 4).

²⁶ Venoco, Inc., *Monterey Shale Focused Analyst Day Slide Show* at 23 (May 26, 2010) (“Venoco Slide Show”), USEIA 2012a at 63.

²⁷ *Id.*

²⁸ NYDEC SGEIS at 5-93.

²⁹ *Id.*

³⁰ *Id.*

The national median volume of water used per hydraulically fractured well is approximately 1.5 million gal (5.7 million L), according to the EPA's analysis of FracFocus disclosures. This estimate likely represents a wide variety of fractured well types, including vertical wells that generally use much less water per well than horizontal wells. Thus, published estimates for horizontal shale gas wells are typically higher (e.g., approximately 4 million gallons (Vengosh et al., 2014)). There is also wide variation within and among states and basins in the median water volumes used per well, from more than 5 million gal (19 million L) in Arkansas, Louisiana and West Virginia to less than 1 million gal (3.8 million L) in California, New Mexico, and Utah, among others. This variation results from several factors, including well length, formation geology, and fracturing fluid formulation.³¹

The above report further addresses flowback, or produced waters, stating at ES-16 that:

The amount of produced water varies, but typically averages 10% to 25% of injected volumes, depending upon the amount of time since fracturing and the particular well (see Figure ES-3a). However, there are exceptions to this, such as in the Barnett Shale in Texas where the total volume of produced water can equal or exceed the injected volume of hydraulic fracturing fluid (see Figure ES-3b). Flow rates are generally high initially, and then decrease over time throughout oil or gas production.³²

Because a typical fracking operation includes several wells per well pad, the site specific water use can be upwards of 15,000,000 gallons per site and produce nearly 4,000,000 gallons of polluted wastewater which must be stored and disposed of. These water-use impacts and associated risks are substantially greater than those posed by conventional oil and gas production, or even hydraulic fracturing limited to vertical wells.

Notwithstanding the grave impacts that these practices have on the environment, this new combination of multi-stage slickwater hydraulic fracturing and horizontal drilling has made it possible to profitably extract oil and gas from formations that only a few years ago were generally viewed as uneconomical to develop.³³ The effect of hydraulic fracturing on the oil and gas markets has been tremendous, with many reports documenting the boom in domestic energy production. A recent congressional report notes that “[a]s a result of hydraulic fracturing and advances in horizontal drilling technology, natural gas production in 2010 reached the highest level in decades.”³⁴ A 2011 U.S. EIA report notes how recently these changes have occurred, stating that “only in the past 5 years has shale gas been recognized as a ‘game changer’ for the U.S. natural gas market.”³⁵ With respect to oil, the EIA notes that oil production has been

³¹ U.S. EPA, *Draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources: Executive Summary 2015*, <http://www.epa.gov/hfstudy/executive-summary-hydraulic-fracturing-study-draft-assessment-2015>.

³² *Id.*

³³ See CITI at 9 ; USEIA 2011 at 4; Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) (“Orszag”).

³⁴ Waxman 2011b at 1.

³⁵ USEIA 2011 at 4.

increasing, with the production of shale oil resources pushing levels even higher over the next decade:

Domestic crude oil production has increased over the past few years, reversing a decline that began in 1986. U.S. crude oil production increased from 5.0 million barrels per day in 2008 to 5.5 million barrels per day in 2010. Over the next 10 years, continued development of tight oil, in combination with the ongoing development of offshore resources in the Gulf of Mexico, pushes domestic crude oil production higher.³⁶

In large part through the use of fracking, the oil and gas sector is now producing huge amounts of oil and gas throughout the United States, rapidly transforming the domestic energy outlook. But fracking is occurring in the absence of any adequate federal or state oversight. The current informational and regulatory void on the state level makes it even more critical that the Service perform its legal obligations to review, analyze, disclose, and avoid and mitigate the impacts of oil and gas leasing to occur on refuge lands.

2. Fracking Poses Significant Risks to Water Resources.

Oil and gas activities pose significant danger to water resources. This includes harms that are common to oil and gas operations in general, and damages fracking in particular can cause. While much remains to be learned about fracking,³⁷ it is clear that the practice poses serious threats to water resources. Across the U.S., in states where fracking or other types of unconventional oil and gas recovery has occurred, surface water and groundwater have been contaminated. Recent studies have concluded that water contamination attributed to unconventional oil and gas activity has occurred in several states, including Colorado,³⁸ Wyoming,³⁹ Texas,⁴⁰ Pennsylvania,⁴¹ Ohio,⁴² and West Virginia.⁴³

³⁶ USEIA 2012a at 2

³⁷ United States Government Accountability Office, *Unconventional Oil and Gas Development – Key Environmental and Public Health Requirements* (2012); United States Government Accountability Office, *Oil and Gas – Information on Shale Resources, Development, and Environmental and Public Health Risks* (2012).

³⁸ Trowbridge, A. *Colorado Floods Spur Fracking Concerns*, CBS News, Sept. 17, 2013, available at http://www.cbsnews.com/8301-201_162-57603336/colorado-floods-spur-fracking-concerns/ (“Trowbridge 2013”) (accessed July 30, 2015).

³⁹ U.S. Environmental Protection Agency, *Draft Investigation of Ground Water Contamination near Pavillion, Wyoming* (2011) (“USEPA Draft Pavillion Investigation”).

⁴⁰ Fontenot, Brian et al., *An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, *Environ. Sci. Technol.*, 47 (17), 10032–10040 DOI: 10.1021/es4011724, available at <http://pubs.acs.org/doi/abs/10.1021/es4011724> (“Fontenot 2013”).

⁴¹ Jackson, Robert et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale Gas Extraction*, *Proc. Natl. Acad. of Sciences Early Edition*, doi: 10.1073/pnas.1221635110/-DCSupplemental (2013) (“Jackson 2013”).

⁴² Ohio Department of Natural Resources, *Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio* (Sep. 2008) (“ODNR 2008”).

⁴³ Begos, K., *Four States Confirm Water Pollution*, Associated Press, January 5, 2014, <http://www.usatoday.com/story/money/business/2014/01/05/some-states-confirm-water-pollution-from-drilling/4328859/> (accessed July 29, 2015); *see also* U.S. EPA, *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*, External Review Draft (June 2015) (“EPA 2015”), available at http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=523539 (accessed July 30, 2015)..

a. Surface Water Contamination

Surface waters can be contaminated in many ways from unconventional well stimulation. In addition to storm water runoff, surface water contamination may also occur from chemical and waste transport, chemical storage leaks, and breaches in pit liners.⁴⁴ The spilling or leaking of fracking fluids, flowback, or produced water is a serious problem. Harmful chemicals present in these fluids can include volatile organic compounds (“VOCs”), such as benzene, toluene, xylenes, and acetone.⁴⁵ As much as 25 percent of fracking chemicals are carcinogens,⁴⁶ and flowback can even be radioactive.⁴⁷ As described below, contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming and other activities, and may be infeasible to restore the original water quality once surface water is contaminated. The Service should consider this analysis in the EIS.

i. Chemical and Waste Transport

Massive volumes of chemicals and wastewater used or produced in oil and gas operations have the potential to contaminate local watersheds. Between 2,600 to 18,000 gallons of chemicals are injected per hydraulically fracked well depending on the number of chemicals injected.⁴⁸ For example, in 2012 alone, New Mexico produced 3 billion gallons of wastewater from fracking.⁴⁹ This waste can reach fresh water aquifers and drinking water.

Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.⁵⁰ If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do not biodegrade or break down over time. The only way to deal with them is to remove them.⁵¹ Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.⁵² Given the massive volumes of chemicals and wastewater produced, their potentially harmful constituents, and their persistence in the environment, the potential for environmental disaster is real.

⁴⁴ Vengosh, Avner et al., *A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States*, Environ. Sci. Technol., DOI: 10.1021/es405118y (2014) (“Vengosh 2014”).

⁴⁵ U.S. Environmental Protection Agency, *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* (Nov. 2011) (“EPA Plan to Study Fracking Impacts”).

⁴⁶ Colborn 2011.

⁴⁷ EPA Plan to Study Fracking Impacts; White, Ivan E., *Consideration of radiation in hazardous waste produced from horizontal hydrofracking*, National Council on Radiation Protection (2012).

⁴⁸ EPA 2015 at ES-12.

⁴⁹ Elizabeth Ridlington Frontier Group, *Fracking by the Numbers: Key Impacts of Dirty Drilling at the State and National Level*, October 2013 at 21 available at http://www.environmentamerica.org/sites/environment/files/reports/EA_FrackingNumbers_scrn.pdf.

⁵⁰ Brittingham, Margaret C. et al., *Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats*, Environ. Sci. Technol. 2014, 48, 11034-11047, p. 11039.

⁵¹ King, Pamela, *Limited study supports findings on bigger brine spill risks*, E&E News (Nov. 4, 2015).

⁵² *Id.*

Fluids must be transported to and/or from the well, which presents opportunities for spills.⁵³ Unconventional well stimulation relies on numerous trucks to transport chemicals to the site as well as collect and carry disposal fluid from the site to processing facilities. A U.S. Government Accountability Office (GAO) study found that up to 1,365 truck loads can be required just for the drilling and fracturing of a single well pad⁵⁴ while the New York Department of Conservation estimated the number of “heavy truck” trips to be about 3,950 per horizontal well (including unloaded and loaded trucks).⁵⁵ Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters. Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.⁵⁶

The EIS should evaluate how often accidents can be expected to occur, and the effect of chemical and fluid spills. Such analysis should also include identification of the particular harms faced by communities near oil and gas fields. The EIS must include specific mitigation measures and alternatives based on a cumulative impacts assessment, and the particular vulnerabilities of environmental justice communities in both urban and rural settings.

ii. On-site Chemical Storage and Processing

Thousands of gallons of chemicals can be potentially stored on-site and used during hydraulic fracturing and other unconventional well stimulation activities.⁵⁷ These chemicals can be susceptible to accidental spills and leaks. Natural occurrences such as storms and earthquakes may cause accidents, as can negligent operator practices.

Some sites may also use on-site wastewater treatment facilities. Improper use or maintenance of the processing equipment used for these facilities may result in discharges of contaminants. Other spill causes include equipment failure (most commonly, blowout preventer failure, corrosion and failed valves) and failure of container integrity.⁵⁸ Spills can result from accidents, negligence, or intentional dumping.

The EIS should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices. Again, such analysis must also include an analysis of potential impacts faced by environmental justice communities in both rural and urban settings.

b. Groundwater Contamination

⁵³ Warco, Kathy, *Fracking truck runs off road; contents spill*, Observer Reporter (Oct 21, 2010).

⁵⁴ U.S. Government Accountability Office, Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks, GAO 12-732 (2012) at 33.

⁵⁵ New York Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program*, Ch. 6 Potential Environmental Impacts (2015) at 6-306 –available at http://www.dec.ny.gov/docs/materials_minerals_pdf/fsgeis2015.pdf.

⁵⁶ Kusnetz, Nicholas, *North Dakota’s Oil Boom Brings Damage Along with Prosperity* at 4, ProPublica (June 7, 2012) (“Kusnetz North Dakota”); E&E News, *Ohio man pleads not guilty to brine dumping* (Feb. 15, 2013).

⁵⁷ EPA 2015 at ES-10.

⁵⁸ EPA 2015 at ES-11.

Studies have reported many instances around the country of groundwater contamination due to surface spills of oil and gas wastewater, including fracking flowback.⁵⁹ Fracking and other unconventional techniques likewise pose inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated.⁶⁰ Once groundwater is contaminated, it is very difficult, if not impossible, to restore the original quality of the water. As a result, in communities that rely on groundwater drinking water supplies, groundwater contamination can deprive communities of usable drinking water. Such long-term contamination necessitates the costly importation of drinking water supplies.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years.⁶¹ Poorly constructed or abandoned wells are recognized as one of the most likely ways by which contaminants may reach groundwater. Faulty well construction, cementing, or casing,⁶² as well as the injection of fracking waste underground, can all lead to leaks.⁶³ Improper well construction and surface spills are cited as a confirmed or potential cause of groundwater contamination in numerous incidents at locations across the U.S. including but not limited to Colorado,⁶⁴ Wyoming,⁶⁵ Pennsylvania,⁶⁶ Ohio,⁶⁷ West Virginia,⁶⁸ and Texas.⁶⁹ These sorts of problems at the well are not uncommon. Dr. Ingraffea of Cornell has noted an 8.9 percent failure rate for wells in the Marcellus Shale.⁷⁰ Also, the Draft EPA Investigation of Ground Water Contamination near Pavillion, Wyoming, found that chemicals found in samples of groundwater were from fracked wells.⁷¹ These results have been confirmed with follow-up analyses.⁷² Moreover, another study based on modeling found that active transport of fracking fluid from a fracked well to an aquifer could occur in less than 10 years.⁷³

⁵⁹ See, e.g., Fontenot 2013, Jackson 2013.

⁶⁰ Vengosh 2014.

⁶¹ Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).

⁶² Natural Resources Defense Council, Water Facts: Hydraulic Fracturing Can Potentially Contaminate Drinking Water Sources (July 2012) at 2; Food & Water Watch, The Case for a Ban on Fracking (2012) (“Food & Water Watch 2012”) at 7.

⁶³ Kusnetz, North Dakota; Lustgarten, Abraham, Polluted Water Fuels a Battle for Answers, ProPublica (2012); Lustgarten, Abraham, Injection Wells: The Poison Beneath Us, ProPublica at 2 (2012); Lustgarten, Abraham, Whiff of Phenol Spells Trouble, ProPublica (2012).

⁶⁴ Gross, Sherilyn A. et al., Abstract: Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations, 63 J. Air and Waste Mgmt. Assoc. 4, 424 doi: 10.1080/10962247.2012.759166 (2013).

⁶⁵ USEPA Draft Pavillion Investigation.

⁶⁶ Darrah, Thomas H. et al., Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales, Proc. Natl. Acad. Of Sciences Early Edition, doi: 10.1073/pnas.1322107111 (2014) (“Darrah 2014”).

⁶⁷ Begos, Kevin, *Some States Confirm Water Pollution from Oil, Gas Drilling*, Seattle Times Jan. 6, 2014, <http://www.seattletimes.com/business/some-states-confirm-water-pollution-from-oil-gas-drilling/> (accessed July 29, 2015) (“Begos, Seattle Times, Jan 6, 2014”). See also, ODNR 2008, *supra*.

⁶⁸ Begos, Seattle Times, Jan 6. 2014.

⁶⁹ Darrah 2014.

⁷⁰ Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations 6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013).

⁷¹ EPA Draft Pavillion Investigation.

⁷² Drajem, Mark, *Wyoming Water Tests in Line with EPA Finding on Fracking*, Bloomberg (Oct. 11, 2012); U.S. Environmental Protection Agency, Investigation of Ground Water Contamination near Pavillion, Wyoming Phase V

Current federal rules do not ensure well integrity. The well casing can potentially fail over time and potentially create pathways for contaminants to reach groundwater. Well casing failure can occur due to improper or negligent construction. The EIS should study the rates of well casing failures over time and evaluate the likelihood that well casing failures can lead to groundwater contamination.

Also, fluids and hydrocarbons may contaminate groundwater by migrating through newly created or natural fractures.⁷⁴ Many unconventional techniques intentionally fracture the formation to increase the flow of gas or oil. New cracks and fissures can allow the additives or naturally occurring elements such as natural gas to migrate to groundwater. “[T]he increased deployment of hydraulic fracturing associated with oil and gas production activities, including techniques such as horizontal drilling and multi-well pads, may increase the likelihood that these pathways could develop,” which, “in turn, could lead to increased opportunities for impacts on drinking water sources.”⁷⁵ Fluids can also migrate through pre-existing and natural faults and fractures that may become pathways once the fracking or other method has been used.

A well in which stimulation operations are being conducted may also “communicate” with nearby wells, which may lead to groundwater and surface contamination, particularly if the nearby wells are improperly constructed or abandoned.⁷⁶ In the last 150 years, as many as 12 million “holes” have been drilled across the United States in search of oil and gas, many of which are old and decaying, or are in unknown locations.⁷⁷ Fracking can contaminate water resources by intersecting one of those wells. For instance, one study found at least nineteen instances of fluid communication in British Columbia and Western Alberta.⁷⁸ Wells as far away as 1.8 miles away have provided pathways for surface contamination.⁷⁹

According to the EPA, “evidence of any fracturing-related fluid migration affecting a drinking water resources...could take years to discover.”⁸⁰ The EIS must consider long-term studies on the potential for fluid migration through newly created subsurface pathways. Fluid

Sampling Event - Summary of Methods and Results (September 2012); Myers, Tom, Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming Prepared by the Environmental Protection Agency, Ada OK (Apr. 30, 2012).

⁷³ Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers (Feb. 2012).

⁷⁴ EPA Draft Pavillion Investigation; Warner, Nathaniel R., et al., Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania, PNAS Early Edition (2012).

⁷⁵ EPA 2015 at 6-55.

⁷⁶ See Detrow, Scott. (2012) *Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser*, StateImpact Pennsylvania, National Public Radio (October 9, 2012), available at <https://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-an-abandoned-well-produced-a-methane-geyser/> (accessed July 29, 2015); Alberta Energy Board, Directive 083: Hydraulic Fracturing – Subsurface Integrity, Alberta Energy Regulator (2013), available at <http://www.aer.ca/documents/directives/Directive083.pdf>.

⁷⁷ Kusnetz, Nicholas, *Deteriorating Oil and Gas Wells Threaten Drinking Water, Homes Across the Country*, ProPublica (April 4, 2011).

⁷⁸ BC Oil & Gas Commission, Safety Advisory 2010-03, Communication During Fracture Stimulation (2010).

⁷⁹ King, Pamela, ‘Frack hits’ provide pathways for methane migration study, E&E News (Oct. 21, 2015).

⁸⁰ EPA 2015 at 6-56 – 6-57.

migration is of particular concern when oil and gas operations are close to drinking water supplies.

Fracking fluid can also spill at the surface during the fracking process. For instance, mechanical failure or operator error during the process has caused leaks from tanks, valves, and pipes.⁸¹ At the surface, pits or tanks can leak fracking fluid or waste.⁸² Surface pits, in which wastewater is often dumped, are a major source of pollution. In California, a farmer was awarded \$8.5 million in damages after his almond trees died when he irrigated them with well water that had been contaminated by nearby oil and gas operations. The contamination was traced to unlined pits where one of California's largest oil and gas producers for decades dumped billions of gallons of wastewater that slowly leached pollutants into nearby groundwater.⁸³

Unfiltered drinking water supplies, such as drinking water wells, are especially at risk because they have no readily available means of removing contaminants from the water. Even water wells with filtration systems are not designed to handle the kind of contaminants that result from unconventional oil and gas extraction.⁸⁴ In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination.⁸⁵ The EIS must disclose where the potential for such drilling exists.

Setbacks may not be adequate to protect groundwater from potential fracking fluid contamination. A recent study by the University of Colorado at Boulder suggests that setbacks of even up to 300-feet may not prevent contamination of drinking water resources.⁸⁶ The study found that 15 organic compounds found in hydraulic fracturing fluids may be of concern as groundwater contaminants based on their toxicity, mobility, persistence in the environment, and frequency of use. These chemicals could have 10 percent or more of their initial concentrations remaining at a transport distance of 300 feet, the average "setback" distance in the U.S. The effectiveness and feasibility of any proposed setbacks must be evaluated.

c. Contamination from disposal of drilling and fracking wastes

Finally, disposal of wastes from oil and gas operations can also lead to contamination of water resources. Potential sources of contamination include:

⁸¹ NRDC, Water Facts at 2; Food & Water Watch 2012 at 7.

⁸² See, e.g., E&E Staff Writer, *Fracking Fluid leaks from wellhead in Colo.*, E&E News (Feb 14, 2013). ("At least 84,000 gallons of water contaminated from hydraulic fracturing seeped from a broken wellhead and into a field . . ."); Michaels, Craig, et al., *Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling*, Riverkeeper (2010) at 12.

⁸³ Renee Sharp & Bill Allayud, California Regulator: See No Fracking, Speak No Fracking at 6 (2012); see also Miller, Jeremy, *Oil and Water Don't Mix with California Agriculture*, High Country News (2012).

⁸⁴ Physicians, Scientist & Engineers for Healthy Energy, Letter from Robert Howarth Ph.D. and 58 other scientists to Andrew M. Cuomo, Governor of New York State re: municipal drinking water filtration systems and hydraulic fracturing fluid (Sept 15, 2011), available at http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf (accessed July 29, 2015).

⁸⁵ EPA 2015 at ES-15.

⁸⁶ University of Colorado--Boulder, New study identifies organic compounds of potential concern in fracking Fluids (July 1, 2015), available at <http://www.colorado.edu/news/releases/2015/06/30/newstudyidentifiesorganiccompoundspotentialconcernfrackingfluids> (accessed July 29, 2015).

- leaching from landfills that receive drilling and fracking solid wastes;
- spreading of drilling and fracking wastes over large areas of land;
- wastewaters discharged from treatment facilities without advanced “total dissolved solids” removal processes, or inadequate capacity to remove radioactive material removal; and
- breaches in pits or underground disposal wells.⁸⁷

The EIS must evaluate the potential for contamination from each of these disposal methods.

d. More Intensive Oil and Gas Development Will Increase Storm Water Runoff

Oil and gas operations require land clearance for access roads, pipelines, well pads, drilling equipment, chemical storage, and waste disposal pits. As a result, new oil and gas development will cause short-term disturbance as well as long-term disturbance within the areas for lease. While undisturbed land can retain greater amounts of water through plants and pervious soil, land that has been disturbed or developed may be unable to retain as much water, thereby increasing the volume of runoff. The area of land that is able to retain water will be significantly decreased if unconventional oil and gas extraction methods are permitted to expand.

Water from precipitation and snowmelt can serve as an avenue through which contaminants travel from an operation site to sensitive areas, including population centers. Contaminated water runoff may seep into residential areas, polluting streets, sidewalks, soil, and vegetation in urban areas, adversely affecting human health. Thus, not only do these oil and gas activities create pollution, they create greater conduits for storm water runoff to carry those pollutants from the operation site, into areas in which significant harm can be caused.

Rapid runoff, even without contaminants, can harm the environment by changing water flow patterns and causing erosion, habitat loss, and flooding. Greater runoff volumes may also increase the amount of sediment that is carried to lakes and streams, affecting the turbidity and chemical content of surface waters. Because a National Pollutant Discharge Elimination System permit is not required for oil and gas operations,⁸⁸ it is particularly important that the impact of runoff is considered as part of the NEPA (National Environmental Policy Act) process.

e. Water Depletion

Some unconventional extraction techniques, most notably fracking, require the use of tremendous amounts of freshwater. Typically between 2 and 5.6 million gallons of water are required to frack each well.⁸⁹ These volumes far exceed the amounts used in conventional natural gas development.⁹⁰

⁸⁷ EPA 2015, 8-20, 8-36, 8-48, 8-65, 8-70.

⁸⁸ 33 U.S.C. § 1342(l)(2).

⁸⁹ U.S. Government Accountability Office 2012 at 17.

⁹⁰ See Clark, Corrie E. et al., *Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas*, Environ. Sci. Technol., 2013, 47 (20), pp 11829–11836, abstract available at

Water used in large quantities may lead to several kinds of harmful environmental impacts. The extraction of water for fracking can, for example, lower the water table, affect biodiversity, harm local ecosystems, and reduce water available to communities.⁹¹

Withdrawal of large quantities of freshwater from streams and other surface waters will undoubtedly have an impact on the environment.⁹² Withdrawing water from streams will decrease the supply for downstream users, such as farmers or municipalities. Rising demand from oil and gas operators has already led to increased competition for water between farmers and oil and gas operators. With the prolonged drought, some farmers in New Mexico have been forced to sell their water out of the aquifer to the booming oil and gas industry.⁹³ Reductions in stream flows may also lead to downstream water quality problems by diminishing the water bodies' capacity for dilution and degradation.

Furthermore, withdrawing large quantities of water from subsurface waters to supply oil and gas production will likely deplete and harm aquifers. Removing water from surface water or directly from underground sources of water faster than the rate that aquifers can be replenished will lower the volume of water available for other uses. Depletion can also lead to compaction of the rock formation serving as an aquifer, after which the original level of water volume can never be restored.⁹⁴ Depleted aquifer water resources may also adversely affect agriculture, species habitat and ecosystems, and human health.

The freshwater in the area therefore would be greatly affected by the increased demand for water if fracking and other unconventional oil and gas extraction are permitted. A no-fracking alternative would preserve scarce water resources and keep critical sources of drinking water in the planning area safe and clean. The EIS must analyze where water will be sourced, how much, and the effects on water sources under different alternatives. All of these effects must be analyzed in the context of increasing water scarcity in refuge lands due to climate change, drought, and increasing population growth.

f. Oil and Gas Developments Harm Aquatic Life and Habitat

When streams and other surface waters are depleted, the habitat for countless plants and animals will be harmed, and the depletion places tremendous pressure on species that depend on having a constant and ample stream of water.

Physical habitats such as banks, pools, runs, and glides (low gradient river sections) are important yet susceptible to disturbance with changing stream flows. Altering the volume of

<http://pubs.acs.org/doi/abs/10.1021/es4013855>.

⁹¹ International Energy Agency, Golden Rules for the Golden Age of Gas at 31-32 (2012).

⁹² See Entekin, Sally et al., *Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters*, 9 Front Ecol. Environ. 9, 503 (2011); EPA 2015 at 4-16.

⁹³ Associated Press, *NM farmers selling water to oil and gas developers*, Albuquerque Journal, June 30, 2013, available at <http://www.abqjournal.com/216332/news/nm-farmers-selling-water-to-oil-and-gas-developers-2.html>.

⁹⁴ Freyman, Monika and Ryan Salmon, *Hydraulic Fracturing and Water Stress: Growing Competitive Pressures for Water*, CERES, 9 (2013) ("Freyman 2013"), available at <http://www.ceres.org/resources/reports/hydraulic-fracturing-water-stress-water-demand-by-the-numbers>.

water can also change the water's temperature and oxygen content, harming some species that require a certain level of oxygenated water. Decreasing the volume of streamflow and stream channels by diverting water to fracking would have a negative impact on the environment. Such impacts must be adequately analyzed in an EIS

The physical equipment itself that is designed to intake and divert water may also pose a threat to certain wildlife. If not properly designed, such equipment and intake points may be a risk to wildlife.

g. Harm to Wetlands

Oil and gas development, and particularly the practice of fracking, pose an immense threat to water resources. High volume removal of surface or groundwater can result in damage to wetlands, which rely on ample water supplies to maintain the fragile dynamics of a wetland habitat. Damage can also occur from spills of chemicals or wastewater, filling operations, and sediment runoff.⁹⁵

Many plant and animal species depend on wetland habitats, and even small changes can lead to significant impacts. Wetlands provide a variety of “eco-service” functions, including water purification, protection from floods, and functioning as carbon sinks.⁹⁶ The ecological importance of wetlands is unquestionable, and their full protection is paramount. The EIS must analyze these potential impacts to wetlands, and the related, potential indirect impacts that may stem from such impacts.

