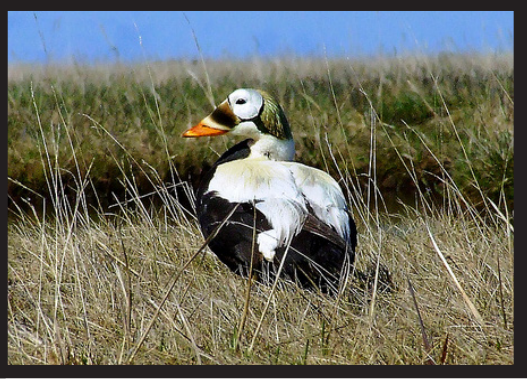
U.S. Department of the Interior
Bureau of Land Management

DRAFT Technical Companion

to the Regional Mitigation Strategy for the NE National Petroleum Reserve in Alaska

September 2016



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Our Vision

To enhance the quality of life for all citizens through the balanced stewardship of America's public lands and resources.

Our Mission

To sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

Draft Technical Companion

to the Regional Mitigation Strategy for the Northeastern National Petroleum Reserve in Alaska

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

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NOTATION

ANCSA	Alaska Native Claims Settlement Act
AO	Authorized Officer
APD	Application for Permit to Drill
ASDP	Alpine Satellite Development Facility
BLM	Bureau of Land Management
BMP	Best Management Practice
CEQ	Council on Environmental Quality
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act
FSEIS	Final Supplemental Environmental Impact Statement
GMT1	Greater Mooses Tooth 1
IAP	Integrated Activity Plan
LUP	Land Use Plan
MLA	Mineral Leasing Act
NEPA	National Environmental Policy Act
NPR-A	National Petroleum Reserve in Alaska
NPRPA	Naval Petroleum Reserves Production Act
NSB	North Slope Borough
NSO	No Surface Occupancy
REA	Rapid Ecoregional Assessment
RMS	Regional Mitigation Strategy for the Northeastern National Petroleum Reserve in Alaska
ROD	Record of Decision
ROW	Right-of-Way
SEIS	Supplemental Environmental Impact Statement
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Service

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ABSTRACT

Oil and gas development that is projected to occur in the Northeastern National Petroleum Reserve in Alaska, will most likely result in disproportionate residual adverse impacts to the Iñupiat people, specifically, their subsistence activities and culture. Residual, sometimes referred to as unavoidable, impacts are those impacts that remain after all efforts to avoid, minimize, and/or reduce impacts. Depending on the exact nature and location of development, other residual adverse impacts to the natural environment, the function of the ecological systems, and to human health may occur. The Regional Mitigation Strategy for the Northeastern National Petroleum Reserve in Alaska presents a landscape-level, science-based strategy for compensating for some residual impacts that will or may occur with oil and gas development in the region. This compensatory mitigation strategy's goals are derived from input from regional and local stakeholders on values that need to be protected. These goals are to:

- Sustain and enhance access to and use of traditional subsistence use areas.
- Sustain and enhance opportunities and rights for Native peoples to live, practice, and pass-on Iñupiaq culture and lifestyle.
- Sustain and enhance the functionality of the ecological system, including land, water, and landscapes that allow for sustainable populations of fish and wildlife and their natural movement and distribution.
- Sustain and enhance the health and safety of the residents.
- Sustain and enhance opportunities for economic and community development, such as job training and local contracting.

The strategy consists of preliminary findings and recommendations on: (1) mitigation actions that can be implemented in the region to compensate for some residual impacts of oil and gas development; (2) methods to estimate the amount of compensatory mitigation that could be assessed for an oil and gas development project; (3) how a regional compensatory mitigation fund could be administered; and (4) how the effectiveness of the strategy might be assessed at the regional level. While this strategy is not a Bureau of Land Management decision, it will inform future decisions on specific oil and gas development projects on public land in the region.

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1 INTRODUCTION AND PURPOSE

1.1 PURPOSE AND GOALS OF THE STRATEGY

The White House Council on Environmental Quality (CEQ) has defined *mitigation* in its regulations at 40 CFR 1508.20 to include: avoiding impacts, minimizing impacts, rectifying impacts, reducing or eliminating impacts over time, and *compensating for remaining residual effects.* Collectively, the five aspects of mitigation (avoid, minimize, rectify, reduce/eliminate, compensate) are referred to as the mitigation hierarchy.

The purpose of the "Regional Mitigation Strategy for the Northeastern National Petroleum Reserve in Alaska" (RMS), which includes this Technical Companion document, is to identify, evaluate, and communicate potential *compensatory mitigation* needs and actions for the Northeastern National Petroleum Reserves in Alaska (NPR-A) in advance of anticipated oil and gas development on public lands. Compensatory mitigation is defined as the actions taken to compensate for (or offset) some of the residual impacts of an authorized land-use; it may include monetary payments made toward accomplishing the offsetting actions or projects. Residual, sometimes referred to as unavoidable, impacts are those impacts that remain after all attempts to avoid, minimize, rectify, and reduce impacts have been applied.