3. Fracking operations harm air quality

Oil and gas operations emit numerous air pollutants, including volatile organic compounds (VOCs), NOX, particulate matter, hydrogen sulfide, and methane. Fracking operations are particularly harmful, emitting especially large amounts of pollution, including air toxic air pollutants. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions in these and other regions. The Service should therefore prohibit fracking techniques on the refuges, which would prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

a. Types of Air Emissions

⁹⁵ U.S. Department of Justice, *Trans Energy Inc. to Restore Streams and Wetland Damaged by Natural Gas Extraction Activities in West Virginia* (Sep. 2, 2014), <http://www.justice.gov/opa/pr/trans-energy-inc-restore-streams-and-wetland-damaged-natural-gas-extraction-activities-west> (accessed July 29, 2015); *See also*, Pennsylvania Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Seneca Resources Corp. \$40,000 for Violations at Marcellus Operation in Tioga County (Jul. 10, 2010), <http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=14655&typeid=1> (accessed July 29, 2015).

⁹⁶ U.S. Environmental Protection Agency, Wetlands and People, <http://water.epa.gov/type/wetlands/people.cfm> (accessed July 29, 2015).

Unconventional oil and gas operations emit large amounts of toxic air pollutants,⁹⁷ also referred to as Hazardous Air Pollutants, which are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.⁹⁸ The reporting requirements recently implemented by the California South Coast Air Quality Management District (“SCAQMD”) have shown that at least 44 chemicals known to be air toxics have been used in fracking and other types of unconventional oil and gas recovery in California.⁹⁹ Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics in California, including crystalline silica, methanol, hydrochloric acid, hydrofluoric acid, 2-butoxyethanol, ethyl glycol monobutyl ether, xylene, amorphous silica fume, aluminum oxide, acrylic polymer, acetophenone, and ethylbenzene. Many of these chemicals also appear on the U.S. EPA’s list of hazardous air pollutants.¹⁰⁰ EPA has also identified six “criteria” air pollutants that must be regulated under the National Ambient Air Quality Standards (NAAQS) due to their potential to cause primary and secondary health effects. Concentrations of these pollutants—ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead—will likely increase in regions where unconventional oil and gas recovery techniques are permitted.

VOCs, from car and truck engines as well as the drilling and completion stages of oil and gas production, make up about 3.5 percent of the gases emitted by oil or gas operations.¹⁰¹ The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.¹⁰² There is substantial evidence showing the grave harm from these pollutants.¹⁰³ Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.¹⁰⁴ In particular, a study covering sites near oil and gas wells in five different states found that concentrations of eight volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded risk-based comparison values under several operational circumstances.¹⁰⁵ Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.¹⁰⁶ Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the

⁹⁷ Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) (“Sierra Club Comments”) at 13.

⁹⁸ U.S. EPA, Hazardous Air Pollutants, *available at* <http://www.epa.gov/haps> (accessed Jan. 10, 2016).

⁹⁹ Center for Biological Diversity, Air Toxics One Year Report, p. 1 (June 2014).

¹⁰⁰ U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site, <http://www.epa.gov/ttnatw01/orig189.html> (accessed July 29, 2015).

¹⁰¹ Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 (“Brown Memo”) at 3.

¹⁰² 42 U.S.C. § 7412(b).

¹⁰³ Colborn 2011; McKenzie 2012; Food & Water Watch 2012.

¹⁰⁴ McCawley, M., Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), West Virginia University School of Public Health, Morgantown, WV (2013) (“McCawley 2013”), *available at* <http://www.dep.wv.gov/oil-and-gas/Horizontal-Permits/legislativestudies/Documents/WVU%20Final%20Air%20Noise%20Light%20Protocol.pdf>; Center for Biological Diversity, Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin (Sept. 2013).

¹⁰⁵ Macey, G.P. et al., Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community-Based Exploratory Study, 13 Environmental Health 82 (2014) at 1.

¹⁰⁶ McCawley 2013.

Denver-Julesburg Fossil Fuel Basin, north of Denver.¹⁰⁷ Another study found that oil and gas operations in this area emit approximately 55% of the VOCs in northeastern Colorado.¹⁰⁸

VOCs can form ground-level (tropospheric) ozone when combined with nitrogen oxides (“NO_x”), from compressor engines, turbines, other engines used in drilling, and flaring,¹⁰⁹ and sunlight. This reaction can diminish visibility and air quality and harm vegetation. Tropospheric ozone can also be caused by methane, which is leaked and vented at various stages of unconventional oil and gas development, as it interacts with nitrogen oxides and sunlight.¹¹⁰ In addition to its role as a greenhouse gas, methane contributes to increased concentrations of ground-level ozone, the primary component of smog, because it is an ozone precursor.¹¹¹ Methane’s effect on ozone concentrations can be substantial. One paper modeled reductions in various anthropogenic ozone precursor emissions and found that “[r]educing anthropogenic CH₄ emissions by 50% nearly halves the incidence of U.S. high-O₃ events”¹¹²

Like methane, VOCs and NO_x are also ozone precursors; therefore, many regions around the country with substantial oil and gas operations are now suffering from extreme ozone levels due to heavy emissions of these pollutants.¹¹³ Ozone can result in serious health conditions, including heart and lung disease and mortality.¹¹⁴ A recent study of ozone pollution in the Uintah Basin of northeastern Utah, a rural area that experiences hazardous tropospheric ozone concentrations, found that oil and gas operations were responsible for 98 to 99 percent of VOCs and 57 to 61 percent of NO_x emitted from sources within the Basin considered in the study’s inventory.¹¹⁵

¹⁰⁷ Pétron, G. et al., Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study, 117 J. Geophysical research D04304 (2012), at 8, 13 (“Pétron 2012”).

¹⁰⁸ Gilman, J.B. et al., *Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado*, 47 *Envtl. Sci & Tech.* 1297, 1303 (2013).

¹⁰⁹ See, e.g., U.S. Environmental Protection Agency, Oil and Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution: Background Technical Support Document for Proposed Standards at 3-6 (July 2011); Armendariz, Al, Emissions for Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (2009) (“Armendariz”) at 24.

¹¹⁰ Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 *Geophys. Res Letters* 19 (2002).

¹¹¹ U.S. Environmental Protection Agency, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews Proposed Rule, 76 *Fed. Reg.* 52,738 (Aug 23, 2011).

¹¹² Fiore, Arlene et al., Linking ozone pollution and climate change: The case for controlling methane, 29 *Geophys. Res Letters* 19 (2002); see also Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.

¹¹³ Armendariz at 1, 3, 25-26; Wendy Koch, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling*, USA Today (May 9, 2011); Craft, Elena, Environmental Defense Fund, Do Shale Gas Activities Play a Role in Rising Ozone Levels? (2012); Colorado Dept. of Public Health and Environment, Conservation Commission, Colorado Weekly and Monthly Oil and Gas Statistics (July 6, 2012) at 12.

¹¹⁴ U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O₃) and Related Photochemical Oxidants (2013).

¹¹⁵ Lyman, Seth and Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013); see also Gilman, Jessica et al., Source signature of volatile organic compounds from oil and natural gas operations in northeastern Colorado, *Environ Sci and Technology* (Jan 14, 2013), DOI: 10.1021/es304119a.

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas “sour.”¹¹⁶ Hydrogen sulfide may be emitted during all stages of operation, including exploration, extraction, treatment and storage, transportation, and refining. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.¹¹⁷

The oil and gas industry is also a major source of particulate matter. The heavy equipment regularly used in the industry burns diesel fuel, generating fine particulate matter¹¹⁸ that is especially harmful.¹¹⁹ Vehicles traveling on unpaved roads also kick up fugitive dust, which is particulate matter.¹²⁰ Further, both NO_x and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.¹²¹ Some of the health effects associated with particulate matter exposure are “premature mortality, increased hospital admissions and development of chronic respiratory disease.”¹²²

Fracking results in additional air pollution that can create a severe threat to human health. One analysis found that 37 percent of the chemicals found at fracked gas wells were volatile, and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.¹²³ Also, the SCAQMD has identified three areas of dangerous and unregulated air emissions from fracking: (1) the mixing of the fracking chemicals; (2) the use of the silica, or sand, as a proppant, which causes the deadly disease silicosis; and (3) the storage of fracking fluid once it comes back to the surface.¹²⁴ Preparation of the fluids used for well completion often involves onsite mixing of gravel or proppants with fluid, a process which potentially results in major amounts of particulate matter emissions.¹²⁵ Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.¹²⁶ Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.¹²⁷

¹¹⁶ Sierra Club Comments.

¹¹⁷ USEPA, Office of Air Quality Planning and Standards, Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas (EPA-453/R-93-045) at i (Oct. 1993) (“USEPA 1993”).

¹¹⁸ Earthworks, Sources of Oil and Gas Pollution (2011).

¹¹⁹ Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).

¹²⁰ U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter (June 2012),

http://www.epa.gov/ttnecas1/regdata/RIAs/PMRIACombinedFile_Bookmarked.pdf at 2-2, (“EPA RIA”).

¹²¹ EPA RIA at 2-2.

¹²² U.S. Environmental Protection Agency, National Ambient Air Quality Standards for Particulate Matter Proposed Rule, 77 Fed. Reg. 38,890, 38,893 (June 29, 2012).

¹²³ Colborn 2011 at 8.

¹²⁴ South Coast Air Quality Management District, Draft Staff Report on Proposed Rule 1148.2 - Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers (January 2013).at 15 (“SCAQMD Revised Draft Staff Report PR1148-2”).

¹²⁵ *Id.*

¹²⁶ South Coast Air Quality Management District, Response to Questions re Air Quality Risks of Hydraulic Fracturing in California, Submission to Joint Senate Hearing (2013) at 3.

¹²⁷ SCAQMD Revised Draft Staff Report PR1148-2 at 15.

The EIS should study the potential for oil and gas operations sites to emit such air toxics and any other pollutants that may pose a risk to human health, paying particular attention to the impacts of air pollution on environmental justice communities that already bear the burden of disproportionately high levels of air pollution. The EIS should rely on the most up-to-date information regarding the contribution of oil and gas operations to VOC and air toxics levels.

b. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of unconventional oil and gas recovery, including drilling, completion, well stimulation, production, and disposal. Drilling and casing the wellbore require substantial power from large equipment. The engines used typically run on diesel fuel, which emits particularly harmful types of air pollutants when burned. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can result in large volumes of air pollution. Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Methane emissions from oil and gas production is as much as 270 percent greater than previously estimated by calculation.¹²⁸ Recent studies show that emissions from pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.¹²⁹

Evaporation from pits can also contribute to air pollution. Pits that store drilling waste, produced water, and other waste fluid may be exposed to the open air. Chemicals mixed with the wastewater—including the additives used to make fracking fluids, as well as volatile hydrocarbons, such as benzene and toluene, brought to the surface with the waste—can escape into the air through evaporation. Some pits are equipped with pumps that spray effluents into the air to hasten the evaporation process. Even where waste fluid is stored in so-called “closed loop” storage tanks, fugitive emissions can escape from tanks.

As mentioned above, increased truck traffic will lead to more air emissions. Trucks capable of transporting large volumes of chemicals and waste fluid typically use large engines that run on diesel fuel. Air pollutants from truck engines will be emitted not only at the well site, but also along truck routes to and from the site.

c. Impact of Increased Air Pollution

The potential harms resulting from increased exposure to the dangerous air pollutants described above are serious and wide ranging. The negative effects of criteria pollutants are well documented and are summarized by the U.S. EPA’s website:

¹²⁸ Miller 2013.

¹²⁹ Allen 2013; Harriss, Robert et al., Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas, *Environ. Sci. Technol.*, 2015, 49 (13), pp 7524–7526.

Nitrogen oxides (NO_x) react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. NO_x and volatile organic compounds react in the presence of heat and sunlight to form ozone.

Particulate matter (PM) – especially fine particles – contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.¹³⁰

Sulfur Dioxide (SO₂) has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.¹³¹ Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.¹³²

Carbon Monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.¹³³ Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress.¹³⁴ For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.¹³⁵

Ozone (O₃) can trigger or worsen asthma and other respiratory ailments.¹³⁶ Ground level ozone can have harmful effects on sensitive vegetation and ecosystems. Ozone may also lead to loss of species diversity and changes to habitat quality, water cycles, and nutrient cycles.

¹³⁰ U.S. Environmental Protection Agency, Particulate Matter, (PM) <http://www.epa.gov/airquality/particlepollution/health.html> (accessed July 30, 2015); Ostro, Bart et al., Long-term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study, 118 *Environmental Health Perspectives* 3 (2010).

¹³¹ U.S. Environmental Protection Agency, Sulfur Dioxide <http://www.epa.gov/airquality/sulfurdioxide/health.html>, available at (accessed July 29, 2015).

¹³² *Id.*

¹³³ U.S. Environmental Protection Agency, Carbon Monoxide, available at <http://www.epa.gov/airquality/carbonmonoxide/health.html> (accessed July 29, 2015).

¹³⁴ *Id.*

¹³⁵ *Id.*

¹³⁶ U.S. Environmental Protection Agency, Ground Level Ozone, available at <http://www.epa.gov/airquality/ozonepollution/health.html> (accessed July 29, 2015).

Air toxics and hazardous air pollutants, by definition, can result in harm to human health and safety. The full extent of the health effects of exposure is still far from being complete, but already there are numerous studies that have found these chemicals to have serious health consequences for humans exposed to even minimal amounts. The range of illnesses that can result are summarized in a study by Dr. Theo Colborn, which charts which chemicals have been shown to be linked to certain illnesses.¹³⁷

Natural gas drilling operations result in the emissions of numerous non-methane hydrocarbons (NMHCs) that have been linked to numerous adverse health effects. A recent study that analyzed air samples taken during drilling operations near natural gas wells and residential areas in Garfield County, detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.¹³⁸ For example:

Thirty-five chemicals were found to affect the brain/nervous system, 33 the liver/metabolism, and 30 the endocrine system, which includes reproductive and developmental effects. The categories with the next highest numbers of effects were the immune system (28), cardiovascular/blood (27), and the sensory and respiratory systems (25 each). Eight chemicals had health effects in all 12 categories. There were also several chemicals for which no health effect data could be found.¹³⁹

The study found extremely high levels of methylene chloride, which may be used as cleaning solvents to remove waxy paraffin that is commonly deposited by raw natural gas in the region. These deposits solidify at ambient temperatures and build up on equipment.¹⁴⁰ While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study noted that such thresholds are typically based on “exposure of a grown man encountering relatively high concentrations of a chemical over a brief time period, for example, during occupational exposure.”¹⁴¹ Consequently, such thresholds may not apply to individuals experiencing “chronic, sporadic, low-level exposure,” including sensitive populations such as children, the elderly, and pregnant women.¹⁴² For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of “clinical significance,” as recent studies have linked low levels of exposure to lower mental development in children who were prenatally exposed.¹⁴³ In addition, government safety standards do not take into account “the kinds of

¹³⁷ Colborn, Theo et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) (“Colborn 2011”); Colborn, Theo, et al., An Exploratory Study of Air Quality near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal doi:10.1080/10807039.2012.749447 (2012); *see* note 120 & accompanying text below.

¹³⁸ Colborn et al., An Exploratory Study of Air Quality Near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal, Vol. 20, Iss. 1, 2014, pp. 21-22 (pages refer to page numbers in attached manuscript and not journal pages) (“Colborn 2014”), *available at* <http://www.tandfonline.com/doi/full/10.1080/10807039.2012.749447>.

¹³⁹ Colborn 2014, p. 11.

¹⁴⁰ *Id.*, p. 10.

¹⁴¹ *Id.*, pp. 11-12.

¹⁴² *Id.* p. 12.

¹⁴³ *Id.*, p. 10-11.

effects found from low-level exposure to endocrine disrupting chemicals..., which can be particularly harmful during prenatal development and childhood.¹⁴⁴

Another study reviewed exposures to emissions from unconventional natural gas development and noted that trimethylbenzenes are among the largest contributors to non-cancer threats for people living within a half mile of a well, while benzene is the largest contributor to cumulative cancer risk for people, regardless of the distance from the wells.¹⁴⁵

d. Air Modeling

The Service should use air modeling to understand what areas and communities will most likely be affected by air pollution. It is crucial to gather independent data rather than relying on industry estimates, which may be inaccurate or biased. Wind and weather patterns, and atmospheric chemistry, determine the fate and transport of air pollution over a region, over time. The EIS should be informed by air modeling to show where the air pollution will flow.

4. Fracking worsens the problem of climate change.

Climate change is a problem of global proportions resulting from the cumulative greenhouse gas emissions of countless individual sources. A full EIS should analyze and consider, at a minimum, the cumulative greenhouse gas emissions of (a) a no-fracking alternative, and (b) an alternative involving adoption of mandatory emission-reduction technologies.

Expansion of fossil fuel production will substantially increase the volume of greenhouse gases emitted into the atmosphere and jeopardize the environment and the health and well being of future generations. The Service's mandate to ensure "the biological integrity, diversity, and environmental health of the System are maintained" requires the Service to limit the climate change effects of its actions.¹⁴⁶ Banning fracking and other unconventional well stimulation methods would lock away millions of tons of greenhouse gas pollution and limit the destructive effects of these practices.

In order to avoid catastrophic climate change, the Service must reduce, rather than increase, greenhouse gas emissions. This requires halting all fracking within the refuges, which would be a responsible step towards slowing the effects of climate change.

On December 12, 2015, 197 nation-state and supra-national organization parties meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to an agreement (Paris Agreement) committing its parties to take action so as to avoid dangerous climate change.¹⁴⁷ As the Paris Agreement opens for signature in April 2016¹⁴⁸ and the United States is expected to sign the treaty¹⁴⁹ as a legally binding instrument

¹⁴⁴ *Id.*, p. 12.

¹⁴⁶ See 16 U.S.C.S. § 668dd(a)(4)(A)-(B).

¹⁴⁷ Paris Agreement, Art. 2.

¹⁴⁸ Paris Agreement, Art. 20(1).

through executive agreement,¹⁵⁰ the Paris Agreement commits the United States to critical goals—both binding and aspirational—that mandate bold action on the United States’ domestic policy to rapidly reduce greenhouse gas emissions.¹⁵¹

The United States and other parties to the Paris Agreement recognized “the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge.”¹⁵² The Paris Agreement articulates the practical steps necessary to obtain its goals: parties including the United States have to “reach global peaking of greenhouse gas emissions *as soon as possible* . . . and to *undertake rapid reductions* thereafter in accordance *with best available science*,”¹⁵³ imperatively commanding that developed countries specifically “should continue taking the lead by undertaking economy-wide absolute emission reduction targets”¹⁵⁴ and that such actions reflect the “highest possible ambition.”¹⁵⁵

The Paris Agreement codifies the international consensus that climate change is an “urgent threat” of global concern,¹⁵⁶ and commits all signatories to achieving a set of global goals. Importantly, the Paris Agreement commits all signatories to an articulated target to hold the long-term global average temperature “to *well below 2°C* above pre-industrial levels and to *pursue efforts to limit the temperature increase to 1.5°C* above pre-industrial levels”¹⁵⁷ (emphasis added).

In light of the severe threats posed by even limited global warming, the Paris Agreement established the international goal of limiting global warming to 1.5°C above pre-industrial levels in order to “prevent dangerous anthropogenic interference with the climate system,” as set forth in the UNFCCC, a treaty which the United States has ratified and to which it is bound.¹⁵⁸ The Paris consensus on a 1.5°C warming goal reflects the findings of the IPCC and numerous scientific studies that indicate that 2°C warming would exceed thresholds for severe, extremely dangerous, and potentially irreversible impacts.¹⁵⁹ Those impacts include increased global food

¹⁴⁹ For purposes of this Petition, the term “treaty” refers to its international law definition, whereby a treaty is “an international law agreement concluded between states in written form and governed by international law” pursuant to article 2(a) of the Vienna Convention on the Law of Treaties, 1155 U.N.T.S. 331, 8 I.L.M. 679 (Jan. 27, 1980).

¹⁵⁰ See U.S. Department of State, Background Briefing on the Paris Climate Agreement, (Dec. 12, 2015), <http://www.state.gov/r/pa/prs/ps/2015/12/250592.htm>.

¹⁵¹ Although not every provision in the Paris Agreement is legally binding or enforceable, the U.S. and all parties are committed to perform the treaty commitments in good faith under the international legal principle of *pacta sunt servanda* (“agreements must be kept”). Vienna Convention on the Law of Treaties, Art. 26.

¹⁵² *Id.*, Recitals.

¹⁵³ *Id.*, Art. 4(1).

¹⁵⁴ *Id.*, Art. 4(4).

¹⁵⁵ *Id.*, Art. 4(3).

¹⁵⁶ *Id.*, Recitals.

¹⁵⁷ *Id.*, Art. 2.

¹⁵⁸ See U.N. Framework Convention on Climate Change, Cancun Agreement. Available at <http://cancun.unfccc.int/> (last visited Jan 7, 2015); United Nations Framework Convention on Climate Change, Copenhagen Accord. Available at http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (last accessed Jan 7, 2015). The United States Senate ratified the UNFCCC on October 7, 1992. See <https://www.congress.gov/treaty-document/102nd-congress/38>.

¹⁵⁹ See Paris Agreement, Art. 2(1)(a); U; U.N. Framework Convention on Climate Change, Subsidiary Body for Scientific and Technical Advice, Report on the structured expert dialogue on the 2013-15 review, No. FCCC/SB/2015/INF.1 at 15-16 (June 2015); IPCC AR5 Synthesis Report at 65 & Box 2.4.

and water insecurity, the inundation of coastal regions and small island nations by sea level rise and increasing storm surge, complete loss of Arctic summer sea ice, irreversible melting of the Greenland ice sheet, increased extinction risk for at least 20-30% of species on Earth, dieback of the Amazon rainforest, and “rapid and terminal” declines of coral reefs worldwide.¹⁶⁰ As scientists noted, the impacts associated with 2°C temperature rise have been “revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between ‘dangerous’ and ‘extremely dangerous’ climate change.”¹⁶¹ Consequently, a target of 1.5°C or less temperature rise is now seen as essential to avoid dangerous climate change and has largely supplanted the 2°C target that had been the focus of most climate literature until recently.

Climate experts have estimated that the world can emit 1,000 gigatons of carbon dioxide (1,000 GtCO₂ or 1 trillion tons of CO₂) after 2010 to have a reasonable chance of staying below 2°C of warming.¹⁶² Given the new 1.5°C threshold, coupled with uncertainties and the dire predictions of climate change impacts, a more conservative carbon budget is likely necessary. Nonetheless, using this budget, the IPCC has found that proven fossil fuel reserves amount to **four to seven times more** than what we can afford to burn, to have only a *likely* chance of staying within the 2°C target.¹⁶³ In short, the vast majority of *proven* reserves must be kept in the ground for preserving a livable planet.

Development of non-federal oil and gas resources within refuges will fuel climate disruption and undercut the needed transition to a clean energy economy. Keeping fossil fuels in

¹⁶⁰ See Jones, C. et al, Committed Terrestrial Ecosystem Changes due to Climate Change, 2 Nature Geoscience 484, 484–487 (2009); Smith, J. B. et al., Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) ‘Reasons for Concern’, 106 Proceedings of the National Academy of Sciences of the United States of America 4133, 4133–37 (2009); ; Veron, J. E. N. et al., The Coral Reef Crisis: The Critical Importance of <350 ppm CO₂, 58 Marine Pollution Bulletin 1428, 1428–36, (2009); ; Warren, R. J. et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141–77 (2011); Hare, W. W. et al., Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming, 11 Regional Environmental Change 1, 1–13 (2011); ; Frieler, K. M. et al., Limiting Global Warming to 2°C is Unlikely to Save Most Coral Reefs, Nature Climate Change, Published Online (2013) doi: 10.1038/NCLIMATE1674; ; M. Schaeffer et al., Adequacy and Feasibility of the 1.5°C Long-Term Global Limit, Climate Analytics (2013).

¹⁶¹ Anderson, K. and A. Bows, Beyond ‘Dangerous’ Climate Change: Emission Scenarios for a New World, 369 Philosophical Transactions, Series A, Mathematical, Physical, and Engineering Sciences 20, 20–44 (2011).

¹⁶²The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change, established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). In its Fifth Assessment Report, the IPCC reported that the remaining carbon budget to have a “likely” (at least 66%) chance of staying below 2°C is 1000 GtCO₂. See IPCC Climate Change 2014 Synthesis Report 63-64, available at http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf.

¹⁶³ *Id.* at 63. In addition, a recent analysis by some of the world’s leading climate scientists estimated that burning the Earth’s proven fossil fuel reserves (i.e., those that are currently economically recoverable) would emit 4196 GtCO₂, over four times the 1000 GtCO₂ budget. See Raupach M. et al. Sharing a quota on cumulative carbon emissions. Nature Climate Change 4, 873-79 (2014), available at <http://www.nature.com/nclimate/journal/v4/n10/full/nclimate2384.html>. Analyses by the Carbon Tracker Initiative and Australian Climate Commission estimated that 80% of proven fossil fuel reserves must be kept in the ground to have a reasonable probability (75-80%) of staying below 2°C. This estimate includes only the fossil fuel reserves that are considered currently economically recoverable with a high probability of being extracted. See Carbon Tracker Initiative, Unburnable Carbon – Are the world’s financial markets carrying a carbon bubble? (2011), available at <http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf>; Steffen, Will et al., Australian Climate Commission. The Critical Decade 2013: Climate Change Science, Risks and Responses (2013), available at http://apo.org.au/files/Resource/ClimateCommission_The-Critical-Decade-2013.pdf

the ground is, therefore, not only reasonable but also imperative. The Service would be remiss to continue permitting oil and gas development when it has never stepped back and taken a hard look at this problem at the appropriate scale. Before allowing more oil and gas extraction, the Service must: (1) comprehensively analyze the total greenhouse gas emissions which result from past, present, and potential future fossil fuel permitting and all other activities on its lands, (2) consider their cumulative significance in the context of global climate change, carbon budgets, and other greenhouse gas pollution sources outside the refuge system, and (3) formulate measures that avoid or limit their climate change effects. By continuing oil and gas permitting, including fracking operations, in the absence of any overall plan addressing climate change the Service is effectively burying its head in the sand.

a. The Service Must Fully Analyze Greenhouse Gas Emissions of Oil and Gas Operations

The Service cannot ignore the mounting evidence proving that oil and gas operations are a major cause of climate change. This is due to emissions from the operations themselves, and emissions from the combustion of the oil and gas produced. Every step of the lifecycle process for development of these resources results in significant carbon emissions, including but not limited to:

End-user oil and gas combustion emissions. The combustion of extracted oil and gas will add vast amounts of carbon dioxide to the atmosphere, further heating the climate and moving the Earth closer to catastrophic and irreversible climate change. Though much of the oil is used as gasoline to fuel the transportation sector, the produced oil may also be used in other types of products. The EIS should study all end-uses as contributors to climate change.

Combustion in the distribution of product. To the extent that distribution of raw and end-use products will rely on rail or trucks, the combustion of gasoline or diesel to transport these products will emit significant greenhouse gas emissions.

Emissions from Refineries and Production. Oil and gas must undergo intensive refinery and production processes before the product is ready for consumption. Refineries and their auxiliary activities constitute a significant source of emissions.

Vented emissions. Oil and gas wells may vent gas that flows to the surface at times where the gas cannot otherwise be captured and sold. Vented gas is a significant source of greenhouse gas emissions and can also pose a safety hazard.

Combustion during construction and extraction operations. Operators rely on both mobile and stationary sources of power to construct and run their sites. The engines of drilling or excavation equipment, pumps, trucks, conveyors, and other types of equipment burn large amounts of fuel to operate. Carbon dioxide, methane, and nitrous oxide (another potent greenhouse gas) are emitted from oxidized fuel during the combustion process. Engines emit greenhouse gases during all stages of oil and gas recovery, including drilling rig mobilization, site preparation and demobilization, completion rig mobilization and demobilization, well drilling, well completion (including fracking and other unconventional extraction techniques), and well production. Transportation of equipment and chemicals to and from the site is an integral part of the production process

and contributes to greenhouse gas emissions. Gas flaring is another important source of carbon dioxide emissions. Significant sources of emissions in oil production include pneumatic devices, dehydrators and pumps, and compressors, and system upsets.¹⁶⁴

Fugitive emissions. Potent greenhouse gases can leak as fugitive emissions at many different points in the production process, especially in the production of gas wells. Recent studies suggest that previous estimates significantly underestimate leakage rates.¹⁶⁵ New research shows methane leakage from some gas wells may be as high as 17.3 percent.¹⁶⁶ Moreover, new research has shown that unconventional gas wells are up to 2.7 times more likely than a conventional well to have a cement or casing impairment, which can lead to methane leaks.¹⁶⁷ The intersection of new fractures with nearby abandoned wells can also result in methane migration to the surface.¹⁶⁸ Leakage can also occur during storage, processing, and distribution to customers.¹⁶⁹

Natural gas emissions are generally about 84 percent methane.¹⁷⁰ Methane is a potent greenhouse gas that contributes substantially to global climate change. Its global warming potential is approximately 34 times that of carbon dioxide over a 100 year time frame and at least 86 times that of carbon dioxide over a 20 year time frame.¹⁷¹ Oil and gas operations release large amounts of methane. While the exact amount is not clear, EPA has estimated that “oil and gas systems are the largest human-made source of methane emissions and account for 37 percent of methane emissions in the United States and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades.”¹⁷² That proportion is

¹⁶⁴ U.S. Environmental Protection Agency, National Gas STAR Program, Basic Information, Major Methane Emission Sources and Opportunities to Reduce Methane Emissions (“USEPA, Basic Information”).

¹⁶⁵ Brandt, A. R. *et al.*, *Methane leaks from North American natural gas systems*, 343 *Science* 733 (2014); Miller, S. M. *et al.* Anthropogenic Emissions of Methane in the United States, *Proc. Natl. Acad. Sci. Early Edition*, DOI: 10.1073/pnas.1314392110 (2013) (“Miller 2013”).

¹⁶⁶ Caulton, Dana R. *et al.*, *Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development*, 111 *Proc. Natl. Acad. Sciences* 17 (2014); Schneising, Oliver, *et al.*, Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations, *Earth’s Future* 2, doi:10.1002/2014EF000265 (2014); Allen, D. T. *et al.*, (2013), *Measurements of Methane Emissions at Natural Gas Production Sites in the United States*, 110 *Proc. Natl. Acad. Sci.* 44 (2013) (“Allen 2013”); Zavala-Araizaa, Daniel *et al.*, *Reconciling divergent estimates of oil and gas methane emissions*, 112 *Proc. Natl. Acad. Sciences* 51 (2015), available at www.pnas.org/cgi/doi/10.1073/pnas.1522126112 (leakage rate 1.5% of production in Barnett shale or twice EPA’s estimate); Vaidyanathan, G, *Bad news for the climate as methane leaks far surpass previous estimates*, *E&E News* (Dec. 8, 2015) (leakage rate in Barnett shale equal to annual emissions of 8,000 cars).

¹⁶⁷ Ingraffea, Anthony R, *et al.*, *Assessment and Risk Analysis of Casing and Cement Impairment in Oil and Gas Wells in Pennsylvania, 2000 – 2012*, 111 *Proc. Natl. Acad. Sciences* 30 (2014).

¹⁶⁸ King, Pamela. ‘Frack hits’ provide pathways for methane migration study, *E&E News* (Oct. 21, 2015).

¹⁶⁹ Howarth, R. W. A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas, *Energy Science and Engineering* 2014; 2(2): 47–60, 49 (“Howarth 2014”).

¹⁷⁰ Brown Memo to EPA at 3; Power, Thomas, *The Local Impacts of Natural Gas Development in Valle Vidal, New Mexico*, University of Montana (2005) (“Power”).

¹⁷¹ Intergovernmental Panel on Climate Change, Chapter 8: Anthropogenic and Natural Radiative Forcing in Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Table 8.7 (2013); Howarth, Robert, *et al.*, Methane and the greenhouse-gas footprint of natural gas from shale formations, *Climatic Change* (Mar. 31, 2011) (“Howarth 2011”); Shindell, Drew, *Improved Attribution of Climate Forcing to Emissions*, 326 *Science* 716 (2009).

¹⁷² USEPA, Basic Information; *see also* Petron, Gabrielle, *et al.*, *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 *Journal of Geophysical Research* (2012).

based on an estimated calculation of methane emissions, rather than measured actual emissions, which indicate that methane emissions may be much greater in volume than calculated.¹⁷³

Fracked wells leak an especially large amount of methane, with some evidence indicating that the leakage rate is so high that shale gas is worse for the climate than coal.¹⁷⁴ In fact, a research team associated with the National Oceanic and Atmospheric Administration recently reported that preliminary results from a field study in the Uinta Basin of Utah suggest that the field leaked methane at an eye-popping rate of nine percent of total production.¹⁷⁵

The EIS must weigh the no-fracking alternatives' climate-change benefits against the impacts of allowing fracking, and address the following:

i. Sources of Greenhouse Gases

In performing a full analysis of climate impacts, the Service must consider all potential sources of greenhouse gas emissions (e.g., greenhouse gas emissions generated by transporting large amounts of water for fracking). The Service should also perform a full analysis of all gas emissions that contribute to climate change, including methane and carbon dioxide. The EIS should calculate the amount of greenhouse gas that will result on an annual basis from (1) each of the fossil fuels that can be developed within each Park Service unit, (2) each of the well stimulation or other extraction methods that can be used, including, but not limited to, fracking, acidization, acid fracking, and gravel packing, and (3) cumulative greenhouse gas emissions expected over the long term (expressed in global warming potential of each greenhouse pollutant as well as CO₂ equivalent), including emissions throughout the entire fossil fuel lifecycle discussed above.

ii. Effects of Climate Change

In addition to quantifying the total emissions that would result from lease sales within the refuges, an EIS should consider the environmental effects of these emissions, resulting from climate disruption's ecological and social effects.¹⁷⁶ Release of greenhouse gases (from extraction, leakage, and downstream combustion) is not merely a reasonably foreseeable consequence of fracking extraction, it is the necessary and intended consequence. The Council on Environmental Quality ("CEQ") and the courts have repeatedly cautioned federal agencies

¹⁷³ Miller, S. M. et al., *Anthropogenic Emissions of Methane in the United States*, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).

¹⁷⁴ Howarth 2011; Brune, Michael, Statement of Sierra Club Executive Director Michael Brune Before the Committee on Oversight & Government Reform (May 31, 2012); Wang, Jinsheng, et al., Reducing the Greenhouse Gas Footprint of Shale (2011); Alvarez, Ramon et al., *Greater focus needed on methane leakage from natural gas infrastructure*, Proc. Nat'l. Acad. Sci. Early Edition (Feb 13, 2012) at 3; see also Howarth, Robert, et al., Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al., (2012); Hou, Deyi, et al., Shale gas can be a double-edged sword for climate change, *Nature Climate Change* at 386 (2012)

¹⁷⁵ Tollefson, Jeff, *Methane leaks erode green credentials of natural gas*, *Nature News* (Jan 2, 2013).

¹⁷⁶ See Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts 11 (Dec. 18, 2014), available at <https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance> (instructing agencies to consider indirect and connected actions, including "downstream" emissions). Although the CEQ guidance is still in draft form and not binding, it is arbitrary for agencies to ignore its reasoning without explanation.

that they cannot ignore either climate change generally, or the combustion impacts of fossil fuel extraction in particular.¹⁷⁷

On December 12, 2015, nearly 200 governments, including the United States, agreed to the commitments enumerated in the Paris Agreement to “strengthen the global response to the threat of climate change”¹⁷⁸ The Paris Agreement codified the international consensus that the climate crisis is an urgent threat to human societies and the planet, with the parties recognizing that:

Climate change represents an *urgent and potentially irreversible threat to human societies and the planet* and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response, with a view to accelerating the reduction of global greenhouse gas emissions (emphasis added).¹⁷⁹

Numerous authoritative scientific assessments have established that climate change is causing grave harms to human society and natural systems, and these threats are becoming increasingly dangerous. The Intergovernmental Panel on Climate Change (IPCC), in its 2014 Fifth Assessment Report, stated that: “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased” and that “[r]ecent climate changes have had widespread impacts on human and natural systems.”¹⁸⁰

The 2014 Third National Climate Assessment, prepared by a panel of non-governmental experts and reviewed by the National Academy of Sciences and multiple federal agencies similarly stated that “That the planet has warmed is ‘unequivocal,’ and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin”¹⁸¹ and “[i]mpacts related to climate change are already evident in many regions and are expected to become increasingly disruptive across the nation throughout this century and beyond.”¹⁸² The United States National Research Council similarly concluded that: “[c]limate change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems.”¹⁸³

¹⁷⁷ See 40 C.F.R. §§ 1508.7, 1508.8; *Center for Biological Diversity v. Nat’l Highway Transp. Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *Utahns for Better Transp. v. U.S. Dep’t of Transp.*, 305 F.3d 1152, 1176 (10th Cir. 2002); *Dine Citizens Against Ruining Our Env’t v. U.S. Office of Surface Mining*, 82 F.Supp.3d 1201, 1212-14 (D. Colo. 2015).

¹⁷⁸ Paris Agreement, Art. 2(1).

¹⁷⁹ Paris Agreement, Decision, Recitals.

¹⁸⁰ IPCC AR5 Synthesis Report at 2.

¹⁸¹ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment(U.S. Global Change Research Program). doi:10.7930/J0Z31WJ2 (“Third National Climate Assessment”) at 61 (quoting IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., Cambridge University Press, 1-18.).

¹⁸² Third National Climate Assessment at 10.

¹⁸³ National Research Council, *Advancing the Science of Climate Change* (2010), available at www.nap.edu. (“Advancing the Science of Climate Change”) at 2.

The IPCC and National Climate Assessment further decisively recognize the dominant role of fossil fuels in driving climate change:

While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.¹⁸⁴

CO₂ emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).¹⁸⁵

These impacts ultimately emanating from the extraction and combustion of fossil fuels are harming the United States in myriad ways, with the impacts certain to worsen over the coming decades absent deep reductions in domestic and global GHG emissions. EPA recognized these threats in its 2009 Final Endangerment Finding under Clean Air Act Section 202(a), concluding that greenhouse gases from fossil fuel combustion endanger public health and welfare: “the body of scientific evidence compellingly supports [the] finding” that “greenhouse gases in the atmosphere may reasonably be anticipated both to endanger public health and to endanger public welfare.”¹⁸⁶ In finding that climate change endangers public health and welfare, EPA has acknowledged the overwhelming evidence of the documented and projected effects of climate change upon the nation:

Effects on air quality: “The evidence concerning adverse air quality impacts provides strong and clear support for an endangerment finding. Increases in ambient ozone are expected to occur over broad areas of the country, and they are expected to increase serious adverse health effects in large population areas that are and may continue to be in nonattainment. The evaluation of the potential risks associated with increases in ozone in attainment areas also supports such a finding.”¹⁸⁷

Effects on health from increased temperatures: “The impact on mortality and morbidity associated with increases in average temperatures, which increase the likelihood of heat waves, also provides support for a public health endangerment finding.”¹⁸⁸

Increased chance of extreme weather events: “The evidence concerning how human induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and

¹⁸⁴ Third National Climate Assessment at 2.

¹⁸⁵ IPCC AR5 Synthesis Report at 46.

¹⁸⁶ Final Endangerment Finding, 74 Fed. Reg. at 66,497.

¹⁸⁷ *Id.*

¹⁸⁸ *Id.*

floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels.”¹⁸⁹

Impacts to water resources: “Water resources across large areas of the country are at serious risk from climate change, with effects on water supplies, water quality, and adverse effects from extreme events such as floods and droughts. Even areas of the country where an increase in water flow is projected could face water resource problems from the supply and water quality problems associated with temperature increases and precipitation variability, as well as the increased risk of serious adverse effects from extreme events, such as floods and drought. The severity of risks and impacts is likely to increase over time with accumulating greenhouse gas concentrations and associated temperature increases.”¹⁹⁰

Impacts from sea level rise: “The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas. The conclusion in the assessment literature that there is the potential for hurricanes to become more intense (and even some evidence that Atlantic hurricanes have already become more intense) reinforces the judgment that coastal communities are now endangered by human-induced climate change, and may face substantially greater risk in the future. Even if there is a low probability of raising the destructive power of hurricanes, this threat is enough to support a finding that coastal communities are endangered by greenhouse gas air pollution. In addition, coastal areas face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The increased risk associated with these adverse impacts also endangers public welfare, with an increasing risk of greater adverse impacts in the future.”¹⁹¹

Impacts to energy, infrastructure, and settlements: “Changes in extreme weather events threaten energy, transportation, and water resource infrastructure. Vulnerabilities of industry, infrastructure, and settlements to climate change are generally greater in high-risk locations, particularly coastal and riverine areas, and areas whose economies are closely linked with climate-sensitive resources. Climate change will likely interact with and possibly exacerbate ongoing environmental change and environmental pressures in settlements, particularly in Alaska where indigenous communities are facing major environmental and cultural impacts on their historic lifestyles.”¹⁹²

Impacts to wildlife: “Over the 21st century, changes in climate will cause some species to shift north and to higher elevations and fundamentally rearrange U.S. ecosystems. Differential capacities for range shifts and constraints from development, habitat fragmentation, invasive species, and broken ecological connections will likely alter ecosystem structure, function, and services, leading to predominantly negative consequences for biodiversity and the provision of ecosystem goods and services.”¹⁹³

¹⁸⁹ *Id.* at 66,497-98.

¹⁹⁰ *Id.* at 66,498.

¹⁹¹ *Id.*

¹⁹² *Id.*

¹⁹³ *Id.*; see also Third National Climate Assessment at 195-219.

In addition to these acknowledged impacts on public health and welfare more generally, climate change is causing and will continue to cause serious impacts on natural resources that the Department of Interior is specifically charged with safeguarding.¹⁹⁴

Impacts to Public Lands: Climate change is causing and will continue to cause specific impacts to public lands ecosystem services. Although public lands provide a variety of difficult-to-quantify public benefits, one recent Forest Service attempt at quantification estimates the public land ecosystem services at risk from climate change at between \$14.5 and \$36.1 billion annually.¹⁹⁵ In addition to the general loss of ecosystem services, irreplaceable species and aesthetic and recreational treasures are at risk of permanent destruction. High temperatures are causing loss of glaciers in Glacier National Park; the Park's glaciers are expected to disappear entirely by 2030, with ensuing warming of stream temperatures and adverse effects to aquatic ecosystems.¹⁹⁶ With effects of warming more pronounced at higher latitudes, tundra ecosystems on Alaska public lands face serious declines, with potentially serious additional climate feedbacks from melting permafrost.¹⁹⁷ In Florida, the Everglades face severe ecosystem disruption from already-occurring saltwater incursion.¹⁹⁸ Sea level rise will further damage freshwater ecosystems and the endangered species that rely on them.

Impacts to Biodiversity and Ecosystems: Across the United States ecosystems and biodiversity, including those on public lands, are directly under siege from climate change—leading to the loss of iconic species and landscapes, negative effects on food chains, disrupted migrations, and the degradation of whole ecosystems.¹⁹⁹ Specifically, scientific evidence shows that climate change is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extirpations.²⁰⁰ Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to result in catastrophic species losses during this century. For example, the IPCC concluded that 20% to 30% of plant and animal species will face an increased risk of extinction if global average temperature rise exceeds 1.5°C to 2.5°C relative to 1980-1999, with an increased risk of extinction for up to 70% of species worldwide if global average temperature

¹⁹⁴ See Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701(a)(8), 1712(c)(1); Multiple-Use Sustained Yield Act of 1960, 16 U.S.C. § 528; National Environmental Policy Act of 1969, 42 U.S.C. §§ 4331-4332.

¹⁹⁵ Esposito, Valerie et al., *Climate Change and Ecosystem Services: The Contribution and Impacts on Federal Public Lands in the United States*, USDA Forest Service Proceedings RMRS-P-64 at 155-164 (2011).

¹⁹⁶ U.S. Environmental Protection Agency, *Climate Change and Public Lands* (1999).

¹⁹⁷ See National Climate Assessment at 48; MacDougall, A. H., et al., Significant contribution to climate warming from the permafrost carbon feedback, 5 *Nature Geoscience* 719-721 (2012), doi:10.1038/ngeo1573.

¹⁹⁸ See National Climate Assessment at 592; Foti, R., Met al., Signs of critical transition in the Everglades wetlands in response to climate and anthropogenic changes, 110 *Proceedings of the National Academy of Sciences* 6296-6300, (2013), doi:10.1073/pnas.1302558110.

¹⁹⁹ National Climate Assessment at 13.

²⁰⁰ See Parmesan, C. and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 *Nature* 37-42 (2003); Root, T. et al., Fingerprints of global warming on wild animals and plants, 421 *Nature* 57-60 (2003); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 *Science* 1024-1026 (2011).

exceeds 3.5°C relative to 1980-1999.²⁰¹

In sum, climate change, driven primarily by the combustion of fossil fuels, poses a severe and immediate threat to the health, welfare, ecosystems and economy of the United States. These impacts are felt across the nation, including upon the public lands the Secretary of the Interior is charged with safeguarding. A rapid and deep reduction of emissions generated from fossil fuels is essential if such threats are to be minimized and their impacts mitigated.

Although cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous, uncertain, and potentially catastrophic as climate change, the Service does have tools available to provide one approximation of external costs and has previously performed a “social cost of carbon” analysis in prior environmental reviews.²⁰² An internal memo by BLM identifies one available analytical tool: “For federal agencies the authoritative estimates of [social cost of carbon] are provided by the 2013 technical report of the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget.”²⁰³ As explained in that report:

The purpose of the “social cost of carbon” (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO₂) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions. The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.²⁰⁴

²⁰² See *High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment [“EA”] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); Taylor, P., “BLM crafting guidance on social cost of carbon -- internal memo,” Greenwire, April 15, 2015, available at <http://www.eenews.net/greenwire/stories/1060016810/>; BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson (“Roberson Internal Memo”), April 2015, available at http://www.eenews.net/assets/2015/04/15/document_gw_01.pdf (noting “some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents”) (accessed July 29, 2015); see also Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, available at www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (accessed Jul 29, 2015) (quantitative analysis required if GHGs > 25k tons/yr).

²⁰³ See *High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment [“EA”] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); Taylor, P., “BLM crafting guidance on social cost of carbon -- internal memo,” Greenwire, April 15, 2015, available at <http://www.eenews.net/greenwire/stories/1060016810/>; BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson (“Roberson Internal Memo”), April 2015, available at http://www.eenews.net/assets/2015/04/15/document_gw_01.pdf (noting “some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents”) (accessed July 29, 2015); see also Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, available at www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (accessed Jul 29, 2015) (quantitative analysis required if GHGs > 25k tons/yr).

²⁰⁴ BLM, Roberson Internal Memo.

²⁰⁵ See Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, May 2013, available at

Other analytical tools exist to evaluate the cost of methane emissions.²⁰⁵ EPA has peer reviewed and employed such a tool in its “Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector.”²⁰⁶

Development of unconventional wells could exact extraordinary financial costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered. The EIS must provide an accounting of these potential costs.

5. Fracking Harms Sensitive Species and Wildlife

The expansion of oil and gas development activities will harm wildlife through habitat destruction and fragmentation, stress and displacement caused by development-related activities (e.g., construction and operation activities, truck traffic, noise and light pollution), surface water depletion leading to low stream flows, water and air contamination, introduction of invasive species, and climate change. These harms can result in negative health effects and population declines. Studies and reports of observed impacts to wildlife from unconventional oil and gas extraction activities are summarized in the Center’s “Review of Impacts of Oil and Gas Exploration and Development on Wildlife,” submitted herewith.²⁰⁷ Because the allowance of destructive oil and gas extraction runs contrary to the Service’s mandate to conserve wildlife a no-fracking alternative minimizing industrial development and its harmful effects on wildlife must be considered.

a. Habitat Loss

Oil and gas development creates a network of well pads, roads, pipelines, and other infrastructure that lead to direct habitat loss and fragmentation, as well as displacement of wildlife from these areas due to increased human disturbance. Habitat loss occurs as a result of a reduction in the total area of the habitat, the decrease of the interior-to-edge ratio, isolation of one habitat fragment from another, breaking up of one habitat into several smaller patches of habitat, and decreasing the average size of a habitat patch. New research has revealed the extent

https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (accessed July 29, 2015); *see also* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Feb. 2010, *available at* <http://www.epa.gov/otaq/climate/regulations/scc-tsd.pdf> (accessed July 29, 2015).

²⁰⁵ *See* Marten A.L., Kopits K.A., Griffiths C.W., Newbold S.C., Wolverton A. 2014, online publication (2015, print publication). “Incremental CH₄ and N₂O mitigation benefits consistent with the US Government’s SC-CO₂ estimates,” *Climate Policy* 15(2):272-298, abstract *available at* <http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.912981>.

²⁰⁶ *See* USEPA, Social Cost of Carbon, *available at* <http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html> (noting application of social cost of methane supported by peer review); USEPA, Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector, Ch. 4, *available at* http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf.

²⁰⁷ *See* Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 20, 2015). This review presents the findings of numerous studies and reports on the impacts of hydraulic fracturing on wildlife.

of this habitat loss. For example, in the western United States, the amount of high-quality habitat for the pronghorn has shrunk drastically due to oil and gas development.²⁰⁸

The indirect effects from unconventional oil and gas development can often be far greater than the direct disturbances to habitat. The impacts from the well site—including noise, light, and pollution—extend beyond the borders of the operation site and will consequently render even greater areas uninhabitable for some wildlife. Species dependent on having an “interior” habitat will lose their habitat as operation sites or other infrastructure fragment previously buffered and secluded areas. These and other indirect effects can be far greater than the direct disturbances to land. In the Marcellus shale of Pennsylvania, for instance, research shows that 8.8 acres of forest on average are cleared for each drilling pad along with associated infrastructure, but after accounting for ecological edge effects, each drilling station actually affected 30 acres of forest.²⁰⁹

While individual well sites may cause some disturbance and destruction, the cumulative impacts of oil and gas production using unconventional methods must receive attention as well. While the actual well pads may only occupy a small proportion of a particular habitat, their impact can be much greater when their aggregate impact is considered. As discussed above, interior habitats will be destroyed by removing the buffer between the interior habitat and the operation site.

b. Water Depletion

Water depletion also affects species whose habitats are far removed from the actual well site. Because of the high volume of water required for even a single well that uses unconventional extraction methods, the cumulative water depletion has a significant impact on species that rely on water sources that serve to supply oil and gas operations. In addition, water depletion adversely impacts water temperature and chemistry, as well as amplifies the effects of harmful pollutants on wildlife that would otherwise be diluted without the depletion.

Hydraulic fracturing and horizontal drilling require water volumes that far exceed the amounts used in conventional natural gas development.²¹⁰ The Service must take into account the much higher fresh water requirements of these practices.

c. Contamination from Wastewater Causing Harm and Mortality

Accidental spills or intentional dumping of wastewater contaminate surface water and cause large-scale harm to wildlife. Numerous incidents of wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills

²⁰⁸ Beckmann, J.P. et al. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone, 147 *Biological Conservation* 1:222 (2012).

²⁰⁹ Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.

²¹⁰ See Clark, Corrie E. et al., Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas, *Environ. Sci. Technol.*, 2013, 47 (20), pp 11829–11836, abstract available at <http://pubs.acs.org/doi/abs/10.1021/es4013855>.

of fish, aquatic invertebrates, and trees and shrubs, as well as negative health effects for wildlife and domestic animals. In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.²¹¹ Among the species harmed was the blackside dace, a threatened minnow species.²¹² An analysis of water quality of Acorn Creek and fish tissues taken shortly after the incident was exposed showed the fish displayed general signs of stress and had a higher rate of gill lesions, than fish in areas not affected by the dumping.²¹³ The discharge of fracking wastewater into the Susquehanna River in Pennsylvania is suspected to be the cause of fish abnormalities, including high rates of spots, lesions, and intersex.²¹⁴ In West Virginia, the permitted application of hydrofracturing fluid to an area of mixed hardwood forest caused extensive tree mortality and a 50-fold increase in surface soil concentrations of sodium and chloride.²¹⁵

In addition, open air pits that store waste fluid pose risks for wildlife that may come into contact with the chemicals stored in the pits. Already, there have been several documented cases of animal mortality resulting from contact with pits. A field inspection of open pits in Wyoming found 269 bird carcasses, the likely cause of death being exposure to toxic chemicals stored in the open pits.²¹⁶ Open pits can also serve as breeding grounds for mosquitoes, which serve as a vector for West Nile virus, a threat to humans and animals alike. In Wyoming, an increase of ponds led to an increase of West Nile virus among greater sage-grouse populations.²¹⁷ Recently, new information has come to light that operators in California have been dumping wastewater into hundreds of unpermitted open pits.²¹⁸ The EIS must take into account the impact of both unpermitted, illegal waste pits as well as those that are regulated.

Contaminants from spills not only directly harm species exposed to these contaminants but can enter the food chain and harm predators. A recent study found that in watersheds where hydraulic fracturing occurs, a top predator, riparian songbird in headwater systems, the Louisiana Waterthrush (*Parkesia motacilla*), accumulated metals associated with the fracking process. “In both the Marcellus and Fayetteville shale regions, barium and strontium were found at significantly higher levels in feathers of birds in sites with fracking activity than at sites without fracking.”²¹⁹ While the study did not resolve the pathway for these metals entering the

²¹¹ Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29, 2013, <http://www.eenews.net/greenwire/2013/08/29/stories/1059986559> (accessed July 30, 2015).

²¹² *Id.*

²¹³ Papoulias, D.M. and A.L. Velasco. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases, 12 *Southwestern Naturalist* (Special Issue 4):92 (2013).

²¹⁴ Piette, Betsy, BP Oil Spill, Fracking Cause Wildlife Abnormalities, *Workers World* (April 27, 2012) available at http://www.workers.org/2012/us/bp_oil_spill_fracking_0503/; Pennsylvania Fish & Boat Commission, Ongoing Problems with the Susquehanna River smallmouth bass, a Case for Impairment (May 23, 2012), www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf

²¹⁵ Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 *Journal of Environmental Quality* 1340 (2011).

²¹⁶ See, e.g., Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 *Environ Mgmt* 5: 820 (2010).

²¹⁷ Zou, Li et al., Mosquito Larval Habitat Mapping Using Remote Sensing and GIS: Implications of Coalbed Methane Development and West Nile Virus, 43 *J. Med. Entomol.* 5:1034 (2006) (“Zou 2006”).

²¹⁸ Cart, Julie. *Hundreds of Illicit Oil Wastewater Pits Found in Kern County*, (Feb. 26, 2015), available at <http://www.latimes.com/local/lanow/la-me-ln-pits-oil-wastewater-20150226-story.html>.

²¹⁹ Latta, Steven C., et al., Evidence from two shale regions that a riparian songbird accumulates metals associated with hydraulic fracturing,” *Ecosphere* vol. 6(9), Article 144 (September 2015),

food chain, their findings suggested that “hydraulic fracturing may be contaminating surface waters and underscores the need for additional monitoring and study to further assess ecological and human health risks posed by the increasingly widespread development of unconventional sources of natural gas around the world.”²²⁰

d. Invasive Species

Invasive species may be introduced through a variety of pathways that would be increasingly common if oil and gas activity is allowed to expand. Machinery, equipment, and trucks moved from site to site can carry invasive plant species to new areas. In addition, materials such as crushed stone or gravel transported to the site from other locations may serve as a conduit for invasive species to migrate to the well site or other areas en route.

Aquatic invasive species may also spread more easily given the large amounts of freshwater that must be transported to accommodate new drilling and extraction techniques. These species may be inadvertently introduced to new habitats when water is discharged at the surface. Alternatively, hoses, trucks, tanks, and other water use equipment may function as conduits for aquatic invasive species to access new habitats.

e. Climate Change

Anthropogenic climate change poses a significant threat to biodiversity.²²¹ Climate disruption is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extinctions.²²² Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to significantly increase extinction risk for many species. The IPCC concludes that it is extremely likely that climate change at or above 4°C will result in substantial special extinction.²²³ Other studies have predicted similarly severe losses: 15-37 percent of the world’s plants and animals committed to extinction by 2050 under a mid-level emissions scenario²²⁴; the

available at <http://www.esajournals.org/doi/pdf/10.1890/ES14-00406.1>.

²²⁰ *Id.*

²²¹ Warren, R. et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 *Nature Climate Change* 678 (2013) (“Warren 2013”).

²²² Cahill, A.E. et al., How Does Climate Change Cause Extinction? *Proceedings of the Royal Society B*, doi:10.1098/rspb.2012.1890 (2012); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 *Science* 1024 (2011); Maclean, I.M.D., and R.J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 *Proc. Natl. Acad. Sci. Early Edition* 12337 (2011) (“Maclean and Wilson 2011”); Parmesan, C., Ecological and Evolutionary Responses to Recent Climate Change, 37 *Annual Review of Ecology Evolution & Systematics* 637 (2006); Parmesan, C., and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 *Nature* 37 (2003); Root, T.L. et al., Fingerprints of Global Warming on Wild Animals and Plants, 421 *Nature* 57 (2003); Warren, Rachel et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 *Climatic Change* 141 (2011). (“Warren 2011”).

²²³ Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).

²²⁴ Thomas, C.D. et al., Extinction Risk from Climate Change, 427 *Nature* 8:145 (2004).

extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.²²⁵ Another recent study predicts the loss of more than half of the present climatic range for 58 percent of plants and 35 percent of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species.²²⁶ Because expansion of oil and gas production in the planning area will substantially increase the emissions of greenhouse gases, this activity will further contribute to the harms from climate change to wildlife and ecosystems.

f. Population-level Impacts

Oil and gas development has been linked to population-level impacts on wildlife, including lower reproductive success of sage grouse and declines in the abundance of songbirds and aquatic species. For example, young greater-sage grouse avoided mating near infrastructure of natural-gas fields, and those that were reared near infrastructure had lower annual survival rates and were less successful at establishing breeding territories compared to those reared away from infrastructure.²²⁷ In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.²²⁸ In the Fayetteville Shale of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.²²⁹ The EIS must consider the population-level impacts that oil and gas development may have on wildlife in the planning area.

²²⁵ Maclean and Wilson 2011.

²²⁶ Warren 2013.

²²⁷ Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 *Journal of Wildlife Management* 1:65 (2010).

²²⁸ Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 *The Journal of Wildlife Management* 4:816 (2011).

²²⁹ Green, Jessie J. et al., Abstract: Examining Community Level Variables of Fishes in Relation to Natural Gas Development, Southeastern Fishes Council, Annual Meeting Program, November 8 - 9, 2012, New Orleans, Louisiana (2012).

g. Endangered, Threatened, and Sensitive Species

The Service must use the existing readily available data to identify which sensitive species that are of critical concern with regards to the lands included in, or in immediate proximity to, the areas in which fracking operations could be conducted. The EIS must discuss any impacts to such species.

In addition, under section 7(a)(1) of the Endangered Species Act (ESA), the Service has an obligation to “utilize their authorities in furtherance of the purposes of [the ESA]” as it relates to fracking and conservation of species:

The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this chapter. All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this chapter by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 1533 of this title.

16 U.S.C. § 1536(a)(1). This “clear statutory directive” not only requires the Service to ensure that the proposed regulations avoid adverse impacts to listed species but that it adopt “substantive conservation programs for [listed] species.” *See Sierra Club v. Glickman*, 156 F.3d 606, 617, 618 (5th Cir. 1998). The proposed rule must address how listed species will be conserved in areas impacted by fracking and other oil and gas activities.

h. Metrics

The Service should conduct a full assessment of the direct and indirect impacts of unconventional oil and gas development activities on wildlife and ecosystems through a suite of comprehensive studies on all species and ecosystems that could be affected. The studies should be particularly detailed for federally and state listed species, federal and state candidates for listing, and state species of special concern. The studies should address the following impacts: (1) habitat loss, degradation, and fragmentation, including edge effects; (2) water depletion; (3) air and water contamination; (4) introduction of invasive species; (5) climate change impacts; (6) health and behavioral effects such as increased stress and changes in life history behaviors; (7) changes in demographic rates such as reproductive success and survival; and (8) potential for population-level impacts such as declines and extirpations. These studies should consider these harms individually and cumulatively.

6. Unconventional Extraction Techniques and Underground Wastewater Disposal Pose Seismic Risks

If fracking is allowed to continue in the NWRS units, increased unconventional oil and gas extraction and underground waste injection will increase the risk of induced seismicity. Induced seismic events could damage or destroy property and cause injuries or even death, especially in a state where earthquakes are rare and communities are typically not prepared for

them. A no-fracking alternative would minimize these risks, while continued unconventional well development would increase them.

Research has shown that in regions of the central and eastern United States where unconventional oil and gas development has proliferated in recent years, earthquake activity has increased dramatically.²³⁰ More than 300 earthquakes with magnitude (M) ≥ 3 occurred between 2010 through 2012, compared with an average of 21 per year between 1967 and 2000.²³¹ Moreover, although earthquakes with magnitude (M) ≥ 5.0 are very uncommon east of the Rocky Mountains, the number per year recorded in the midcontinent increased 11-fold between 2008 and 2011, compared to 1976 to 2007.²³² Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.²³³

Research has linked much of the increased earthquake activity and several of the largest earthquakes in the U.S. midcontinent in recent years to the disposal of wastewater into deep injection wells, which is well-established to pose a significant seismic risk.²³⁴ Much of the fracking wastewater is a byproduct of oil and gas production and is routinely disposed of by injection into wells specifically designed and approved for this purpose. The injected fluids push stable faults past their tipping points, and thereby induce earthquakes.²³⁵ In 2015, a study published in *Science* found that, the unprecedented increase in earthquakes in the U.S. midcontinent began in 2009 has been caused solely by the instability caused by fluid injection wells associated with fracking waste disposal.²³⁶ To put an exclamation point on this finding, a 4.7 magnitude earthquake struck northern Oklahoma that was felt in 7 additional states, leading the Oklahoma Geological Survey to reiterate the connection between disposal wells and earthquakes and to shut down the most high risk wells.²³⁷ Earthquakes at magnitudes (M) that are felt (M3 and M4) or destructive (M4 and M5) have been attributed to wastewater injection wells in at least five states - Arkansas, Colorado, Ohio, Oklahoma, and Texas. The largest of these was a M5.7 earthquake in Prague, Oklahoma, which was the biggest in the state's history, destroying 14 homes and injuring two people.²³⁸ Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,²³⁹ M4.9 in Texas,²⁴⁰ M4.7 in Arkansas,²⁴¹ and M3.9 in Ohio.²⁴²

²³⁰Ellsworth, W.L. Injection-Induced Earthquakes, 341 *Science* 1225942 (2013) (“Ellsworth 2013”); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, *Geology* doi:10.1130/G34045.1 (March 26, 2013) (“Keranen 2013”).

²³¹Ellsworth 2013.

²³²Keranen 2013.

²³³Ellsworth 2013.

²³⁴*Id.*

²³⁵ Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013. Available at: <https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study>.

²³⁶ M. Weingarten, S. Ge, J. W. Godt, B. A. Bekins, and J. L. Rubinstein. June 19, 2015. High-rate injection is associated with the increase in U.S. mid-continent seismicity. *Science*, VOL 348 ISSUE 6241, pages 1336-1340.

²³⁷ Chow, Lorraine. November 19, 2015. Strong Earthquake Rattles Oklahoma, Felt in 7 Other States. <https://ecowatch.com/2015/11/19/oklahoma-earthquake-fracking/>

²³⁸Ellsworth 2013, Keranen 2013.

²³⁹ Rubinstein, J.L. et al., The 2001–present triggered seismicity sequence in the Raton Basin of southern Colorado/northern New Mexico, 104 *Bull. Seismol. Soc’y of America* 5 (2014).

²⁴⁰ Brown, W.A. et al. Abstract: Investigating the cause of the 17 May 2012 M4.8 earthquake near Timpson, East Texas, *Abstract 84 Seismol. Res. Lett* 374 (2013).

The proliferation of unconventional oil and gas development, including increases in extraction and injection, will increase earthquake risk in areas susceptible to induced seismicity. Accordingly, the EIS must fully assess the risk of induced seismicity cause by all unconventional oil and gas extraction and injection activities, including wastewater injection wells.

The analysis should assess the following issues based on guidance from the scientific literature, the National Research Council,²⁴³ and the Department of Energy²⁴⁴:

- (1) whether existing oil and gas wells and wastewater injection wells in the refuges have induced seismic activity, using earthquake catalogs (which provide an inventory of earthquakes of differing magnitudes) and fluid extraction and injection data collected by industry;
- (2) the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database and the most recent Colorado Geological Survey Fault Activity Map GIS layer. In its analysis, the Service should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect;
- (3) the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults;
- (4) the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults;
- (5) the hazards to human communities and infrastructure from induced seismic activity; and
- (6) the current state of knowledge on important questions related to the risk and hazards of induced seismicity from oil and gas development activities, including:
 - (a) how the distance from a well to a fault affects seismic risk (i.e., locating wells in close proximity to faults can increase the risk of inducing earthquakes);
 - (b) how fluid injection and extraction volumes, rates, and pressures affect seismic risk;

²⁴¹ Horton, S., Disposal of Hydrofracking Waste Fluid by Injection into Subsurface Aquifers Triggers Earthquake Swarm in Central Arkansas with Potential for Damaging Earthquake, 83 *Seismol. Res. Lett.* 2 (2012).

²⁴² Kim, Won-Young, Induced Seismicity Associated with Fluid Injection into a Deep Well in Youngstown, Ohio, 118 *J. of Geophys. Res.: Solid Earth* 3506 (February 1, 2013).

²⁴³ National Research Council, *Induced Seismicity Potential in Energy Technologies*. National Academies Press (2012).

²⁴⁴ U.S. Department of Energy, *Protocol for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems*, DOE/EE-0662 (2012); U.S. Department of Energy, *Best Practices for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems - Draft* (2013).

- (c) how the density of wells affects seismic risk (i.e., a greater density of wells affects a greater volume of the subsurface and potentially contacts more areas of a single fault or a greater number of faults);
- (d) the time period following the initiation of injection or extraction activities over which earthquakes can be induced (i.e., studies indicate that induced seismicity often occurs within months of initiation of extraction or injection although there are cases demonstrating multi-year delays);
- (e) how stopping extraction or injection activities affects induced seismicity (i.e., can induced seismicity be turned off by stopping extraction and injection and over what period, since studies indicate that there are often delays—sometimes more than a year—between the termination of extraction and injection activities and the cessation of induced earthquake activity);
- (f) the largest earthquake that could be induced by unconventional oil and gas development activities in refuges, including earthquakes caused by wastewater injection; and
- (g) whether active and abandoned wells are safe from damage from earthquake activity over the short and long-term.

7. Fracking Poses Significant Human Health and Safety Risks.

Ample scientific evidence indicates that well development and well stimulation activities have been linked to an array of adverse human health effects, including carcinogenic, developmental, reproductive, and endocrine disruption effects. The potential human health dangers and the precautionary principle should further compel the Service to consider not allowing further development of oil and gas minerals in the areas for lease. In comparing the fracking ban to continued unconventional well development scenarios, the EIS should include a health impact assessment, or equivalent, of the aggregate impact that unconventional extraction techniques, including fracking, will have on human health and nearby communities.

Due to the heavy and frequent use of chemicals, proximity to fracked wells is associated with higher rates of cancer, birth defects, poor infant health, and acute health effects for nearby residents who must endure long-term exposure:

- In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.²⁴⁵
- Another study found that pregnant women living within 10 miles of a fracked well were more likely to bear children with congenital heart defects and possibly neural tube defects.²⁴⁶ A separate study independently found the same pattern; infants born near

²⁴⁵ McKenzie, L. et al., Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources, 424 *Science of the Total Environment* 79 (2012) (“McKenzie 2012”).

²⁴⁶ McKenzie, L. et al., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural

fracked gas wells had more health problems than infants born near sites that had not yet conducted fracking.^{247, 248}

- A study analyzed Pennsylvania birth records from 2004 to 2011 to assess the health of infants born within a 2.5-kilometer radius of natural-gas fracking sites. They found that proximity to fracking increased the likelihood of low birth weight by more than half, from about 5.6 percent to more than 9 percent.²⁴⁹ The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.²⁵⁰ Another recent Pennsylvania study found a correlation between proximity to unconventional gas drilling and higher incidence of lower birth weight and small-for-gestational-age babies.²⁵¹
- A recent study found increased rates of cardiology-patient hospitalizations in zip codes with greater number of unconventional oil and gas wells and higher well density in Pennsylvania.²⁵² The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km², the number of cardiology-patient hospitalizations per 100 people (or “cardiology inpatient prevalence rate”) in that zip code would increase by 27%. If a zip code went from having zero wells to a well density of 0.17 to 0.79 wells/km², a 14% increase in cardiology inpatient prevalence rates would be expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.
- Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation and throat irritation.²⁵³
- In Texas, a jury awarded nearly \$3 million to a family who lived near a well that was hydraulically fractured.²⁵⁴ The family complained that they experienced migraines, rashes, dizziness, nausea and chronic nosebleeds. Medical tests showed one of the

Colorado, Advance Publication Environmental Health Perspectives (Jan. 28, 2014), <http://dx.doi.org/10.1289/ehp.1306722> (“McKenzie 2014”).

²⁴⁷ Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).

²⁴⁸ Whitehouse, Mark, *Study Shows Fracking is Bad for Babies*, Bloomberg View, Jan. 4, 2014, available at <http://www.bloombergvew.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies>.

²⁴⁹ *Id.*, citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.

²⁵⁰ *Id.*

²⁵¹ Stacy, Shaina L. et al. (2015) Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. PLoS ONE 10(6): e0126425. doi:10.1371/journal.pone.0126425, available at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425>.

²⁵² Jemielital, T. et al. Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. PLoS ONE 10(7): e0131093, available at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131093>.

²⁵³ Rabinowitz, P.M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania. Environmental Health Perspectives Advance Publication (2014); Bamberger, Michelle and R.E. Oswald, Impacts of Gas Drilling on Human and Animal Health, 22 New Solutions 51 (2012); Steinzor, N. et al., Gas Patch Roulette: How Shale Development Risks Public Health in Pennsylvania, Earthworks Gas & Oil Accountability Project (2012).

²⁵⁴ *Parr v. Aruba Petroleum, Inc.*, Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).

plaintiffs had more than 20 toxic chemicals in her bloodstream.²⁵⁵ Air samples around their home also showed the presence of BTEX — benzene, toluene, ethylbenzene and xylene — colorless but toxic chemicals typically found in petroleum products.²⁵⁶

Chemicals used for fracking also put nearby residents at risk of endocrine disruption effects. A study that sampled water near active wells and known spill sites in Garfield, County Colorado found alarming levels of estrogenic, antiestrogenic, androgenic, and antiandrogenic activities, indicating that endocrine system disrupting chemicals (EDC) threaten to contaminate surface and groundwater sources for nearby residents.²⁵⁷ The study concluded:

[M]ost water samples from sites with known drilling-related incidents in a drilling-dense region of Colorado exhibited more estrogenic, antiestrogenic, and/or antiandrogenic activities than the water samples collected from reference sites[,] and 12 chemicals used in drilling operations exhibited similar activities. Taken together, the following support an association between natural gas drilling operations and EDC activity in surface and ground water: [1] hormonal activities in Garfield County spill sites and the Colorado River are higher than those in reference sites in Garfield County and in Missouri, [2] selected drilling chemicals displayed activities similar to those measured in water samples collected from a drilling-dense region, [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites, and [4] known spills of natural gas fluids occurred at these spill sites.

The study also noted a linkage between EDCs and “negative health outcomes in laboratory animals, wildlife, and humans”:

Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.

Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of

²⁵⁵ Deam, Jenny, *Jury Awards Texas family Nearly \$3 million in Fracking Case*, Los Angeles Times (Apr. 3, 2014) <http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424-story.html>.

²⁵⁶ *Id.*

²⁵⁷ Kassotis, Christopher D. et al., *Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region*. *Endocrinology*, March 2014, 155(3):897–907, pp. 905–906, available at <http://press.endocrine.org/doi/full/10.1210/en.2013-1697>.

this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.²⁵⁸

Harmful chemicals are also found in the flowback fluid after well stimulation events. Flowback fluid is a key component of oil-industry wastewater from stimulated wells. A survey of chemical analyses of flowback fluid dating back to April 2014 in California revealed that concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the federal limits for drinking water.²⁵⁹ Of the 329 available tests that measured for benzene, the chemical was detected at levels in excess of federal limits in 320 tests (97 percent).²⁶⁰ On average, benzene levels were around 700 times the federal limit for drinking water.²⁶¹ Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.²⁶² These hazardous substances were detected in excess of federal limits for drinking water in over one hundred tests. This dangerous fluid is commonly disposed of in injection wells, which often feed into aquifers, including some that could be used for drinking water and irrigation.

Acidizing presents similarly alarming risks to public health and safety. In acidizing operations, large volumes of hydrochloric and hydrofluoric acid are transported to the site and injected underground. These chemicals are highly dangerous due to their corrosive properties and ability to trigger tissue corrosion and damage to sensory organs through contact.

While many risks are known, much more is unknown about the hundreds of chemicals used in fracking. The identity and effects of many of these additives is unknown, due to operators' claims of confidential business information. But, as the EPA recognizes, chemical identities are "necessary to understand their chemical, physical, and toxicological properties, which determine how they might move through the environment to drinking water resources and any resulting effects."²⁶³ Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.²⁶⁴ The lack of this information also precludes effective remediation: "Knowing their identities would also help inform what chemicals to test for in the event of suspected drinking water impacts and, in the

²⁵⁸ *Id.*, p. 905.

²⁵⁹ California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report, available at <http://www.conservation.ca.gov/dog/Pages/WellStimulationTreatmentDisclosure.aspx>. The highest concentration was 7,700 parts per billion (ppb) for a well with API number 03052587. The US EPA's maximum contaminant level for benzene is 5 ppb.

²⁶⁰ *Id.*

²⁶¹ *Id.*, see also Cart, J., High Levels of Benzene Found in Fracking Wastewater, Los Angeles Times, Feb. 11, 2015, <http://www.latimes.com/local/california/la-me-fracking-20150211-story.html#page=1>.

²⁶² *Id.*; see also Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015) Feb. 11, 2015, available at http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html.

²⁶³ EPA 2015 at 10-18.

²⁶⁴ Souther, Sara et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, *Front Ecol Environ* 2014; 12(6): p. 334.

case of wastewater, may help predict whether current treatment systems are effective at removing them.”²⁶⁵

Even where chemical identities are known, chemical safety data may be limited. In EPA’s study of the hazards of fracking chemicals to drinking water, EPA found that “[o]ral reference values and oral slope factors meeting the criteria used in this assessment were not available for the majority of chemicals used in hydraulic fracturing fluids [87%], representing a significant data gap for hazard identification.”²⁶⁶ Without this data, EPA could not adequately assess potential impacts on drinking water resources and human health.²⁶⁷ Further, of 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physiochemical properties reported in EPA’s toxics database, although this information is “essential to predicting how and where it will travel in the environment.”²⁶⁸ The data gaps are actually much larger, because EPA excluded 35% of fracking chemicals reported to FracFocus from its analysis because it could not assign them standardized chemical names.²⁶⁹ The EIS should incorporate a literature review of the harmful effects of each of the chemicals known to be used in fracking and other unconventional oil and gas extraction methods. Without knowing the effects of each chemical, the EIS cannot accurately project the true impact of unconventional oil and gas extraction.

The EIS should also study the human health and safety impacts of noise pollution, light pollution, and traffic accidents resulting from oil and gas development. A recent study found that automobile and truck accident rates in counties in Pennsylvania with heavy unconventional oil and gas extraction activity were between 15 and 65 percent higher than accident rates in counties without unconventional oil and gas extraction activities.²⁷⁰ Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.²⁷¹ In addition, operational accidents pose a significant threat to public health.²⁷²

8. Fracking Will Impact Land Use

Increased oil and gas extraction and production have the potential to dramatically and permanently change the landscape of the areas for lease and their surroundings. Countless acres of land will likely be leveled to allow for the construction and operation of well pads and related facilities such as wastewater pits. Roads may have to be constructed or expanded to accommodate trucks transporting chemicals and the large quantities of water needed for some recovery methods. Transmission lines and other utilities may also be required. The need for new distribution, refining, or waste treatment facilities will expand industrial land use. With new

²⁶⁵ EPA 2015 at 10-18.

²⁶⁶ *Id.* at 10-7, 9-7.

²⁶⁷ *Id.* at 9-37-38.

²⁶⁸ *Id.* at 5-73.

²⁶⁹ *Id.* at 9-38.

²⁷⁰ Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania.

74 Accident Analysis and Prevention 203 (2015).

²⁷¹ *Id.*

²⁷² Wiserman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, Fordham Env'tl. Law Rev. 115 (2009), 138-39 (describing incident where worker got caught in a fracking fluid spill and nurse treating him in emergency room was later diagnosed with chemical poisoning).

roads and other industrial infrastructure, certain areas could open up to new industrial or extractive activities, permanently changing the character and use of the land.

Such changes would result in a significant cumulative losses of agricultural and conservation lands. Vegetation removal by oil and gas development across central North America between 2000 and 2012 is estimated to be 4.5 tetragrams of carbon or 10 tetragrams of dry biomass.²⁷³ This is equivalent to more than half of annual available grazing on public lands managed by the BLM or 6% of the wheat produced in 2013 within the region (120.2 million bushels of wheat).²⁷⁴ This loss of “net primary production” (amount of carbon fixed by plants and accumulated as biomass) is “likely long-lasting and potentially permanent, as recovery or reclamation of previously drilled land has not kept pace with accelerated drilling.”²⁷⁵ The total surface disturbance by oil and gas development within this time period is 3 million hectares, the equivalent of three Yellowstone National Parks.²⁷⁶ As noted above, the fragmented nature of this surface disturbance negatively impacts wildlife by severing migratory pathways, altering wildlife behavior and mortality, and increasing susceptibility to ecologically disruptive species.²⁷⁷

The conversion of substantial acreages from rural or natural landscapes to industrial sites will also mar scenic views throughout the planning area. Given the Service’s failure to ensure full reclamation of idle wells and the difficulty of restoring sites to their original condition, scenic resources may be permanently impaired.

C. The Service Has Authority to Regulate the Exercise of Nonfederal Mineral Rights

The Service’s draft EIS and proposed rulemaking seems to suggest that non-federal mineral owners whose minerals are within the refuge boundary have an absolute right to access and extract their minerals, including via fracking. *See* Proposed Rule § 29.40(c) (“Although we would place refuge-protecting mitigation measures on proposed operations, the Service does not intend that implementation of these regulations would result in a denial of access to prospective operators to exercise their non-Federal oil and gas rights. We would work with operators to ensure they have reasonable access to their operations and that refuge resources and values are protected without resulting in a taking...”). This assumption misstates both the nature of the mineral right and the Service’s obligations under the Refuge Act. The Service’s statutory duty is to limit harmful and dangerous oil and gas activities that will materially interfere with or detract from the fulfillment of the mission of the NWRS (conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats). Mineral owners’ property rights are not absolute. They do not include the right to cause unreasonable harm to refuge lands, and the Service is well within its statutory rights to strictly regulate means of mineral extraction, including prohibiting use of extraction techniques not proven safe.

²⁷³ Allred, Brady et al. Ecosystem services lost to oil and gas in North America: Net primary production reduced in crop and rangelands. *Science*, vol. 384, issue 6233 (April 24, 2015) at 401.

²⁷⁴ *Id.*

²⁷⁵ *Id.*

²⁷⁶ *Id.* at 402.

²⁷⁷ *Id.*

It is a long-standing and uniform principle of oil and gas law that private oil and gas rights of the mineral interest to cause harm to surface interests is limited, and alternative means of surface access must be weighed against the harm to the surface owner. *See, e.g., Gerrity Oil & Gas Corp. v. Magness*, 946 P.2d 913, 928 (Colo. 1997); *Hunt Oil Co. v. Kerbaugh*, 283 N.W.2d 131, 137 (N.D. 1979). Mineral owners do not have an absolute right to conduct hydraulic fracturing operations on refuge lands.

The Service's statutory authority and regulations require it to "ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans." 16 U.S.C. § 668dd(a)(4)(B). It is an eminently reasonable exercise of this authority to decline authorization for hydraulic fracturing and other unconventional stimulation techniques on refuge lands until such time as those techniques can be proven to be safe to the environmental health of the Refuge System. Nor are mineral owners owed compensation for the value of their mineral rights if they are denied the ability to drill or frack as part of reasonable regulation of surface activities. More likely than not, in the vast majority of cases, a moratorium on fracking to protect health, environment, and refuge lands could not result in a regulatory taking warranting compensation to the owner. *See, e.g., City of Houston v. Trail Enters.*, 377 S.W.3d 873 (Tex. App. 2012) (rejecting taking claim against drilling ban near lake).

Because hydraulic fracturing and other unconventional extraction techniques pose significant and insufficiently understood risks to public health, the environment, and System values and resources, the Fish and Wildlife Service has both the authority and the duty to exclude such methods from the Refuge System. In the unlikely event that a mineral owner may succeed in a claim for compensation for the value of his or her minerals, the Service could craft a limited exception for the operation conditioned on strict mitigation offset and monitoring requirements, buy out the owner's mineral rights, or pay court-ordered compensation. This approach of restricting fracking to the maximum extent possible is mandated by the Service's duty to "provide for the conservation of fish, wildlife, and plants, and their habitats within the System; and ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans." At the very least, the Service should prohibit fracking and other unconventional well stimulation techniques until their complete safety to the Refuge System can be proven.

1. Limiting Fracking in Refuges Would Not Result in a Categorical Taking under *Lucas*

Mineral owners seeking to prove that a prohibition on fracking has effected a taking of their property would bear a "heavy burden" in proving this claim. *Keystone Bituminous Coal Ass'n v. DeBenedictis*, 480 U.S. 470, 493 (1987). Regulation of fracking on mineral rights underlying NWRS land would plainly not be a confiscation of the mineral right or *per se* taking, but rather an exercise of the Government's dual authority as surface owner and sovereign. Under such circumstances, the threshold questions for determining which test applies are: (1) whether the regulated activity is permissible in the first place under "background principles" of property or nuisance law, and (2) whether the regulation "deprives land of *all* economically beneficial use." *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1027 (1992) (emphasis added). Engaging in

oil and gas operations that would constitute a common law nuisance or destroy public trust resources are not protected property rights in the first place.

If the regulation does not result in a “complete elimination of value” or a “total loss,” then the Court’s multi-factor balancing test formulated in *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104 applies. *Lucas*, 505 U.S. at 1019-1020 n.8. Otherwise, the categorical rule under *Lucas* applies: A statute that “wholly eliminate[s] the value” of land qualifies as a taking unless the regulated activity is already proscribed under “background principles” of state property or nuisance laws. *See id.* at 1027, 1029. The Takings Clause prohibits appropriation of property or total elimination of value; it does not guarantee property owners freedom from all regulation, nor the most profitable of all possible means of realizing value. *See Keystone Bituminous Coal Ass’n*, 480 U.S. at 496-97.

In determining whether the owner’s fee simple title value has been wholly eliminated, the court looks to the value of the “parcel as a whole.” *Tahoe-Sierra Pres. Council v. Tahoe Reg’l Planning Agency*, 535 U.S. 302, 331 (2002); *Penn Central Trans. Co. v. New York City*, 438 U.S. 104, 131 (1978) (“‘Taking’ jurisprudence does not divide a single parcel into discrete segments and attempt to determine whether rights in a particular segment have been entirely abrogated.”). In other words, the economic impact of a regulation is measured against the value of the whole parcel, including the surface and mineral estate. *See Keystone Bituminous Coal Ass’n v. DeBenedictis*, 480 U.S. 470, 501 (1987) (restriction on removing coal from “support estate” (coal left in place to prevent subsidence) was not a taking, despite support estate being a separate property right under state law); *see also Andrus v. Allard*, 444 U.S. 51, 65-66 (1979) (“[T]he denial of one traditional property right does not always amount to a taking. At least where an owner possesses a full bundle of property rights, the destruction of one strand of the bundle is not a taking, because the aggregate must be viewed in its entirety.”). Thus, a moratorium on fracking until its safety is proven would not deprive inholding operators who owned both surface and mineral rights the entire use of their property, where other surface uses of the parcel were still available.

The Supreme Court has not addressed what is the proper “denominator” or “full bundle of property rights” when split estate or severed mineral rights are at issue. The one federal court that has squarely addressed this issue has found that the “whole parcel” consists of exactly that – both the severed mineral interests and the surface rights despite the split ownership. *See Mid Gulf v. Bishop*, 792 F. Supp. 1205, 1214 (D. Kan. 1992) (value of oil and gas leaseholder’s interest not considered separately from value of surface). Such an approach avoids defeat of the state’s regulatory power where it would otherwise exist if the surface and mineral rights were unsevered. “‘Taking’ jurisprudence does not divide a single parcel into discrete segments and attempt to determine whether rights in a particular segment have been entirely abrogated. In deciding whether a particular governmental action has effected a taking, this Court focuses rather both on the character of the action and on the nature and extent of the interference with rights in the parcel as a whole.” *Penn Central Trans. Co. v. New York City*, 438 U.S. 104, 131 (1978).

Even if the “whole parcel” consists of just the severed mineral rights, where the owner retains some ability to develop minerals, the regulation does not deny the owner of “all economically beneficial use” of these rights. *See Machipongo Land & Coal Co. v. Dep’t of*

Envtl. Prot., 569 Pa. 3, 35, 799 A.2d 751, 769-70 (2002) (no categorical taking under *Lucas*, in part, because restriction on coal extraction did not affect owner's ability to develop gas); *cf. Tarrant Cty. Water Control & Improvement Dist. No. One v. Haupt, Inc.*, 854 S.W.2d 909, 913 (Tex. 1993) (no taking where alternative means to develop minerals available while accommodating surface owner's use). In the case of a fracking moratorium, an owner would not be denied all economically beneficial use where it could develop or had developed minerals without fracking. That a particular technique for exploiting the mineral estate could not be utilized—e.g., shale gas fracking—would not necessarily result in a taking.

2. Even Where The *Lucas* Test Applies, the Service May Impose Restrictions Arising Under Property or Nuisance Law.

In the “rare” instance where an owner is deprived of all beneficial use of his or her property, compensation to the owner would still not be required if the challenged property restrictions are rooted in (1) “background principles of the State’s law of property”; or (2) “nuisance [law] already placed upon land ownership.” *See Lucas*, 505 U.S. at 1029. This is because “such ‘background principles’ may place pre-existing limitations on the property owner’s title.” *Air Pegasus of D.C., Inc. v. United States*, 424 F.3d 1206, 1211 (Fed. Cir. 2005) (citing *Lucas*, 505 U.S. at 1028-29). Where federal property is concerned, background principles of federal property law also operate to restrict these activities. *Cf. id.*, 424 F.3d at 1218 (finding claimant lacked “private property right in the navigable air space” of the U.S. under “‘background principles’ of long-standing federal property law”).

Background principles of property and nuisance law include the state and federal public trust doctrines, which could prohibit activities that pollute groundwater and surface waters or otherwise interfere with uses protected by the public trust. *See, e.g., New Mexico v. GE*, 467 F.3d 1223, 1243 (10th Cir. 2006) (New Mexico public trust doctrine protects groundwater resources from contamination); *Esplanade Properties, LLC v. City of Seattle*, 307 F.3d 978, 986-87 (9th Cir. 2002) (public trust doctrine operated to restrict development on shoreline near public park that would have interfered with public recreational uses, and thus claimant’s development plans “never constituted a legally permissible use”); *Aztec Minerals Corp. v. Romer*, 940 P.2d 1025, 1031-32 (Colo. App. 1996) (right to pollute or contaminate streams or property is not part of the “bundle of rights that are commonly characterized as property”); *Machipongo Land and Coal Co.*, 569 Pa at 40-42 (causing water pollution prohibited by statute or principles of public nuisance is not a compensable property right); *State v. Sour Mountain Realty, Inc.*, 276 A.D.2d 8, 16 (N.Y.A.D. 2000) (taking does not occur when government exercises its police power to protect public trust in wild animals.).

State laws governing environmental protection may also operate to restrict an owner’s allowable activities in exploiting a property right. *See Rith Energy, Inc. v. United States*, 44 Fed. Cl. 108, 115 (1999) (denial of permit due to “high probability of acid mine drainage” into aquifer was “exercise of regulatory authority indistinguishable in purpose and result from which plaintiff was always subject” under state nuisance law embodied in Tennessee’s water quality control statute); *see also Palazollo v. Rhode Island*, 503 U.S. 606, 629 (2001) (remanding for determination of “when a legislative enactment can be deemed a background principle of state law”). As described above, fracking presents serious risks to drinking water and surface water,

due to the intentional creation of underground fractures through which methane and fracking chemicals may migrate to neighboring aquifers or the surface. Fracking and horizontal drilling also pose higher risks of well failure than conventional wells. Further, increased use, storage, and transport of millions of gallons of fracking chemicals, produced water, and other wastewaters results in a significant risk of spills and leaks that could contaminate water resources.

State nuisance law may also protect against the many disturbances associated with fracking operations, including groundwater and surface contamination, air pollution, increased vehicle traffic, noise, lighting, risk of accidents, and invasive vegetation. Generally, public nuisance claims are brought to abate an activity which significantly interferes with “the public health, the public safety, the public peace, the public comfort or the public convenience.” *See* Restatement 2d of Torts, § 821B (2nd ed. 1979); *see, e.g., Flo-Sun, Inc. v. Kirk*, 783 So. 2d 1029, 1036 (Fla. 2001) (public nuisance under Florida law is “any annoyance to the community or harm to public health”). These state laws are not limited to abating those activities traditionally considered nuisances. “Changed circumstances or new knowledge may make what was previously permissible no longer so.” *Lucas*, 505 U.S. at 1031. Ample information, including new knowledge about the induced seismicity and other public health risks of fracking operations, *see* section I(B)(6) above, warrant deeming fracking operations on sensitive NWRS lands a public nuisance under both state and federal common law. The Service is well-equipped to make extensive findings to this effect in support of a fracking ban.

3. Owners Also Bear a Heavy Burden for Proving a Taking Under *Penn Central*.

A determination that a regulation results in “anything less than a ‘complete elimination of value’ or a ‘total loss’” would require application of the *Penn Central* test. *See Tahoe-Sierra Pres. Council*, 535 U.S. at 330 (citing *Lucas*, 505 U.S. at 1019-1020, n. 8). This test involves balancing a “complex of factors,” including “[1] the regulation’s economic effect on the landowner, [2] the extent to which the regulation interferes with reasonable investment-backed expectations, and [3] the character of the government action.” *Palazzolo v. Rhode Island*, 533 U.S. 606, 617 (2001) (citing *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978)).

While this test is “essentially [an] ad-hoc, factual inquiry,” and there is no “set formula” determining when a taking has occurred, *Penn Central*, 438 U.S. at 124, all of these factors would most likely weigh in the Service’s favor in any given scenario. First, with respect to the economic effect on the landowner, the Supreme Court has generally required a near-total reduction in value to find a taking. *See, e.g., Agins*, 447 U.S. 255, 65 L. Ed. 2d 106, 100 S. Ct. 2138 (no taking with an eighty-five percent reduction in value); *Vill. of Euclid v. Ambler Realty Co.*, 272 U.S. 365, 71 L. Ed. 303, 47 S. Ct. 114 (1926) (no taking with a seventy-five percent reduction in value); *Hadacheck v. Sebastian*, 239 U.S. 394, 60 L. Ed. 348, 36 S. Ct. 143 (1915) (no taking with a 92.5% diminution in value). But the baseline value of a mineral right is necessarily determined in the first place by the limits placed on surface disruption by surface owners’ rights, nuisance law, and the government’s police power. *See Animas Valley Sand & Gravel v. Bd. of Cty. Comm’Rs*, 38 P.3d 59, 66 (Colo. 2001) (requiring assessment of reduction in value attributable to challenged plan “rather than to the accumulated state and federal

regulations of the past several decades”).

Second, a court must weigh the extent to which the regulation would interfere with distinct investment-backed expectations. This includes assessing the reasonableness of the investor’s expectations, in light of the existing regulatory regime at the time of the acquisition of title to property, but this factor is not dispositive. *See Palazzolo*, 533 U.S. at 633-34 (O’Connor, J., concurring). An owner, moreover, does not establish reasonable expectations by simply showing that he or she “heretofore had believed [the property] was available for development.” *Penn Central*, 438 U.S. at 130.

Several factors bear on the reasonableness of owners’ investment-backed expectations. As an initial matter, because high volume fracking is a relatively new technique, which operators did not begin using until about a decade ago, the vast majority of property owners likely acquired mineral rights underlying refuge lands *before* the fracking boom, or before this new technology emerged. They therefore likely never expected to produce oil or gas from shale at the time of acquiring their property or that fracking would be a permissible use. With respect to these owners, a fracking moratorium could not interfere with expectations that never existed to begin with. Moreover, regardless of when the owner actually acquired title, if the technology did not exist at the time that a parcel’s mineral interests were severed from surface rights, there is no reason for an owner to believe that title to the mineral estate conveyed the right to frack. This is especially given the greater surface disturbance and other disturbances and risks associated with fracking compared to conventional oil and gas. *See United States v. Stearns Coal and Lumber Co.*, 816 F.2d 279 (6th Cir. 1987) (examining parties’ intent at time of mineral severance to determine whether mineral owner was allowed to strip mine). In any case, shale oil and gas production from any particular location is inherently speculative such that owners could almost never reasonably expect to fully develop a given area.

In addition, the Service itself has wide latitude to regulate activities on its lands as described above and to ensure the protection and conservation of fish and wildlife. It has long regulated oil and gas operations under the Refuge Act and under management plans for various refuge units. *See, e.g., Trustees for Alaska v. Watt*, 524 F. Supp. 1303, 1310 (D. Alaska 1981). While fracking is currently allowed in some states, it is a relatively new technique that has sparked significant controversy and moratoria to protect public health.²⁷⁸ Regulators are still catching up to fully understand the risks of fracking and have come under mounting public pressure to tighten restrictions since its use first became widespread. Operators could not reasonably expect that regulatory conditions would remain static in light of this controversy and evolving efforts to address these risks, including through bans. Further, because many of the risks and activities associated with fracking may create a public nuisance, operators could not reasonably expect to have unfettered rights to conduct fracking operations, especially on or near public recreational lands within the National Wildlife Refuge System.

Finally, the “character of the governmental action” factor would weigh against finding a taking. *See Penn Central*, 438 U.S. at 124. A fracking ban would be intended to conserve and

²⁷⁸ *See* New York State Department of Environmental Conservation, 2015 SEQR Findings Statement, *available at* http://www.dec.ny.gov/docs/materials_minerals_pdf/findingstatevhf62015.pdf.

protect fish and wildlife, a legitimate government purpose that would certainly be served by a ban.

4. The Service's Proposed Rule Can Account for Takings

While a fracking moratorium is likely to withstand takings challenges, to account for the rare case that it may not, the Service may take steps to avoid takings where disallowing an operation is legally infeasible. First, it could include a provision that would allow buy-out of minerals where a potential taking should be avoided. Second, it should include a provision that provides an exception for fracking operations in limited cases where all other alternatives are infeasible and the operation is "compatible with the major purposes" of the refuge 16 U.S.C. § 668dd(d)(1)(A). In such cases, fracking operations should only be allowed subject to strict mitigation and monitoring requirements. Mitigation measures should also include requirements to offset any impacts to refuge lands. The Service should also include a severability provision to ensure that a fracking moratorium could remain on the books, in the event that a claimant establishes a taking in a particular case. Because the Takings Clause does not prohibit valid regulation, only requiring compensation if that regulation eliminates *entirely* a property right, that provision could require the Service to pay court-ordered compensation to a claimant consistent with its constitutional obligation, while preserving the validity of the fracking ban.

II. The Proposed Secrecy for Well Stimulation Chemicals Is Unacceptable, Unlawful and Based on Another Agency's Misunderstanding of its Rulemaking Powers

Proposed § 29.121(f) would require operators provide public disclosure of chemicals used in hydraulic fracturing operations using the FracFocus Chemical Disclosure Registry or another approved database system:

If operations include hydraulic fracturing, the operator must provide the Service with a report including the true vertical depth of the well, total water volume used, and a description of the base fluid and each additive in the hydraulic fracturing fluid, including the trade name, supplier, purpose, ingredients, Chemical Abstract Service Number (CAS), maximum ingredient concentration in additive (percent by mass), and maximum ingredient concentration in hydraulic fracturing fluid (percent by mass). The report must be submitted through FracFocus or another Service-designated database.

Proposed § 29.121(f).

Given the appropriately high level of public concern about the health and environmental impacts of fracking chemicals, this proposed amendment is an important one.

However, proposed revisions to § 29.210 completely undermine the important information-gathering mechanism set out in § 29.121(f). The former allows operators to avoid any obligations to disclose the identity of fracking chemicals used simply by submitting nothing more than an affidavit in support of their claim that the information is confidential and the Service would have no power to disclose the information to the public if the operator were to

provide it. Operators will almost certainly use this loophole to keep chemical identification and concentrations from the agency, effectively rendering meaningless the requirement to submit such data to FracFocus and/or the Service. This change to the regulations is ill-advised, unworkable, and unlawful.

The proposed revisions now allow an operator to withhold pertinent information regarding the chemical identities and concentrations used on and in refuges from the very agency charged with managing and protecting those lands. Instead, the operator may submit an affidavit claiming that withholding the information is appropriate under some other law.²⁷⁹ With no other provision requiring the Service to independently verify trade secret claims, operators have an incentive to make overbroad claims to protect information that should otherwise be made available to the agency and to the public.

Allowing operators to withhold from the Service information claimed confidential also makes adequate baseline testing considerably more onerous, if not impossible. Parties that wish to test groundwater before hydraulic fracturing commences will not know what chemicals to test *for*. Doctors treating patients will be less able to properly diagnose a patient without access to a list of chemicals that the patient may have been exposed to. Scientific and public health research is also greatly hindered when information relating to chemical use is kept hidden.²⁸⁰ The Service will lose the ability to study, track, and disclose aggregate data on the effects of fracking by allowing operators to withhold this information. This is especially troubling given that the Service has a legal duty under NEPA and CEQ regulations to analyze the cumulative environmental impacts of a particular action.²⁸¹ A fully informed evaluation of the cumulative impacts of well stimulation and enhanced oil recovery on refuges requires gathering and aggregating information. Without doing so, the Service cannot conceivably base its decisions on an adequate analysis of the risks associated with oil and gas activities.

Another problem is that the proposed exception on provision of information to the Service is that it places recordkeeping duties in the hands of the operators. Proposed rule § 29.210(h) requires operators to retain records of withheld information for a mere 7 years after completion of fracking operations on refuges. Considering that well failure can occur at any time over the life of the well, and that failures may not become apparent until after the life of a well, this short period of time that records must be retained is wholly inadequate to preserve pertinent information about the chemicals used in fracking operations. The rule also fails to deal with the prospect of companies who withhold information dissolving, which will likely result in the loss of withheld information.

Insofar as information is withheld on the basis that it is a trade secret, the social costs of allowing pertinent information to remain secret increase over time and vastly outweigh any private interest in the proprietary value of the trade secret.²⁸² Thus, secrecy adds an unacceptable

²⁷⁹ Proposed Regulations at § 9.200(c).

²⁸⁰ Weinberger, et al., *Legislative Interference with the Patient–Physician Relationship*, *New England Journal of Medicine* (October 18, 2012.)

²⁸¹ 40 C.F.R. § 1508.7; see also *Considering Cumulative Effects Under the National Environmental Policy Act*, Council of Environmental Quality Report, January 1997

²⁸² See Lyndon, Mary, *Trade Secrets and Information Access in Environmental Law*, *The Law and Theory of Trade Secrecy* (2011).

increased burden on society and hinders the proper management of the risks posed by enhanced oil recovery techniques.²⁸³

A. The Service Cannot Comply with NEPA Requirements without Access to Pertinent Information about Chemicals and Well Integrity

NEPA and the implementing regulations by the CEQ require that federal agencies assess the environmental impacts of their proposed actions and inform their decision-making.²⁸⁴ The Service simply cannot comply with NEPA without knowing the identity of chemicals injected into the ground, the quantities and concentrations of those chemicals, and the chemical composition of the flowback fluid.

The Service falls far short of explaining how the requirement of a full assessment of the environmental risks in issuing permits to operators can be satisfied with incomplete knowledge of what chemicals are being used. NEPA requires that an agency assess the “*nature and extent* of the action’s environmental effects.”²⁸⁵ According to the proposed rule, “[d]uring the formal review process, under proposed §§ 29.102–29.103, the Service would evaluate the potential impacts of the proposed operations on refuge resources in compliance with applicable Federal laws, such as the National Environmental Policy Act of 1969 (NEPA, 42 U.S.C. 4321 et seq.) . . .”²⁸⁶ The Service does not explain how the agency can possibly understand and assess the nature, extent, and appropriate mitigation of the environmental risks when it does not know the actual chemicals being used. Moreover, as stated above, the Service will be left unable to fully assess the cumulative impacts of its permitting actions on refuge units. As described above, the aggregate effect on air, water, and the climate are serious concerns that require an in-depth assessment.

B. The Service Should Not Follow the BLM’s Regulations Insofar as They Provide Exceptions to Requirements to Disclose Information About Hydraulic Fracturing Chemicals

The Service touts that the proposed regulations would largely follow the Bureau of Land Management’s (BLM) regime for information submission, but those regulations are based on a misunderstanding of BLM’s power to require disclosure of information. The federal Trade Secrets Act, which BLM interprets as a restriction on disclosing chemical information to the public, does not in fact place such restrictions on an agency. The Trade Secret Act only prohibits disclosure of trade secrets “to [the] extent not authorized by law.”²⁸⁷ BLM has the authority to create regulations that permit disclosure of information that would otherwise be considered a

²⁸³ See Letter from David Levine to Alaska State Oil and Gas Conservation Commission (April 1, 2013) Re: Second Revised Notice of Proposed Changes in the Regulations of the Alaska Oil and Gas Conservation Commission dated January 17, 2013, specifically 20 AAC 25.283, Hydraulic Fracturing; see also OMB Watch, *The Right to Know, the Responsibility to Protect* (July 2012) available at http://www.foreffectivegov.org/files/info/naturalgasfrackingdisclosure_med.pdf.

²⁸⁴ 78 Fed. Reg. at 31644.

²⁸⁵ *Marbled Murrelet v. Babbitt*, 83 F.3d 1068, 1075 (9th Cir. 1996).

²⁸⁶ Proposed Rule at 77208.

²⁸⁷ 18 U.S.C. § 1905.

trade secret.²⁸⁸ Given BLM's duty to prevent unnecessary and undue degradation of public lands and to protect federal and Indian resources, the collection and disclosure of crucial information is well within the contemplation of the grant of legislative authority under the Federal Land Policy and Management Act (FLPMA).²⁸⁹ In fact, BLM has the obligation to collect such information and make it publicly available to comply with the FLPMA. Likewise, the collection and disclosure of this information is not only well within the contemplation of the Service's authority under the Refuge Act, but is required by its conservation mandate which also requires the Service ensure that the biological integrity, diversity, and environmental health of the System are maintained.

The federal Mineral Leasing Act ("MLA")²⁹⁰ provides additional legislative authorization for BLM to require the disclosure of information pertaining to chemicals. The MLA grants authority to BLM to "*prescribe necessary and proper rules and regulations and to do any and all things necessary to carry out and accomplish the purposes of this Act.*"²⁹¹ Among other delegated powers, the MLA also explicitly authorizes BLM to (1) require "statements, representations, or reports"²⁹², (2) revoke any permit that does not satisfy permit conditions²⁹³, (3) penalize circumvention of the MLA²⁹⁴, and (4) inspect, audit, or investigate lessees.²⁹⁵ As these examples illustrate, requiring the full disclosure of chemical information is but one of many tools available to BLM to regulate oil and gas operations and is well within the authority granted to BLM.

In its final rule, BLM concluded that none of these rulemaking powers are sufficient for BLM to promulgate a regulation that would require operators to provide information about trade secrets and then disclose that information. In reaching this conclusion, BLM relied on *Chrysler Corp. v. Brown*, 441 U.S. 281 (U.S. 1979).²⁹⁶ However, BLM misinterprets the relevant portions of *Chrysler*. BLM asserts that the decision stands for the principle that, in order to overcome the prohibition in §1905 of the Trade Secrets Act, "[t]he rule must be based on a statutory grant of authority allowing the agency to disclose privileged information," and that BLM has no power to make such a disclosure because its authorizing statutes "do not expressly authorize regulations requiring disclosure of privileged information," is a misreading of that case. To the contrary, the Supreme Court held that it is not necessary that:

²⁸⁸ See, e.g., *United States v. Geophysical Corp. of Alaska* (9th Cir. 1984) 732 F.2d 693 (Regulations promulgated pursuant to Outer Continental Shelf Land Act (43 USCS §§ 1331 et seq.) regarding issuance of permits for geophysical and geological exploration of outer continental shelf and providing for disclosure of data and processed information received by Secretary pursuant to such regulations does not violate 18 USCS § 1905; regulations and permit provisions regarding disclosure are "authorized by law."; see also, FLPMA (43 U.S.C. § 1732(b)) ("The Secretary shall, by regulation or otherwise, take *any action necessary* to prevent unnecessary or undue degradation of the lands.")

²⁸⁹ 42 U.S.C. § 1701 et seq.

²⁹⁰ 30 U.S.C. §§ 181 et seq.

²⁹¹ Id. § 189 (emphasis added).

²⁹² Id. § 190.

²⁹³ Id. §§ 183, 188.

²⁹⁴ Id. § 195.

²⁹⁵ Id. § 196.

²⁹⁶ 80 Fed. Reg. 16,173.

a grant of legislative authority to a federal agency by Congress [] be specific before regulations promulgated pursuant to it can be binding on courts in a manner akin to statutes. What is important is that the reviewing court reasonably be able to conclude that *the grant of authority contemplates the regulations issued.*²⁹⁷

Ultimately, the Court in *Chrysler* found that the regulations in question did not overcome § 1905 because they did not have the binding effect of law. Unlike BLM’s rules, the regulations at issue in *Chrysler* were made pursuant to a purported grant of authority by an Executive Order. The Executive Order spoke of regulations “necessary and appropriate” to achieve the purposes of the Executive Order, which sought to avoid procurement from corporations that were discriminatory employers. However, the source of authority for the Executive Order was unclear, which meant the regulations made pursuant to the Executive Order were invalid. The Court observed, however, that if the Executive Order had a more identifiable legislative basis, “we might agree with the respondents that this “compatibility” [between the purpose of the Executive Order being to combat discrimination in employment, and the disclosure policy designed to further this purpose,] gives the disclosure regulations the necessary legislative force.”

That is, *Chrysler* does not stand for the principal that an *express* grant of legislative authority is necessary to make regulations requiring disclosure of confidential information. Rather, a court must be able to conclude that the grant of authority to make regulations “contemplates” regulations requiring disclosure,²⁹⁸ or that there is “compatibility” between the purpose of the grant of authority and the regulations requiring disclosure.

Finally, in preparing its hydraulic fracturing regulations, BLM failed to provide any justification as to why, even if the Trade Secrets Act prohibits BLM staff from disclosing confidential information to the public, BLM should therefore refuse to collect such information at all. As set out above, such an approach denies the agency important data sources that may be aggregated and publicly disclosed, or that may be used for BLM’s internal purposes.

C. The Service Has the Power to Require Disclosure of Fracking Chemicals in All Circumstances

Given that BLM’s regulations allow operators to avoid disclosure of fracking chemicals only because BLM misunderstands the scope of its power to require disclosure, and that providing operators with such a loophole is generally undesirable, the Service should not follow BLM’s hydraulic fracturing regulations in this respect. Rather, the Service should consider its statutory power under the Refuge Act and require disclosure to fulfill its mandate to conserve, protect, and maintain wildlife refuge resources.

The Service asserts that its authority to promulgate the revised regulations is the Refuge Act.²⁹⁹ As previously discussed, that Act gave the Service authority to promulgate regulations to carry out the NWRSA. *Wyoming*, 279 F.3d at 1228. This regulatory power is derived from

²⁹⁷ *Chrysler Corp. v. Brown*, 441 U.S. 281 (U.S. 1979), emphasis added.

²⁹⁸ *Id.*, cited with approval in *United States v. Geophysical Corp. of Alaska*, 732 F.2d 693, 702 (9th Cir. Alaska 1984).

²⁹⁹ Proposed Regulations, 77201-202.

the Property Clause of the U.S. Constitution, which entrusts Congress with “power over the public land . . . without limitations.” *Kleppe*, 426 U.S. at 539; U.S. Const. art. VI, sec. 3, cl. 2. Congress, through the Refuge Act, directed the Service to manage and protect refuge lands, consistent with the refuges’ mission.³⁰⁰ As the proposed rule identifies, additional enabling legislation grants the Service authority to regulate the exercise of non-federal oil and gas rights in specific refuge units.³⁰¹ Given that the chemicals used in fracking may pose risks to the land, air, surface and subterranean waters, and wildlife in refuges, a regulation requiring disclosure of the use of all such chemicals is consistent with the Service’s power to promulgate regulations which will conserve those elements. A regulation providing that such information be made available to the public is likewise consistent with the purpose for which the Service may make regulations, in that it allows those for whom the refuges are conserved to be informed about the use of chemicals on NWRS lands, thereby allowing those persons to ensure the ongoing conservation of the refuge system for future generations.

D. The Disclosure Obligations Should Apply to All Well Stimulation Operations

The same considerations that justify requiring disclosure of chemicals used in fracking operations justify requiring disclosure used in all forms of well stimulation. Although many of the provisions of the proposed rule apply to “well stimulation,” which appears to be broader than “hydraulic fracturing,” *see* proposed § 29.95(d), the disclosure obligations contained in § 29.121(f) apply only to “hydraulic fracturing” operations. This provision should be broadened to require disclosure of chemicals used in all “well stimulation” operations.

III. The EIS Must Analyze Potential Impacts from Failure to Regulate Existing Operations, Directional Drilling, and Inholding Operations

The EIS’s comparison of alternatives is deficient, because it fails to acknowledge significant impacts that could result from the failure to regulate (1) proposed directional drilling operations that access minerals within a refuge from a surface location outside the refuge (“directional drilling exemption”); (2) non-Federal oil and gas operations that occur on private surface within the boundary of a refuge (i.e., inholdings); and (3) existing operations with and without a Service-issued permit. The preferred alternative (and proposed rule), Alternative B, would only regulate new operations within a refuge unit, while exempting all of the above categories of operations.

In contrast, under Alternative C, Service jurisdiction would expand to regulate all of the above operations exempt under Alternative B, as well as new operations. Therefore, all existing and new operations within the boundary of the refuge (including inholdings) or directional drilling beneath a refuge would be required to obtain an operations permit, meet all relevant operating standards, and post suitable financial assurance, in compliance with the provisions of the proposed rule.

The EIS fails to meaningfully analyze the impacts of exempting various operations under Alternative B compared with Alternative C. Although the Service admits “regulatory

³⁰⁰ 16 U.S.C.S. § 668dd(d)(1)(A).

³⁰¹ Proposed Regulations, 77201-202.

improvements in Alternative C would result mainly in long-term direct and indirect beneficial impacts on refuge resources and uses primarily from bringing previously exempt operations under regulation,” the EIS concludes that Alternative B is the Preferred Alternative, because purportedly environmental benefits of Alternative C are not worth the additional administrative costs associated with its implementation. In weighing the costs and benefits of making this conclusion, however, the EIS overlooks potentially significant impacts that it should have considered in its analysis.

A. Failing to Regulate Directional Drilling Operations Would Cause Significant Harm to the Refuge System

The EIS fails to fully analyze the impacts of exempting directional drilling operations from regulation. The EIS dances around, hinting at the potential direct and indirect impacts that directional drilling operations under Alternative B would have on refuge resources. Although it implies “indirect impacts” of directional drilling operations, including to “refuge geology and soils,”³⁰² “water and sediment transport downslope into refuge units through streams, gullies, or overland flow,”³⁰³ “air emissions adjacent to refuge units, and thus their transport across the refuge boundary,”³⁰⁴ the Service minimizes these impacts by suggesting that purportedly “indirect” impacts resulting from increased operations outside the refuge under Alternative B is preferable to “direct” impacts resulting from increased operations within the refuge under Alternative C:

Alternative C would provide some additional protection from the indirect impacts of these operations to refuge geology and soils by requiring mitigation measures that would reduce water and sediment transport downslope into refuge units through streams, gullies, or overland flow. However, Alternative C eliminates the incentive to locate operations outside of a refuge, so there would likely be a significant increase in the number of drilling and production operations located on refuges, as well as the direct impacts to geology and soils associated with these operations. Therefore, compared to Alternatives A and B, Alternative C would increase the instances where new drilling operations create direct, adverse, and long-term impacts to refuge soils and geology resources.³⁰⁵

It is unclear why unregulated drilling operations immediately outside the refuge under Alternative B would have any less “direct, adverse, and long-term” impacts to refuge resources than under Alternative C. This assumption is especially unfounded because new operations outside a refuge under Alternative B would be exempt from the Service’s proposed rule, including adequate financial assurance, updated environmental standards, and permitting requirements—the very reasons why regulation of non-federal oil and gas operations is needed in the first place. In addition, the EIS fails to address the commonsense relationship between well development immediately outside the refuge and downstream, downwind, and downslope effects to resources within the refuge. If increased cumulative impacts on refuge resources or

³⁰² DEIS at 4-19.

³⁰³ *Id.*

³⁰⁴ DEIS at 4-34

³⁰⁵ DEIS at 4-20.

neighboring communities would result, the Service should develop mitigation offsets that would compensate for these effects.

Moreover, more directional drilling outside the NWRS units could result in more intensive drilling of longer boreholes, involving overall greater freshwater depletion, surface disturbance, air pollution, greenhouse gas emissions, and noise compared to a scenario where drilling outside the park is not encouraged. The EIS neglects to acknowledge any of these effects in its comparison of Alternatives B and C, and as a result it does not study mitigation that would reduce these effects.

For example, according to the Final Environmental Impact Statement for the Revised Land and Resource Management Plan for the George Washington National Forest, horizontal drilling requires much greater surface disturbance and water depletion (just for drilling alone) than vertical wells, as shown in the table below.³⁰⁶ Increased surface disturbance could result in greater erosion and surface runoff, vegetation clearing, and air pollution. Further, greater construction needs and water requirements could result in greater use of drilling rigs and other equipment with combustion-engines, as well as increased traffic to and from the well site. These activities in turn would result in more air pollution, greenhouse gases, and noise. All of these impacts could degrade wildlife habitat and impact neighboring communities. Further, because these operations could be exempt from permitting requirements, they may not be subject to enforceable mitigation requirements to ensure that these impacts are offset or avoided.

Activity	Vertical	Horizontal
Pad development (acres)	2.07	5.74
Access roads (acres)	4.85	9.7
Total surface disturbance (acres)	6.92	15.44
Water use per well (drilling, gallons)	20,000	100,000
Area initially reclaimed	1.84	5.22
Area unreclaimed (for production)	5.08	10.22
Area used for production	0.23	0.52
Pipeline area disturbed (acres/mile of road)	2.91	2.91
Access road miles	1	2
Total pipeline area disturbed (acres)	2.91	5.82
Surface area disturbed per well pad (acres)	7.99	16.04

Horizontal drilling also tends to result in greater well failure, and “may be more prone to casing vent flow and/or gas migration away from the wellhead.”³⁰⁷ Such leaks could contaminate

³⁰⁶ U.S. Forest Service, Final Environmental Impact Statement for the Revised Land and Resource Management Plan for the George Washington National Forest (2014) at 3-428, available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3822821.pdf.

³⁰⁷ Ingraffea, Anthony R. et al. “Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000–2012.” Proceedings of the National Academy of Sciences of the United States of America

groundwater resources, including drinking water. Methane leaks could also result in increased greenhouse gas emissions, but climate-change related impacts were improperly eliminated from study in the EIS entirely.

Finally, to the extent the EIS assumes that the Service's enforcement of existing state laws and regulations would be adequate to sufficiently mitigate the impacts of exempt directional drilling operations under Alternative B, this assumption is unsupported. As noted in our rulemaking comments submitted by Defenders of Wildlife, existing state oil and gas laws and regulations are not necessarily focused on the protection of wildlife or other resources, and often do not mitigate impacts to wildlife. For example, the Center's review of the requirements governing wastewater storage in several states—Louisiana, Texas, Mississippi, and North Dakota— shows that earthen pits are allowed in these states.³⁰⁸ In Mississippi, unlined pits are allowed, increasing the risk of groundwater contamination, Code of Mississippi Rules 26-000-002, Rule 1.45(III)(E)(2)-(3), and in Louisiana, regulators permit open and unscreened pits, which could be death traps for birds attracted to these pits. Louisiana Administrative Code 43:XIX.303.F. In Texas and North Dakota, netting or screening requirements are riddled with exceptions, 16 Texas Administration Code § 3.22(b), North Dakota Administrative Code 43-02-03-19.1.

Likewise, financial assurance requirements in many states are often inadequate to ensure that operators fully reclaim areas disturbed or damaged by their operations.³⁰⁹ Without adequate financial assurance to ensure the Service has some recourse to hold operators responsible for any damage they may cause, it is likely that significant damage or other problems caused by irresponsible operators would not be remediated for many years, but the EIS fails to acknowledge this.

B. Failing to Regulate non-Federal Inholdings on NWRS units Would Cause Significant Harm to Refuge Resources

As we have already asserted in our comments on the proposed rule, submitted on our behalf by Defenders of Wildlife, the potential for environmental damage to refuge resources and impacts to wildlife and other public values from oil and gas development on inholdings is no less than operations permitted on the federal surface estate. The EIS must include analysis of the potential environmental consequences of exempting such operations from regulation.

The Wildlife Refuge System is the most vulnerable to development of non-federal oil and gas interests. As the Service acknowledges, “refuges have sustained significant damages from leaks and spills, unplugged or inadequately plugged wells, abandoned equipment, and

Early Edition (2014) at 1, 2, available at <http://www.pnas.org/content/111/30/10955.full>.

³⁰⁸ A breakdown of these states' pit requirements is provided in a spreadsheet titled “Open Pit Regulation Chart” submitted with this comment. Numerous refuges in North Dakota that do not have existing oil and gas development could be subject to new drilling and fracking. *See* FWS Spreadsheet 2016.

³⁰⁹ Environment America, *Who Pays the Costs of Fracking? Weak Bonding Rules for Oil and Gas Drilling Leave the Public at Risk* (2013), available at http://www.environmentamerica.org/sites/environment/files/reports/Who%20Pays%20the%20Cost%20of%20Fracking_vUS%20screen_0.pdf.

insufficient or no reclamation of refuge lands and resources.”³¹⁰ Failure to regulate oil and gas operations could result in potentially significant impacts to refuge resources if drilling on inholdings is allowed without enforceable permit requirements or safeguards to prevent damage to refuge resources, or without holding exempt operators accountable for any damage they may cause. Just as the EIS fails to analyze the impacts of exempting directional drilling operations from outside the refuge, the EIS performs no analysis of these significant effects of exempting inholding operations and fails to address their mitigation. Similarly, with respect to inholding operations, the EIS erroneously assumes that the Service’s enforcement of existing state laws and regulations would be adequate to mitigate their potential impacts.

C. Failing to Regulate Pre-Existing Operations Would Cause Significant Harm to the Refuge Resources

The NPS’s proposed rule to update its 9B regulations governing non-federal oil and gas development on Park Service lands included removing exemptions for grandfathered operations. The NPS based its decision to impose permit requirements on both existing and new operations on Park lands on the fact that such operations cause unnecessary and readily avoidable impacts to public resources and values, including habitat degradation, soil contamination, increased risk of fire, and spills, leaks, gas venting, noise, and odors, jeopardizing visitor safety and degrading visitor experience (80 Fed. Reg. 65577). The obvious significant impacts such operations have on wildlife resources has led NPS to require these existing operators to apply for an operations permit under its newly proposed regulations (proposed 36 C.F.R. part 9, subpart B).

As we have already asserted, the EIS does not address the potential impacts from the enforcement of inadequate state regulations. Even in cases where state regulations may be adequate to protect natural resources within wildlife refuges, state oil and gas agencies often have difficulty enforcing compliance, penalty fees are generally too low to deter noncompliance, and the same rules are repeatedly violated.³¹¹ The EIS must include these considerations in its analysis of the potentially significant impacts on refuge lands from its failure to regulate existing oil and gas operations.

IV. Conclusion

Thank you for considering our comments on the Service’s proposed nonfederal oil and gas regulations and the draft EIS for the proposed rule. We look forward to reviewing the Service’s response to our comments and a revised rule and EIS. If you have any questions concerning these comments, please do not hesitate to contact us at the contact information below.

Sincerely,

Wendy Park, Staff Attorney

³¹⁰ 80 Fed. Reg. 77204

³¹¹ USFWS 2013: 13, *citing* Earthworks 2012

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OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

February 9, 2016

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5275 Leesburg Pike
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To Whom It May Concern:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act (NEPA), the Environmental Protection Agency (EPA) has reviewed the U.S. Fish and Wildlife Service's (FWS) 2015 Draft Programmatic Environmental Impact Statement (PEIS) for the National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Activities (CEQ No. 20150349).

The EPA appreciates the efforts of the FWS to revise the National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Activities that have been in effect for over 50 years. The EPA supports the revision of these regulations to reflect updated technical, regulatory and policy developments for oil and gas.

Based on our review of the draft PEIS, we offer the following comments for consideration to be included in the final PEIS:

- We continue to recommend that the final PEIS consider using EPA's Underground Injection Control Program permitting guidance specific to oil and gas hydraulic fracturing activities using diesel fuels. Although developed specifically for hydraulic fracturing where diesel fuels are used, many of the guidance's recommended practices are consistent with best practices for hydraulic fracturing in general, including those found in state regulations and model guidelines for hydraulic fracturing developed by industry and stakeholders. See "Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance #84" at: http://www.epa.gov/sites/production/files/2015-05/documents/revise_dfhf_guid_816r14001.pdf
- We recommend that the final PEIS discuss whether there is potential for induced seismicity due to underground injection of produced/flowback waters and whether mitigation or management controls could be used to reduce or eliminate any problems

or concerns. Induced seismicity is an increasing concern in regions of the United States where the produced fluids and wastewaters from oil and natural gas production activities are being injected into the subsurface through deep disposal wells. See the National Underground Injection Control Technical Workgroup's report on injection-induced seismicity at: <http://www.epa.gov/sites/production/files/2015-08/documents/induced-seismicity-201502.pdf>

- We recommend that the final PEIS include a preliminary assessment of aquatic resources. Consider including inventories of existing wetlands and waters of the U.S. in the planning areas, including wetlands that are regulated under Section 404 of the CWA and wetlands that are determined to be non-jurisdictional and protected under Executive Order 11990 – Protection of Wetlands (May 24, 1977).

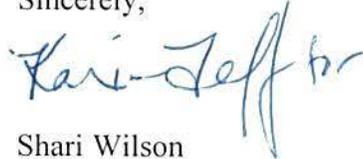
Since additional NEPA analysis will be needed for any plans of operation associated with oil and gas activities, the EPA recommends that the FWS:

- As appropriate, use the “Memorandum of Understanding (MOU) Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process,” which the EPA, U.S. Department of Agriculture and U.S. Department of Interior entered into on June 11, 2011. Based on this MOU, future projects implemented under the FWS regulations may be subject to additional air quality analyses and project level mitigation. It may be appropriate to utilize the MOU’s agency stakeholder process to share reasonable and foreseeable development and emissions inventory information and to determine appropriate steps for the air quality analysis, such as quantitative air quality modeling.
- Disclose and consider the potential environmental effects of oil and gas development on air quality in the planning areas, and determine whether there is a need to revise management actions or develop stipulations to minimize the potential air quality impact of oil and gas development. This would include emissions of criteria air pollutants and hazardous air pollutants that can cause or contribute to human health impacts or impacts to Air Quality Related Values such as visibility, vegetation, water, fish, and wildlife. We also recommend that you identify potential mitigation measures, including control measures and design features such as equipment type and design requirements, emission standards or limitations, best management practices, dust suppression measures for unpaved roads and construction areas, add-on control technologies, and limitations on the density and/or pace of development.
- Consider the use of EJSCREEN, the EPA’s environmental justice screening and mapping tool that utilizes standard and nationally consistent data to highlight places that may have higher environmental burdens and vulnerable populations, when determining potential project-specific impacts to minority and low-income populations.
- Conduct appropriate greenhouse gas (GHG) and climate change analyses for subsequent project-specific operation actions and consider both the potential effects

of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate change for the environmental effects of a proposed action. EPA recommends that you not compare project emissions to nationwide emission of GHGs because such comparisons do not reveal anything beyond the nature of climate change itself, i.e., the fact that diverse individual sources of emissions each make relatively small additions to global atmospheric GHG concentrations that collectively have a huge impact.

In summary, the EPA believes the actions proposed under the draft PEIS will result in reduced adverse impacts on resources. We have rated the proposed action, "LO" (Lack of Objections). A copy of the EPA's rating criteria is enclosed. If we can provide further explanation of our comments, I can be reached at 202-564-5400, or you can contact Julie Roemele of my staff at 202-564-5632.

Sincerely,

A handwritten signature in blue ink that reads "Shari Wilson". The signature is written in a cursive style with a long, sweeping tail on the letter "n".

Shari Wilson
Acting Director
Office of Federal Activities

Enc.

Summary of Rating Definitions and Follow-up Action

Environmental Impact of the Action

LO--Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

February 9, 2016

PUBLIC COMMENTS PROCESSING
ATTN: FWS-HQ-NWRS-2012-0086
DIVISION OF POLICY, PERFORMANCE, AND MANAGEMENT PROGRAMS
U.S. FISH AND WILDLIFE SERVICE, MS: BPHC
5275 LEESBURG PIKE
FALLS CHURCH, VA 22041-3803

RE: 50 CFR Parts 28 and 29 (FWS-HQ-NWRS-2012-0086) Management of Non-Federal Oil and Gas Rights: **Draft Environmental Impact Analysis**

The North Dakota Department of Trust Lands (NDDTL) manages 706,823 acres of land which is mostly native grassland (trust surface lands). The majority of this land was set aside by congress in the enabling act solely for the financial support of the common schools, grades K-12. These lands are dedicated to producing income for the common schools. A smaller amount of land was set aside and is managed for 13 other trust funds. Cultivation, with a few minor exceptions, is constitutionally prohibited on original grant lands. The land has been leased to ranchers and farmers for grazing and haying since 1889 and continues to be leased for these purposes. The proposed rules would push significantly more wells onto trust surface lands and unnecessarily increase environmental damage to those lands.

In addition, on behalf of the Board of University and School Lands the NDDTL manages 2.6 million mineral acres of which nearly 1 million acres are sovereign minerals including minerals below the ordinary high water mark (OHWM) of navigable waters. With surface ownership of 706,823 acres it is clear that the majority of the 2.6 million mineral acres underlie non-state surface (severed estate). Because the mineral ownership also includes tracts with an undivided 5% and 50% ownership interest, the surface acres over these mineral acres far exceeds the net mineral acres. State owned minerals are leased to oil and gas companies and provide significant revenue to the trust funds. During the last two year budget cycle, July 1, 2013 through June 30, 2015, nearly \$741 million were generated through oil and gas leasing and production from State owned minerals. This source of revenue is critical to the growth and future stability of income for the schools of North Dakota and the 13 additional trusts managed by the NDDTL. The increased costs to oil and gas production as a result of the Proposed Rule could be disproportionately impact the trust funds. This would interfere with the purpose of these minerals as provided in the Enabling Act for the State of North Dakota.

Under the Proposed Rule the "Refuge System" includes both "...Service-administered surface estate of lands held in fee or less-than fee." (Page 77206). Of particular concern to the NDDTL is the potential impact on trust lands adjacent to "Service-administered surface estate held in less-than fee" (easements). The attached map shows that the extensive system of USFWS Conservation Easements that would be affected by the proposed rule which is far more than lands held in fee and managed by the US Fish and Wildlife Service (USFWS).

Following are our comments on the **Draft Environmental Impact Analysis (EIS)** for the Management of Non-Federal Oil and Gas Rights where the surface is administered by the U.S. Fish and Wildlife Service as part of the Refuge System.

- 1) We strongly disagree with the statement on page "X" of the Executive Summary of the EIS which states that the "The Service estimates that that the equivalent of an additional three FTE could be necessary to provide management at the level needed to meet the objectives of Alternative B." The Proposed Rule and the EIS do not clearly exempt easements

managed by the USFWS from the application of the Proposed Rule and as shown on the attached map, easements located in the Bakken/Three Forks production area of North Dakota would be the majority of the work load. Fee land refuges are insignificant in area when compared to the area occupied by easements in North Dakota. We suggest that the Proposed Rule clearly exempt easements from the Proposed Rule. Even if they are exempted, the estimate of only an additional 3 FTE to implement the Proposed Rule is grossly understated unless the intent is to dramatically reduce oil and gas related activities on refuges through regulation and lack of timely application reviews.

- 2) The Proposed Rule would apply to easements managed by the USFWS. The EIS suggests that the application of the Proposed Rule would be limited as shown by the statement on page 2.6 as it relates to Alternative B. "For example, where the Service has purchased a wetland easement, the regulations would apply only as necessary to protect the values and functions of wetlands that could be affected by proposed operations on that property." This is an ambiguous statement and is repeated in other sections concerning grassland easements. There is no clear statement of the limitations of the Proposed Rule for easements and the pressure from the environmental community to tightly regulate oil and gas development on those easements would likely be significant. When State owned minerals underlie privately owned land with wetland or grassland easements, the damage to the State from lost royalty income could be significant.
- 3) Based on our experience oil and gas companies try to avoid permitting pipelines on private lands encumbered by grassland easements because of the USFWS regulations. Application of the Proposed Rule would further exacerbate this situation. This would also impact adjacent lands as a result of longer pipeline routes to avoid refuge lands.
- 4) On page 2-8 of the EIS it is stated that for Alternative B, "Operations on non-Federal surfaces outside of refuge boundaries or private inholdings within a refuge are exempt from the proposed regulation." Because the final EIS could well attempt to incorporate the application of at least portions of Alternative C including protection of the view shed, archeological resources and noise abatement, we oppose any application of the Proposed Rule to adjacent non-Federal surfaces outside refuge boundaries. The USFWS does not have the authority to impose oil and gas regulations on trust surface lands.
- 5) On page 4-107 it states with reference to Scenic Views and Night Sky Resources that "Additionally, under the proposed rule operators on easements would be required to comply with these standards to the extent necessary to protect that easement interest." This statement is open ended and the words "to the extent necessary" is open to interpretation. Such statements could imply full compliance with the entire Proposed Rule if not immediately then at a future date. This would further inhibit development of State owned oil and gas under private surface encumbered by an easement.
- 6) Page 77206 of the Proposed Rule states that "These regulations are not intended to apply to the operations on neighboring private lands or non-Federal surface estates within refuge boundaries." However, on page 4-117 of the EIS it states that "Alternative C would also require operations on inholdings and those directionally drilling underneath a refuge from non-Federal surface locations to obtain a permit to the extent necessary to protect refuge natural soundscapes and the acoustic environment." In the language of the Proposed Rule that says the "intent" is to not apply to non-Federal surface does not mean that an attempt would not be made to apply it to non-Federal surface as stated in the EIS. We oppose applying the Proposed Rule in any form to adjacent trust surface lands.

We appreciate the opportunity to comment on behalf of the public school students and residents of North Dakota, we hope that you will earnestly consider our comments.

Sincerely,

Lance D. Gaebe
Commissioner of University and School Lands



INDUSTRIAL COMMISSION OF NORTH DAKOTA

Jack Dalrymple
Governor

Wayne Stenehjem
Attorney General

Doug Goehring
Agriculture Commissioner

February 9, 2016

Public Comments Processing
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The North Dakota Industrial Commission (NDIC) appreciates this opportunity to comment on the DEPARTMENT OF THE INTERIOR Fish and Wildlife Service 50 CFR Parts 28 and 29; [Docket No. FWS-HQ-NWRS-2012--0086; FXRS12610900000-156-FF09R24000] RIN 1018-AX36; Management of Non-Federal Oil and Gas Rights; Proposed rule.

The State of North Dakota is ranked 2nd in the United States among all states in the production of oil and gas. North Dakota produces approximately 400 million barrels of oil per year and 465 billion cubic feet of natural gas per year.

The NDIC, Department of Mineral Resources, Oil and Gas Division is responsible for administering North Dakota's comprehensive oil and gas regulations found at North Dakota Administrative Code (NDAC) Chapter 43-02-03. These regulations include regulation of the drilling, producing, and plugging of wells; the restoration of drilling and production sites; the perforating and chemical treatment of wells, including hydraulic fracturing; the spacing of wells; operations to increase ultimate recovery such as cycling of gas, the maintenance of pressure, and the introduction of gas, water, or other substances into producing formations; disposal of saltwater and oil field wastes through the ND UIC Program; and all other operations for the production of oil or gas.

The proposed rule could have significant impacts on North Dakota's ability to administer its oil and gas regulatory program. The State of North Dakota intends to defend its sovereign jurisdiction over oil and gas regulation in any manner necessary.

North Dakota has a unique history of land ownership that has resulted in a significant portion of the state consisting of split estate lands that could be adversely affected by the proposed rule. Unlike many western states that contain large blocks of unified federal surface and federal mineral ownership, the surface and mineral estates in North Dakota were at one time more than 97% private and state owned as a result of the railroad and homestead acts of the late 1800s. However, during the depression and drought years of the 1930s, numerous small tracts in North Dakota went through foreclosure. The federal government through the Federal Land Bank

and the Bankhead Jones Act foreclosed on many farms taking ownership of both the mineral and surface estates. Many of the surface estates were later sold to private parties, but some or all of the mineral estates were retained by the federal government. This resulted in a very large number of small federally-owned mineral estate tracts scattered throughout western North Dakota. Those federal mineral estates impact more than 30% of the oil and gas spacing units that are typically recognized as a communitized area (CA) by the BLM. In North Dakota, there are a few large blocks of federal mineral ownership or trust responsibility where the federal government also manages the surface estate through the U.S. Forest Service or Bureau of Indian Affairs. These are on the Dakota Prairie Grasslands in southern McKenzie and northern Billings County as well as on the Fort Berthold Indian Reservation. See map, Exhibit 1. However, even within those areas federal mineral ownership is interspersed with a “checkerboard” of private and state mineral or surface ownership. Therefore, virtually all federal management of North Dakota’s oil and gas producing region consists of some form of split estate.

In addition the attached map indicates that much of the oil and gas producing areas of North Dakota lies under or near a United States Fish and Wildlife Service (USFWS) refuge, waterfowl production area or conservation easement.

Given North Dakota’s unique land ownership situation, the proposed rule could have far-reaching adverse impacts on North Dakota’s ability to administer its oil and gas regulatory program. The State of North Dakota intends to defend its sovereign jurisdiction over oil and gas regulation in any manner necessary.

The impacts of the proposed rule on North Dakota’s ability to administer its oil and gas regulatory program are explained below:

Alternative C: This alternative states that operating standards and the permitting process under Alternative C would be the same as Alternative B, except the Service would actively regulate downhole operations, such as well cementing, well casing, and well integrity testing, as a matter of course. The Service’s goals in regulating downhole aspects of oil and gas well drilling, production, and plugging are to 1) prevent escape of fluids to the surface, and 2) isolate and protect usable quality water zones throughout the life cycle of the well. The Service found that these regulatory goals can adequately be met by current state regulatory programs, and that Service regulation would slightly reduce already very low risks to usable quality water zones. Refuge resources and uses, other than usable quality water zones, would only be impacted by accidents associated with well control, and as discussed above, these events are extremely rare. For these other resources and uses, the Service does not expect any reduction of impacts or risks of impacts to refuge resources and uses related to our regulation of downhole operations. The Service finds that State requirements for well control and the expectation that companies will act in their own best interest provide adequate protections.

North Dakota’s comprehensive oil and gas regulations found at NDAC Chapter 43-02-03 include regulation of the drilling, producing, and plugging of wells; the restoration of drilling and production sites; the perforating and chemical treatment of wells, including hydraulic fracturing; the spacing of wells; operations to increase ultimate recovery such as cycling of gas, the maintenance of pressure, and the introduction of gas, water, or other substances into producing formations; disposal of saltwater and oil field wastes through the ND UIC Program; and all other

operations for the production of oil or gas. In addition the Department of Interior's Bureau of Land Management (BLM) has extensive regulations in place to address most or all of the above surface and downhole operations. It is our contention that USFWS regulation as suggested in Alternative C would yield no reduction of impacts or risks to refuge resources and is not authorized by the statutory language in the National Wildlife Refuge system Administration Act and the national Wildlife Refuge System Improvement Act.

Alternative B - performance bond, or other acceptable method of financial assurance: North Dakota's comprehensive oil and gas regulations found at NDAC 43-02-03 include regulation of financial assurance and the restoration of drilling and production sites. In addition the BLM has similar regulations in place. It is our contention that the proposed USFWS regulation would yield no reduction of impacts or risks to refuge resources and is not authorized by the statutory language in the National Wildlife Refuge system Administration Act and the national Wildlife Refuge System Improvement Act.

Alternative B – extension of regulation of oil and gas operations to tracts where the Federal interest is less than fee (e.g., wetland or grassland easements) to the extent necessary to protect Federal interest: North Dakota's comprehensive oil and gas regulations found at NDAC 43-02-03 include regulation of the drilling, producing, and plugging of wells; the restoration of drilling and production sites; the perforating and chemical treatment of wells, including hydraulic fracturing; the spacing of wells; operations to increase ultimate recovery such as cycling of gas, the maintenance of pressure, and the introduction of gas, water, or other substances into producing formations; disposal of saltwater and oil field wastes through the ND UIC Program; and all other operations for the production of oil or gas. In addition the BLM has extensive regulations in place to address most or all of the above operations. It is our contention that the proposed USFWS regulation would yield no reduction of impacts or risks to refuge resources and is not authorized by the statutory language in the National Wildlife Refuge System Administration Act and the national Wildlife Refuge System Improvement Act.

Alternative B – technologically feasible, least damaging oil and gas development methods: The proposed rule defines technologically feasible, least damaging methods as those that USFWS determine, on a case-by-case basis, to be most protective of refuge resources and uses while ensuring human health and safety, taking into consideration all relevant factors, including environmental, economic, and technological factors and the requirements of applicable law. North Dakota's comprehensive oil and gas regulations found at NDAC Chapter 43-02-03 include regulation of the construction of drilling and production sites; drilling, producing, and plugging of wells; and the restoration of drilling and production sites to as closely as practicable to original condition. . It is our contention that the proposed USFWS regulation would yield no reduction of impacts or risks to refuge resources and will impair North Dakota's ability to administer its oil and gas regulatory program.

Federalism: The proposed rule states that "it does not have sufficient federalism implications to warrant the preparation of a federalism summary impact statement. It addresses use of refuge lands, and would impose no requirements on other agencies or governments. A federalism summary impact statement is not required". For the reasons discussed above this conclusion is not correct and the State of North Dakota intends to defend its sovereign jurisdiction over oil and gas regulation in any manner necessary.

The North Dakota Industrial Commission recommends that USFWS withdraw the proposed rule and 1) adhere to the statutory language in the National Wildlife Refuge System Administration Act and the national Wildlife Refuge System Improvement Act, and 2) conduct and properly document in the administrative record the required consultation with state and tribal governments.

Alternatively the NDIC respectfully requests a 60 day extension of the comment period in order to facilitate consultation and the submission of additional comments.

Sincerely,

Lynn D. Helms

Director

North Dakota Industrial Commission, Department of Mineral Resources

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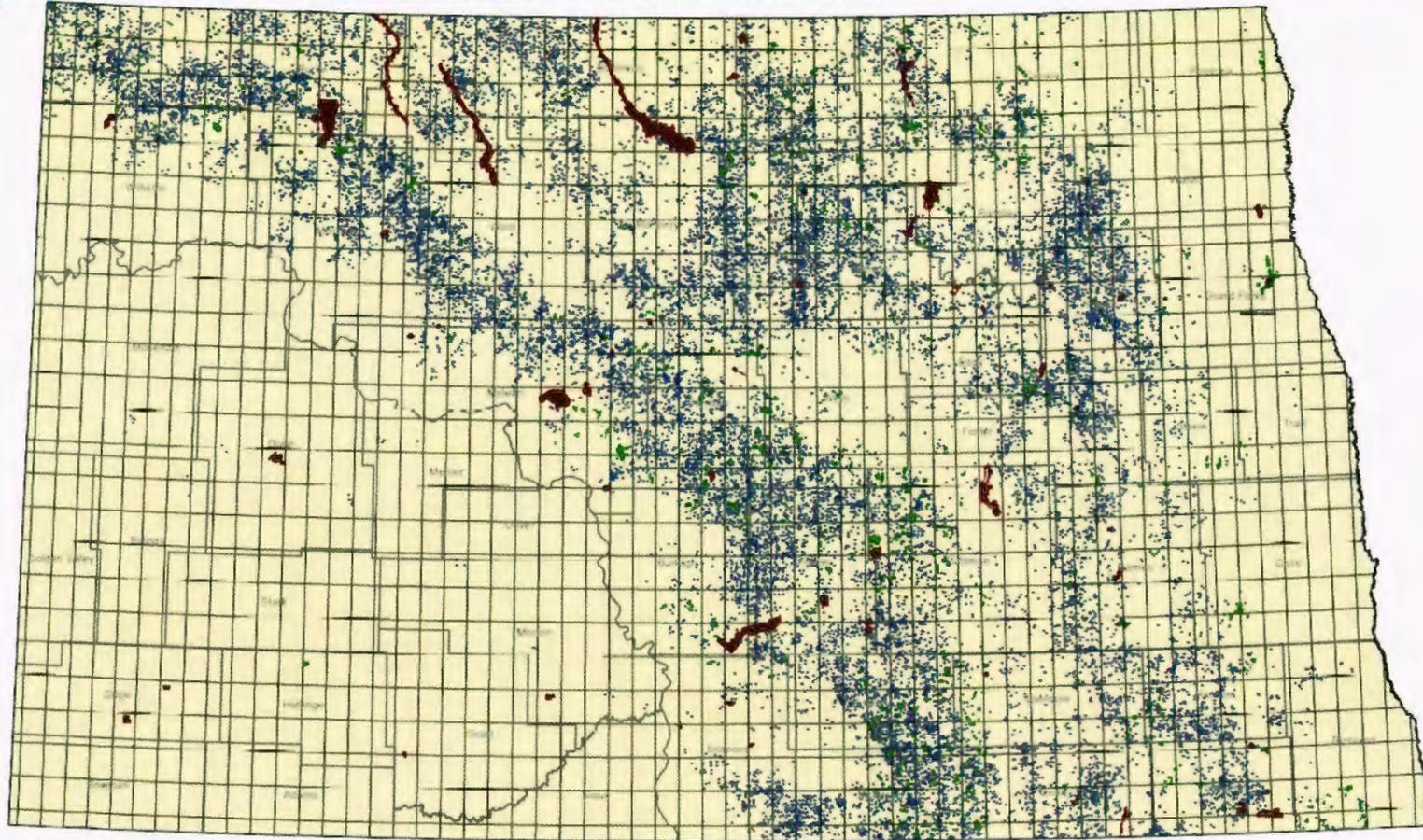
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U.S. Fish & Wildlife Service

U.S. Fish & Wildlife Service Land Interests for the State of North Dakota



DISCLAIMER

The USFWS makes no claim as to the accuracy or completeness of the displayed information. Shaded areas depicting the location of USFWS WPA land interest easements are for illustrative purposes only and approximate the location of parcels identified in the easement contract. The quality of the data used to develop spatial locations is variable and the digital representation of these locations is subject to change as higher quality data becomes available. For more detailed information, please contact one of the USFWS Realty Offices located in Bismarck and Minot, North Dakota, Sand Lake and Huron, South Dakota, or Great Falls, Montana.

The USFWS easement layer is current through October 2012. Please contact the appropriate Wetland Management District for any newly acquired easements.

Map was produced by the MAPET Office, Bismarck, ND - September 2013
Map location: \\Projects\ND\ONI & Gas Division\ND_StateMap_22x34.mxd

- USFWS Conservation Easement
- Waterfowl Production Area
- National Wildlife Refuge



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February 9, 2016

SUBMITTED ELECTRONICALLY

Re: USFWS Proposed Rule: Management of Non-Federal Oil and Gas Rights
FWS-HQ-NWRS-2012-0086-0063

Draft Environmental Impact Analysis dated November 2015

To Whom It May Concern:

INTRODUCTION

I represent PAPCO, Inc. (“PAPCO”), which has a business address of P.O. Box 627, Warren, Pennsylvania. PAPCO hereby submits the following comments in response to the Proposed Rule published by the U.S. Fish and Wildlife Service (“USFWS”) on December 11, 2015, and the related Draft Environmental Impact Analysis dated November 2015 (“DEIA”).

COMMENTS

PAPCO takes exception to the assertion of legal authority by the USFWS to “reasonably regulate” the exercise of non-Federal (*i.e.*, privately owned) mineral rights on National Wildlife Refuge System (“NWRS”) lands. PAPCO’s specific comments are as follows: 1) the USFWS lacks the legal authority to exercise “reasonable regulatory authority” as asserted in the Proposed Rule; 2) the USFWS likewise lacks the legal authority to implement its “Preferred Alternative” in the DEIA; 3) the USFWS also lacks the legal authority to impose a permitting requirement on the lawful exercise of privately owned mineral rights; 4) the USFWS also lacks the legal authority to require bonding as a condition to exercising privately owned mineral rights; 5) the USFWS also lacks the legal authority to impose penalties for the lawful exercise of privately owned mineral rights; and 6) the manner in which the USFWS proposes to regulate private oil and gas resources constitutes an impermissible Taking without just compensation. These will be addressed, in turn.

1) The USFWS lacks the legal authority to exercise “reasonable regulatory authority” as asserted in the Proposed Rule.

In the section of the rulemaking package entitled “Authority to Promulgate Regulations,” the USFWS explained that its current regulations concerning the exercise of private oil and gas rights on NWRS lands pre-date the National Wildlife Refuge System Administration Act, as amended by the National Wildlife Refuge System Improvement Act (collectively “NWRISA”), “...and do not clearly assert or implement the full extent of the Service’s authority to regulate

non-Federal oil and gas rights or provide for consistent management of the exercise of those rights.” Stated another way, the USFWS is arguing (not clarifying) that Congress intended the NWRSIA to provide the USFWS with maximum regulatory authority under the Property Clause of the U.S. Constitution, thereby providing the requisite legal authority to support the proposed “reasonable regulatory” scheme. This argument lacks merit for two reasons: 1) the NWRSIA does not reflect Congressional intent to confer regulatory authority over private oil and gas activities on split estate NWRS lands; and 2) the USFWS’s reliance on the NWRSIA is misplaced.

Contrary to the USFWS’s assertions, there is no mention in the referenced statutes of the USFWS being granted regulatory authority over oil and gas activities (private or otherwise). Moreover, the USFWS has not identified any specific statutory provision intended to authorize the expansion of regulatory authority as reflected in the Proposed Rule, nor has the USFWS identified anything in the legislative history of the referenced statutes to support its claim that Congress intended to authorize such expansion. To the contrary, there are a number of provisions in Subchapter III that reflect Congressional intent to not interfere with State law. *See, e.g.*, 16 U.S.C. §§ 668dd(a)(4)(E) and (M) (duty to cooperate with State agencies); § 668dd(a)(4)(G) (acquisition of water rights subject to State law); § 668dd(b)(4) (authorizing cooperative agreements with State agencies); § 668dd© (maintaining U.S. mining and mineral laws as of October 1966, and providing that the regulation of hunting and fishing shall be consistent with State laws); § 668dd(e)(3)(A) (requiring the USFWS to consult with State and local agencies and private landowners in developing conservation plans); § 668dd(e)(4)(A) (requiring the USFWS to consider comments by States, owners of affected lands, and other affected persons, in preparing conservation plans); § 668dd(j) (expressly mandating that the Federal government is not exempt from State water laws); § 668dd(m) (expressly recognizing the authority, jurisdiction, and responsibility of States to manage, control and regulate fish and wildlife under State law); and § 668dd(o) (exempting coordination with State agencies from the Federal Advisory Committee Act). In short, there is simply no statutory basis to conclude that the USFWS is free to ignore State property law in managing NWRS lands in a split estate context. The bald assertion that Congress intended the USFWS to have regulatory authority over the exercise of privately owned mineral rights on NWRS lands, without more, is wholly unsupported and indeed contradicted by the referenced statutes.

In addition, the case law relied upon by the USFWS to support its proposed expansion of regulatory authority – specifically *Burlison v. United States*, 533 F.3d 419 (6th Cir. 2008); *Duncan Energy Co. v. U.S. Forest Service*, 50 F.3d 584 (8th Cir. 1995); and *School Board of Avoyelles Parish v. U.S. Department of the Interior*, 647 F.3d 570 (5th Cir. 2011) – is incomplete and misleading. As the USFWS is undoubtedly aware, the Third Circuit Court of Appeals in

Minard Run Oil Co. v. U.S. Forest Service, 670 F.3d 236 (3rd Cir. 2011) (“*Minard Run III*”¹), squarely addressed a nearly identical assertion of “reasonable regulatory authority” by the U.S. Forest Service over privately owned oil and gas rights in a split estate context in the Allegheny National Forest (“ANF”). Although ignored by the USFWS, *Minard Run III* is factually and legally on point, much more so than the cases cited in support of the Proposed Rule.

By way of background, *United States v. Minard Run Oil Co.*, 1980 U.S. Dist. LEXIS 9570 (W.D. Pa. 1980) (“*Minard Run I*”) involved the same parties as the *Minard Run II Litigation* but in a different dispute. There, the Forest Service filed an action against Minard Run Oil Company for failing to provide adequate notice of surface disturbing activities related to private oil and gas development in the ANF. The district court correctly concluded that the Forest Service was entitled to 60-days advance notice under Pennsylvania common law as the servient owner of the surface estate (not as a sovereign regulatory agency).

As noted above, the *Minard Run II Litigation*, like the Proposed Rule, involved the assertion by the Federal government of “reasonable regulatory authority” over private oil and gas development on split estate land. Following a three-day hearing and extensive briefing,² the district court (in *Minard Run II*) and the Court of Appeals (in *Minard Run III*) both rejected the same arguments now being advanced by the USFWS. In doing so, the Court of Appeals concluded that *Duncan* “does not support the [Forest Service’s] broad claim of regulatory authority.” *Minard Run III*, at 253. To the contrary, the Court held that “the [Forest Service] does not have the broad authority it claims over private mineral rights owners’ access to surface lands.” *Id.*, 254.

In addition to rejecting the Federal government’s Property Clause and *Duncan* arguments, the Court in *Minard Run III* also concluded that *Duncan* was inapposite. There were two main reasons for this: 1) the Forest System land at issue in *Duncan* was acquired under the Bankhead-Jones Farm Tenant Act, while the Forest System land at issue in the *Minard Run II Litigation* was acquired under the Weeks Act (*id.*, at 253); and 2) the State law at issue in *Duncan* was North Dakota law, which led to a different outcome than the State law of Pennsylvania (and did not result in unreasonable interference with private property rights) (*id.*). The significance of these two distinguishing factors is clear, and highlights the USFWS’s misplaced reliance on the NWRSA: in determining the nature and extent of a Federal agency’s claimed regulatory authority in a split estate context, what matters is how the surface estate was acquired by the

¹ *Minard Run III* is one in a series of reported decisions involving one piece of litigation. The other reported decisions are *Minard Run Oil Co. v. U.S. Forest Service*, 2009 U.S. Dist. LEXIS 116520 (W.D. Pa. 2009) (“*Minard Run I*”); *Minard Run Oil Co. v. U.S. Forest Service*, 894 F. Supp. 2d 642 (W.D. Pa. 2012) (“*Minard Run IV*”); and *Minard Run Oil Co. v. U.S. Forest Service*, 2013 U.S. App. LEXIS 19664 (3rd Cir. 2013) (“*Minard Run V*”) (collectively, the “*Minard Run II Litigation*”).

² The briefs filed by the parties in *Minard Run II* and *Minard Run III* are a matter of public record and are hereby incorporated by reference in their entirety.

Federal government (*see, e.g., United States v. Srnsky*, 271 F.3d 595 (4th Cir. 2001)) and where the property is located (in order to evaluate applicable State law). The Proposed Rule, which is drafted to be national in scope, is fatally defective by not considering either of these factors.³

Another case not cited in the rulemaking package is *Pennsylvania Oil and Gas Association v. U.S. Forest Service*, 2014 U.S. Dist. LEXIS 21601 (W.D. Pa. 2014). This case, which was one of several cases related to the *Minard Run II Litigation*,⁴ concerned the Forest Service's unauthorized exercise of "reasonable regulatory authority" in updating the Land and Resource Management Plan for the ANF ("2007 ANF Forest Plan"). More specifically, to address predicted environmental consequences of private oil and gas development in the ANF (primarily road construction and surface occupation), the 2007 ANF Forest Plan included a number of measures to restrict private development, including but not limited to: a) Guidelines in Part 4 (Management Area Direction) of the Plan, which required mitigation measures as a precondition to the exercise of legal rights by private owners of oil, gas and mineral interests; b) requirements to reduce impacts on the environmental resource objectives of specific designated Management Areas; and c) establishment of so-called Design Criteria to regulate certain environmental aspects of private oil and gas activities. According to the Regional Forester, these new provisions were intended to make "energy minerals... available in an environmentally sensitive manner..." while establishing a framework for "restoring, enhancing, or maintaining ecological conditions that will improve ecosystem resiliency, sustain biological diversity, and aid in conserving and recovering federally-listed threatened and endangered species and other species with viability concern." As the Court determined in *Minard Run III*, however, the Forest Service lacked the authority to include these regulation-style Plan provisions. Ultimately conceding as much, the Forest Service voluntarily suspended the private oil and gas provisions of the 2007 ANF Forest Plan, thereby returning to the provisions of the previous 1986 ANF Forest Plan. As a result, the Court dismissed the lawsuit as moot, without prejudice, expressly noting that the "form of dismissal will preserve the ability of the Plaintiffs to petition to reopen this case, and pick up where they left off, should the Forest Service resume the challenged activity by discontinuance of its adherence to the 1986 Plan." *POGA*, at *23-*24.

To summarize, the legal argument presented by the USFWS in the rulemaking package is misleading. *Minard Run III* is the only U.S. Court of Appeals case to directly address proposed regulation of private oil and gas development by a Federal government land management agency in the context of split estates. There, the Court squarely rejected the government's assertion of "reasonable regulatory authority" based on the Property Clause because the land acquisition

³ Moreover, in light of the Land Acquisition Justification Program administered by the USFWS, the imposition of "reasonable regulatory requirements" should be justified on a case-by-case basis. Presumably, the acquisition of a surface estate was deemed to be acceptable to the United States government at the time of acquisition. As such, the USFWS should be required to justify after-the-fact interference with private property rights, explaining what has changed on a particular NWRS refuge to necessitate increased regulatory control.

⁴ *See POGA*, 2014 U.S. Dist. LEXIS 21601, *3, n. 2.

statute did not reflect Congressional intent for the government to regulate private property rights. The Court's reasoning makes plain that a government surface owner's assertion of regulatory authority in a split estate context must be evaluated in light of the *land acquisition statute* and applicable State law. Here, the Proposed Rule broadly and erroneously asserts national regulatory authority under the NWRSA, without regard to more relevant factors relied upon by the Court in *Minard Run III*. Perhaps more fundamentally, a rulemaking package published for public comment is not an appropriate place to advance adversarial and disingenuous legal argument. Not only did private oil and gas developers repeatedly prevail in the *Minard Run II Litigation* (and related cases), the Federal government eventually settled the plaintiffs' claim for attorneys' fees under the Equal Access to Justice Act.⁵ The Proposed Rule irresponsibly sets the stage for the same type of protracted litigation.

2) The USFWS lacks the legal authority to implement its “Preferred Alternative” in the DEIA.

In the DEIA drafted to support the Proposed Rule, the USFWS once again overstates its legal authority to “reasonably regulate” privately owned oil and gas resources on NWRSA lands. For the reasons set forth above, the USFWS lacks the legal authority to implement its “Preferred Alternative” in the DEIA. And because Alternatives B and C both rely on legal authority which the USFWS does not possess, the only legally viable Alternative presented in the DEIA is the “No Action” Alternative (*i.e.*, Alternative A). Accordingly, Alternative A must be chosen.

In addition, 40 C.F.R. § 1502.23 requires a cost-benefit analysis to address the requirement of Section 102(2)(B) of the National Environmental Policy Act (“NEPA”), 42 U.S.C. § 4332(2)(B). Under 40 C.F.R. § 1508.14, when an Environmental Impact Statement (“EIS”) “is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.” NEPA does not require a formal and mathematically precise cost-benefit analysis of alternatives; however, where, as here, the preferred alternative will result in measurable adverse socioeconomic consequences to private industry and local/regional economies, the EIS should fully and objectively describe the adverse economic and social consequences of the various alternatives and the perceived trade-off in environmental benefits. Although the DEIA contains a discussion entitled “Socioeconomics” (at 3-28 to 3-31), it fails to provide a meaningful socioeconomic analysis of the impacts of the alternatives. It therefore violates NEPA and is fatally defective.

⁵ Significantly, one of the private developers adversely affected by the actions of the Forest Service in the *Minard Run II Litigation* recently filed suit against the Forest Service to pursue an unresolved \$8.7 million administrative claim based primarily on tortious interference with private property rights. See *Duhring Resource Company v. United States of America*, Docket No. 1:15-cv-289 (W.D. Pa., filed Dec. 3, 2015).

3) The USFWS lacks the legal authority to impose a permitting requirement on the exercise of privately owned mineral rights.

The *Minard Run II Litigation* is also instructive with respect to the USFWS proposal to require private mineral owners to obtain permits. The genesis of *Minard Run II* was the Forest Service practice of issuing so-called “Notice to Proceed” letters (“NTPs”) before “allowing” development of privately owned oil and gas resources in the ANF. Originally used as a written communications of acknowledgment, NTPs over time were modified to contain conditions and requirements, thereby effectively elevating them to permit status. Not surprisingly, the Forest Service eventually determined that the issuance of an NTP constituted a “major federal action” under NEPA. This, in turn, resulted in a requirement to perform an Environmental Assessment or Environmental Impact Study before NTP issuance, which led to a *de facto* ban on private oil and gas development in the ANF. In light of these circumstances, the Court in *Minard Run III* framed the “dispositive question” as being whether or not private mineral owners in a split estate context are required to obtain approval from the Federal government surface owner before proceeding with development. The Court unambiguously concluded (*Minard Run III*, at 250) that such approval is not necessary. For the same reason, the USFWS lacks the legal authority to require permitting as a condition to the exercise of privately owned mineral rights on NWRS lands.

4) The USFWS lacks the legal authority to require bonding as a condition of exercising privately owned mineral rights.

The point of *Minard Run III* is that the Federal government as surface owner in a split estate context lacks “approval” authority over private oil and gas development. In this regard, the power to condition the lawful exercise of private property rights is tantamount to approval authority. In other words, if a private mineral owner does not comply with a condition or requirement imposed by a government surface owner, the government’s primary recourse is to deny development approval. This is precisely what the Court in *Minard Run III* concluded the Forest Service cannot do. Likewise, the USFWS lacks approval authority over private oil and gas development on NWRS lands, and therefore lacks authority to condition the lawful exercise of such rights on bonding (or anything else).

5) The USFWS lacks the legal authority to impose penalties for the lawful exercise of privately owned mineral rights.

The attempt by the USFWS in the Proposed Rule to impose penalties or criminalize a developer’s lawful exercise of private mineral rights is also infirm for the above reasons. Given that the USFWS lacks the authority to impose permitting, bonding, or other regulatory requirements, imposing sanctions for not adhering to such requirements is unauthorized and *ultra vires*.

6) The manner in which the USFWS proposes to regulate privately owned oil and gas resources constitutes an impermissible Taking.

One of the Court's concerns in *Minard Run III* was that, if the "reasonable regulatory authority" argument were accepted, "this would effectively 'wipe the National Forest System clean of any and all easements, implied or express' and dramatically reduce the value of reserved mineral and timber rights." *Minard Run III*, at 252, quoting *Srnsky*, 271 F.3d at 604. This, in the Court's view, would in turn require the Court to resolve "difficult and sensitive questions arising out of the guarantees of the takings clause." *Id.*, quoting *United States v. Security Indus. Bank*, 459 U.S. 70, 82 (1982). According to the Court, the better reading of the Weeks Act was to avoid the Takings issue. Applied here, and assuming that the USFWS enjoys eminent domain authority, applicable land acquisition statutes should be construed in a manner to avoid the Takings issue. Otherwise, the USFWS must pay just compensation for private property taken for a public purpose.

CONCLUSION

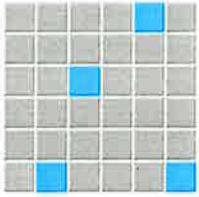
For the reasons outlined above, the USFWS lacks the requisite legal authority to impose "reasonable regulatory requirements" on private oil and gas development on split estate NWRS lands. Accordingly, the USFWS must choose the "No Action" Alternative of the DEIA and continue to administer NWRS lands under 50 C.F.R. § 29.32 as currently written. To the extent that the USFWS desires to assert regulatory authority in a particular refuge, it must evaluate its authority under the land acquisition statute at issue in light of applicable State law, and justify the need for such regulation on a case-by-case basis.

Thank you for your consideration.

Sincerely,



Matthew L. Wolford



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February 9, 2016

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Re: Comments on Proposed Rule and DEIS for Management of Non-Federal Oil and Gas Rights on National Wildlife Refuges

To Whom It May Concern:

This letter provides the comments of the Utah School and Institutional Trust Lands Administration (SITLA) in response to the Fish and Wildlife Service's (the "Service") proposed rule and associated draft environmental impact statement ("DEIS") addressing the management of non-federal oil and gas rights on National Wildlife Refuge System ("NWRS") lands and waters. *See* 80 Fed. Reg. 77,200 (Dec. 11, 2015) ("Proposed Rule"). SITLA appreciates the Service's consideration of these comments.

I. INTRODUCTION

SITLA is an independent state agency that manages lands granted in trust to the State of Utah by the United States for the financial support of enumerated beneficiaries, primarily Utah's K-12 public education system. The State of Utah accepted this grant in its' State Constitution, and administers the grant through the statutory authority provided in the Utah Trust Lands Management Act, Utah Code Ann. § 53C-1-101 *et. seq.*

SITLA administers substantial split estate mineral lands within NWRS lands in Utah, and will be directly affected in the management and enjoyment of the retained mineral estate by the Proposed Rule. In particular, SITLA manages split-estate mineral lands for Utah's school trust in the Bear River NWR, the Fish Springs NWR, and the Ouray NWR. The Ouray

NWR is of special concern to SITLA, because SITLA severed minerals in that refuge are the subject of existing mineral leases where operations have been substantially delayed by the Service's non-responsiveness to proposals for cooperative means of development for the mineral estate in question.

II. COMMENTS

A. **The Service's authority to regulate holders of subsurface mineral interests is limited.**

The Proposed Rule states that the Service has authority to require permits for, and to regulate, the access and use of NWRS lands by mineral interest holders. However, the Proposed Rule overlooks applicable law that is not consistent with the scope of authority assumed by the Service. NWRS lands are primarily acquired by the United States pursuant to the Migratory Bird Conservation Act ("MBCA"). With respect to acquisitions of land from private parties or, in this case, the State, the MBCA provides:

[R]ights-of-way, easements, and reservations retained by the grantor or lessor from whom the United States receives title under this or any other Act for the acquisition by the Secretary of Interior of areas for wildlife refuges shall be subject to rules and regulations prescribed by the Secretary of Interior for the occupation, use, operation, protection, and administration of such areas as inviolate sanctuaries for migratory birds or as refuges for wildlife; and it shall be expressed in the deed or lease that the use, occupation, and operation of such rights-of-way, easements and reservations shall be subordinate to and subject to such rules and regulations as are set out in such deed or lease or, if deemed necessary by the Secretary of Interior, to such rules and regulations as may be prescribed by him from time to time.

16 U.S.C. § 715e (emphasis added). The Supreme Court has confirmed that Congress included this provision "to require the Secretary either to include his rules or regulations in the contract itself or to state in the contract that the reservation or easement would be subject to regulations promulgated 'from time to time.'" *United States v. Little Lake Misere Land Co.*, 412 U.S. 580, 597-98 (1973); see *Minard Run Oil Co. v. U.S. Forest Serv.*, 2009 U.S. Dist. LEXIS 116520, *76 (W.D. Pa. Dec. 15, 2009) ("a federal agency's authority to regulate in a split-estate context is properly determined by the terms of the specific statute pursuant to which the federal estate was acquired").

In addition, Congress explicitly decided to eliminate an amendment to the National Wildlife Refuge System Administration Act ("NWRSA") in 1966 that would have specifically provided the Secretary of Interior with regulatory authority over the surface use of

NWRS lands by holders of mineral interests. See *Caire v. Fulton*, 1986 U.S. Dist. LEXIS 31049, *17-18 (W.D. La. 1986). Although the NWRSA was substantially amended in 1997 by the National Wildlife Refuge System Improvement Act (“Improvement Act”), the Improvement Act did not include specific authority addressing mineral rights and it retained, in similar form, the original provisions of the NWRSA that generally allow the Secretary to permit certain uses and prescribe regulations. Compare 16 U.S.C. § 668dd(d) with Public Law 89-669, Oct. 15, 1966. In other words, Congress took no action in the Improvement Act to alter the balance it struck in 1966 when it expressly chose not to regulate the surface use of NWRS lands by mineral interest holders. Consistent with this legislative history, the Service has long interpreted its authority over holders of subsurface mineral rights to be limited.¹

SITLA recognizes, as explained in the Proposed Rule, that some courts have construed the NWRSA to generally provide the Service with authority to require permits for, and to regulate, uses of NWRS lands pursuant to the sovereign police power of the United States. See *School Bd. of Avoyelles Parish v. U.S. Dept. of Int.*, 647 F.3d 570 (5th Cir. 2011); *Burlison v. U.S.*, 533 F.3d 419 (6th Cir. 2008). However, neither *Avoyelles Parish* nor *Burlison* involved split estates involving subsurface mineral interest holders and, therefore, do not address the lack of legislative authority regarding the use of surface lands by mineral interest holders. Moreover, the Third Circuit recently held that the U.S. Forest Service does not have the authority to require subsurface mineral interest holders to obtain a permit to access those rights on Forest Service lands. *Minard Run Oil Co. v. U.S. Forest Serv.*, 670 F.3d 236 (3rd Cir. 2011). The court’s holding in *Minard Run* is premised on the statutory authority for the purchase of Forest Service lands (the Weeks Act), which states that “rights of way, easements, and reservations retained by the owner from whom the United States receives title are subject to the regulations expressed in and made part of the written instrument conveying title to the lands to the United States.” *Id.* at 251 (internal quotation marks omitted; emphasis added). The Weeks Act and the MBCA use almost identical language in mandating that any regulations applicable to reserved rights in a deed (such as subsurface mineral rights) must be referenced in the deed itself.²

¹ See Memorandum from Gale Norton, Assoc. Solicitor, Conservation and Wildlife, to the Assistant Sec’y, Fish and Wildlife and Parks (Dec. 22, 1986); FWS Service Manual pt. 612; see also *Caire*, 1986 U.S. Dist. LEXIS at *36 (holding that United States “forfeited by statutory exception and stipulation its authority to require entry permits and impose regulatory schemes on owners and their assigns of specifically reserved mineral interests”). The General Accounting Office has also taken the position that the current version of the NWRSA does not address the Service’s authority over subsurface mineral interest holders. See GAO, *U.S. Fish & Wildlife Serv.: Opportunities Remain to Improve Oversight & Mgmt. of Oil & Gas Activities on Nat’l Wildlife Refuges*, GAO-07-829R (Wash., D.C. June 29, 2007) (“We continue to believe that such information is necessary for DOI to adequately inform the Congress regarding the need for additional authority. Moreover, we believe it is for Congress, not DOI, to weigh the needs of the refuge lands and the interests of mineral owners and, ultimately, to determine what oversight authority would be appropriate.”). See also 80 Fed. Reg. at 77,213 (“OIRA has determined that this proposed rule is significant, because it may raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the Executive order.”).

² See Jonathan Thrope, *Case Comment: Minard Run Oil Co. v. United States Forest Service*, 36 Harv. Envtl. L. Rev. 567, 590-91 (2012) (“There is no relevant difference between section 9 of the Weeks Act and the post-1935 section e of the MBCA. Both permit acquisitions of land encumbered by private reservations only after the relevant Secretary determines that the private use will not interfere with the purposes of the act and both require

Accordingly, unless otherwise expressly conditioned in a deed in which a subsurface mineral right is reserved, the “mineral owner need not obtain consent or approval before entering land to mine for minerals.” *Minard Run*, 670 F.3d at 244. However, the mineral interest holder must show “due regard” to the surface owner and may only “use as much of the surface as reasonably necessary to extract and produce the minerals,” as long that use is “reasonable.” *Id.* at 242, 244.

Courts in other states have generally followed the “due regard” or “reasonable accommodation” doctrine expressed in *Minard*. See *Merriman v. XTO Energy, Inc.*, 407 S.W.3d 244, 248-49 (Tex. 2013); see also *Gerrity Oil & Gas Corp. v. Magness*, 946 P.2d 913, 926-27 (Colo. 1997); *DuLaney v. Okla. State Dep’t of Health*, 868 P.2d 676, 680 (Okla. 1993). With respect to Utah state trust minerals, a somewhat different framework must be applied. Utah state law requires that the patent (deed) for any lands sold by the State to contain a specific reservation of the mineral estate and the right of the state and its mineral lessees to occupy the surface estate as reasonably necessary to remove minerals. Utah Code Ann. 53C-2-401(1)(c). State statute goes on to provide that a mineral lessee has the right at all times to enter upon the mineral leasehold, and shall have “reasonable use” of the surface, although the mineral lessee must compensate the surface owner for damage to any improvements. Utah Code Ann. 53C-2-409(2). If the surface owner does not consent to entry by the mineral lessee, SITLA may grant surface access, subject to a requirement that the mineral lessee file a bond for the benefit of the surface owner (with the surface owner given a right to appeal the amount of surface damages to a court of competent jurisdiction). Utah Code Ann. 53C-2-409.

The Service appears to recognize the importance of deed language, stating that it “will respect any applicable deed conditions” and that the proposed regulatory requirements “apply to the extent that they do not conflict with deed conditions...” 80 Fed. Reg. at 77,202. The state statutory provisions cited above must also be recognized, as they are legal conditions incorporated in any patent of state lands, including any patents to the Service for surface lands now included in NWR units.

Put another way, the question is not whether the regulations conflict with deed conditions, but rather whether the deed explicitly makes reserved rights subject to federal rules and regulations. Therefore, it is not enough to include a provision stating that the regulations shall not “contravene or nullify rights vested in holders of mineral interests on refuge lands.” 50 C.F.R. § 29.32(b) (as proposed). The regulations must include an additional provision that expressly applies the regulations only to NWRS lands for which the applicable deed explicitly makes subsurface mineral interests subject to federal regulation. Without such a deed

that regulations pertaining to reserved mineral rights be stated within the deed. Additionally, each contain an alternative section—section 11 in the case of the Weeks Act and section i in the case of the MBCA—that grants the respective agency very broad authority over all other private acts within the acquired land, aside from those reserved by private owners. Thus, arguments that subsequent statutes granting broad authority to the FWS have changed the status quo can likely be defeated; without explicitly referring to privately owned mineral rights, these statutes do not change the division of regulatory authority established by the MBCA.” (emphasis added).

restriction, the respective rights of the Service and SITLA are governed by state statutory law dealing with split estate minerals managed by Utah's school trust.

B. Notwithstanding the objections stated above, the proposed regulations should be modified before they are promulgated.

Should the Service proceed to promulgate new regulations, there are a number of areas in which the proposed regulations should be modified. Without conceding SITLA's positions stated above, SITLA offers the following comments on certain aspects of the Service's proposed regulations.

1. Geographic scope

SITLA agrees that the regulations cannot "apply to operations on neighboring private lands or non-Federal surface estates within refuge boundaries." 80 Fed. Reg. at 77,206. As addressed above, the Service's authority, if any, to regulate surface use by a subsurface mineral interest holder derives from the language of the deed to the NWRS land. Moreover, the NWRSA addresses NWRS land, not non-federal land. The Service therefore has no authority under the NWRSA or the MBCA to regulate activities on non-federal land.³

2. Existing operations

SITLA agrees that the regulations should not apply to operations being conducted under existing permits or under no permit if operating in accordance with applicable laws before the final regulations are promulgated. *See* 50 C.F.R. §§ 29.43, 29.44. However, the Service must delete the phrases "subject to the provisions of this subpart" and "subject to applicable requirements of this subpart" from proposed subsections 29.43 and 29.44, respectively. The effect of these phrases is to make pre-existing operations subject to the new regulations and to apply the regulations retroactively without a legal basis for doing so. Similarly, the language subjecting pre-existing operations to the new regulations in proposed subsections 29.60, 29.61, and 29.64 must also be eliminated.⁴ The only proposed regulations that can reasonably apply to pre-existing operations are those addressing the operational modifications and operator changes.

3. Timing and appeals

The proposed period of 180 days for the processing of permit applications is unreasonably long and unduly burdens the rights of mineral interest holders. The contemplated 180-day time period is longer than those considered reasonable in existing case law. *See Minard Run*, 670 F.3d 236 (60 days); *Duncan Energy Co. v. U.S. Forest Serv.*, 109 F.3d 497, 499 (8th

³ In this light, the Service should insert the phrase "located or occurring within a refuge" after "and all other activities" at the end of the definition of "operations" in 50 C.F.R. § 29.50 (as proposed). This would appropriately clarify that only incidental activities occurring within a Refuge are covered by the regulations.

⁴ The reference to the applicability to 50 C.F.R. § 29.120 (as proposed) is particularly troubling because that subsection requires compliance with all operating standards in 50 C.F.R. §§29.111-119 (as proposed), which are precisely the provisions that should not apply to pre-existing operations.

Cir. 1997) (considering processing times of 60 days, 74 days, and 91 days; “[t]he Forest Service has only limited authority to regulate use of the subservient surface estate by the dominant mineral estate, and its processing time must be reasonable, expeditious, and as brief as possible”). In addition to shortening the processing time for applications, we recommend that the Service include in the regulations a categorical exclusion from National Environmental Policy Act requirements and a provision stating that operations conducted in compliance with the terms of a permit are deemed to be not likely to adversely affect any species listed under the federal Endangered Species Act.

Additionally, the two-tiered appeals process proposed in the regulations is unreasonable and unduly burdensome. There should be a single, expedited administrative appeal available for challenges to actions taken by the Service under the proposed regulations. This administrative decision should be directly appealable in federal court.

4. Information requests

The proposed information requirements for permit applications are extraordinarily extensive and unduly burdensome. *See* 50 C.F.R. §§ 29.94-29.97. These requirements, particularly including proposed subsection 29.121(f), also unlawfully require the disclosure of confidential and/or proprietary information. The information requirements must be significantly scaled down so that they request only the basic information needed for the Service to assess the location and type of operations that will be undertaken. All provisions requesting confidential or proprietary information must be eliminated.

5. Access

The Service should modify the proposed regulations to make clear that the Service cannot place conditions on operations in a permit that only allows an operator to access and traverse federal lands (*i.e.*, in order to access its operations on non-federal lands). In addition, we agree that fees cannot be required for access that is already within the scope of the operator’s oil and gas right or other right provided by law and that there should be no fees for emergency access. *See* 50 C.F.R. §§ 29.141, 142 (as proposed). If an access fee can be applied, then it must be reasonable and cannot burden the underlying oil and gas right or otherwise diminish the value of the mineral estate.

6. Financial assurances

SITLA requests that the Service modify proposed subsection 29.150 to provide that a bond is not required to the extent that a sufficient bond, applicable to the operation, has already been lodged with a state authority or another federal authority. As noted above, state law provides for the filing of a bond with SITLA to protect the surface owner from damage from split-estate operations. Utah Code Ann. 53C-2-409(3)(c). Adding a duplicative layer of bonding requirements is unfair and unreasonable, particularly for operators that have a history of full compliance. Any additional bonding should only be required on a case-by-case basis and only to the extent necessary to supplement bonds that have already been lodged.

7. Operational restrictions

The Proposed Rule states that it “contains performance-based standards that provide flexibility to resource managers and operators to use various and evolving technologies within different environments to achieve the standards.” 80 Fed. Reg. at 77,203. However, the text of the proposed operational requirements is, in many instances, not faithful to this “flexible” approach. For example, the proposed regulations requiring the installation and maintenance of secondary containment, applying seasonal access requirements, and specifying the location, type, and design of facilities are unreasonable and unduly burden and unlawfully diminish the value of the mineral estate. *See* 50 C.F.R. §§ 29.111-29.119 (as proposed). These requirements should be eliminated and replaced with recommended operational methods, general goals to be achieved to the extent technologically and economically feasible, and a requirement to use best management practices.

In a similar vein, the Service does not have the authority to permit only the “least-damaging” operational methods. The Service may recommend the “least damaging” methods, but the mineral interest owner is not required to modify its operations in a manner that is not economically or technologically feasible in order to access its mineral rights. Accordingly, the term “technologically feasible, least damaging methods” (as proposed) is not appropriate and should be replaced with “feasible methods.” “Feasible methods” should be defined as those methods that are technologically and economically feasible, as determined by the best industry practices available.

Finally, the operational restrictions set forth in the Proposed Rule in many instances are duplicative of, or conflict with, applicable state regulations. This will inevitably result in confusion for both operators and regulatory agencies.

8. Mitigation

The Service does not have the authority to require mitigation for impacts by mandating that operators provide for “habitat creation, habitat restoration, land purchase, or other compensation.” 50 C.F.R. § 29.120(g) (as proposed). This broad provision should be eliminated from the regulations as it amounts to an access fee that unreasonably and unlawfully restricts access to mineral rights.

9. Modifications

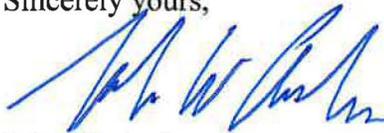
SITLA recommends two changes to the regulations addressing modification of existing operations. First, the word “significant” should be inserted before “additional impacts” in the definition for “modifying” (proposed subsection 29.50). This would clarify that modified permits are not (and should not be) required for minor modifications to operations that do not result in significant changes in effects to the environment. Second, proposed subsection 29.160 should be modified to clarify that the Service may amend a permit only when there is a “significant” or “substantial” modification to the permitted operation.

C. Alternative C in the DEIS must be rejected.

Alternative C, as set forth in the DEIS, would “expand” the jurisdiction of the Service to “regulate non-Federal oil and gas operations that occur on private surfaces within the boundary of a refuge (*i.e.*, inholdings) and to operations on non-Federal surface locations that use directional drilling to access non-Federal oil and gas underneath the surface of a refuge.” DEIS at v. For the reasons explained in Section II.D.1 *supra*, the Service has no authority under the NWRSA or the MBCA to regulate activities on non-federal land.⁵ Accordingly, Alternative C is not “reasonable” and must be rejected. *See* 40 C.F.R. § 1502.14.

Thank you for your attention to these comments. Please contact me at (801) 538-5180 if or by email at jandrews@utah.gov you have any questions or comments.

Sincerely yours,



John W. Andrews
Associate Director/Chief Legal Counsel

Cc: David Ure
LaVonne Garrison
Kathleen Clarke, PLPCO

⁵ Relatedly, we recommend that the Service insert the phrase “located or occurring within a refuge” after “and all other activities” at the end of the definition of “operations” in 50 C.F.R. § 29.50 (as proposed). This would clarify that only incidental activities occurring within a Refuge are covered by the regulations.



February 9, 2016

Via Federal eRulemaking Portal

Public Comments Processing
Division of Policy, Performance, and Management Programs
U.S. Fish and Wildlife Service
MS: BPHC
5275 Leesburg Pike
Falls Church, VA 22041

Re: Proposed Rule and DEIS for Management of Non-Federal Oil and Gas Rights, FWS-HQ-NWRS-2012-0086

To Whom It May Concern:

Western Energy Alliance is concerned with the proposed revisions to regulations governing the exercise of non-federal oil and natural gas rights located within U.S. Fish and Wildlife Service (FWS) refuge units. The revisions proposed under the draft environmental impact statement's (DEIS) preferred alternative exceed FWS's authority and place overly burdensome requirements on the owners of valid mineral rights on non-federal lands. Western Energy Alliance requests FWS modify the EIS to adopt Alternative A, the no action alternative.

Western Energy Alliance represents over 450 companies engaged in all aspects of environmentally responsible exploration and production of oil and natural gas in the West. Alliance members are independents, the majority of which are small businesses with an average of fifteen employees. The Alliance incorporates by reference the comments of the Independent Petroleum Association of American (IPAA) and the American Petroleum Institute (API), which provide excellent detailed legal and technical information on the deficiencies of the proposed rule. We share IPAA and API's concerns about FWS' authority to regulate mineral interests and the overbroad nature of the proposed rule, and support the changes proposed by the two organizations.

The imposition of additional regulations on non-federal oil and gas development within the National Wildlife Refuge System is unnecessary and will only result in duplicative layers of regulation. The DEIS states that current regulations are "ineffective at protecting refuge resources or providing operators explicit requirements for operating on refuge lands." However, FWS has recently issued new guidelines for management of these lands, and operations on these lands are also subject to other federal and state laws governing operational requirements that are intended to protect refuge resources.

In 2012, FWS released an update to its "Management of Oil and Gas Activities on

National Wildlife Refuge System Lands” guidance document. This document describes the various requirements for oil and natural gas development, including Best Management Practices, minimization of environmental impacts, documentation requirements, bonding and insurance, and other extensive monitoring requirements. FWS should continue to follow these guidelines and evaluate the results over an extended timeframe, rather than proposing new regulations that are duplicative of current efforts. In the absence of a proper evaluation of current practices, the need for new regulations is unclear.

Furthermore, numerous federal and state laws and regulations apply to these lands. States especially have extensive rules and regulations intended to protect natural resources and the environment. These rules address a variety of issues, such as drilling, development, and production activities; setbacks; ground water protection measures; financial assurance requirements; spill reporting; and reclamation requirements. Ultimately, Western Energy Alliance believes present rules and regulations are sufficient to protect refuge resources and the DEIS is unnecessary.

Should FWS decide to promulgate final regulations for refuge lands, the agency must recognize it does not have the authority to regulate activities on non-federal lands, and as such, Alternative C cannot be adopted. Alternative C would include all proposed changes under the preferred Alternative B, but would also apply these changes to “operations on non-Federal surface locations that drill beneath the surface of a refuge to access their non-Federal oil and gas right.”

Such a change would clearly exceed FWS’s authority, which is limited to operations on federal lands. Western Energy Alliance urges that a final EIS make clear that FWS does not seek and will not attempt to regulate oil and natural gas operations that fall outside the boundaries of the refuge units.

Western Energy Alliance urges the adoption of Alternative A, the no action alternative. Current rules and regulations, including those specific to FWS management of refuge lands and general federal and state laws, are sufficient to protect refuge resources. Thank you for considering our comments, and please do not hesitate to contact me with any questions.

Sincerely,



Kathleen Sgamma
Vice President of Government & Public Affairs

END OF DOCUMENT