BLM's management of the NPR-A is guided by the 2013 NPR-A Integrated Activity Plan (IAP) Record of Decision (BLM 2013a). The plan made more than half of the land in the NPR-A (11.8 million acres) available for oil and gas leasing. The remaining land (11 million acres) is not open to leasing, in order to protect important ecological systems and the Alaskan Native cultures that are linked to them. Designating these areas as not open to leasing is an example of the avoidance element of the mitigation hierarchy. The IAP also specified best management practices (BMPs) that must be implemented to minimize impacts from development that may occur in areas open to leasing. Requiring developers to implement the existing BMPs is an example of the minimization element of the mitigation hierarchy. Measures to avoid and minimize, however, may not fully eliminate impacts. In situations where the residual impacts meet certain criteria, compensatory mitigation may be required.

This strategy is focused on *compensatory mitigation* for some of the impacts of anticipated oil and gas development in the Northeastern NPR-A. The ways in which the other elements of the mitigation hierarchy will be accomplished in the NPR-A are described in the NPR-A IAP Final Environmental Impact Statement (EIS) and Record of Decision (ROD) (BLM 2012 and 2013a), and in project-specific National Environmental Policy Act (NEPA) documents, such as the Supplemental EIS for the Alpine Satellite Development Plan (ASDP) for the Greater Mooses Tooth 1 (GMT1) development project (BLM 2014).

In the past, the BLM determined on a project-by project basis whether the residual impacts warranted compensatory mitigation, and if so, what compensatory mitigation would be required. For oil and gas, the process began when an oil company submitted an application for development. In accordance with NEPA, BLM prepared an assessment of the impacts expected with the proposed project. The assessment identified mitigation measures that, if implemented,

could avoid and/or minimize impacts, and the residual impacts that would remain after these measures were applied. In determining whether the residual impacts warranted compensatory mitigation, the BLM considered the potential for any of the following:

- Residual adverse effects that inhibit achieving compliance with laws, regulations, and/or policies.

- Residual adverse effects that inhibit achieving the applicable land use plan's resource goals, including applicable mitigation standards.

- Residual adverse effects to important, scarce, or sensitive resources that had been previously identified in a mitigation strategy as warranting compensatory mitigation.

- Residual adverse effects to important, scarce, or sensitive resources that were identified through a NEPA process as warranting compensatory mitigation.

If compensatory mitigation was found to be warranted, the next step was to determine what might be done to adequately compensate for the residual impact(s). The assessment of what might be done included:

- Identifying potential actions/projects, such as rehabilitating a previously disturbed wildlife habitat of the same character (where the residual impact is the loss of wildlife habitat).

- Identifying an appropriate amount of rehabilitation, such as how many acres (which could also be calculated in dollars).

- Identifying the expected duration of the mitigation action.

The selection of compensatory mitigation actions included consideration of feasibility, cost-effectiveness, risk, stakeholder opinion, and whether the residual impacts were found to disproportionately impact a minority group.

Several methods were employed to accomplish compensatory mitigation, including:

- Developers proposing compensatory mitigation actions, obtaining BLM approval, and implementing the action "on the ground." The BLM carried-out compliance checks to ensure that the actions were completed as required.

- BLM identifying compensatory mitigation actions and:
  - Developers implementing the mitigation action on the ground, with BLM doing compliance checks.
  - Developers funding the mitigation action, but BLM arranging for and overseeing on-the-ground implementation.

In all cases, the BLM developed or approved implementation plans for each mitigation action and monitored the effectiveness of the actions to ensure they were achieving the desired results. Where results were not achieving expectations, BLM sometimes directed or implemented changes designed to improve performance.

While this project-by-project approach is workable, it is not particularly efficient, nor does it adequately address important impacts that may reveal themselves at a landscape (also called regional) level, or over time. The process is also reactive, and opens the door for inconsistency between projects. As stated above, the purpose of the RMS is to develop a proactive strategy that, to the greatest extent possible, anticipates development and its associated residual impacts at a landscape level; provides a suite of potential mitigation actions that could compensate for these anticipated residual impacts; and assesses their feasibility, potential for success, and relative importance among stakeholders, with particular consideration given to any people who are directly and disproportionately impacted. The RMS also describes the most common approaches to determining the amount of compensatory mitigation that would be required, so that decision-makers may select the method best suited to a particular development project. Finally, the RMS offers potential ways to monitor the success of compensatory mitigation actions for the residual impacts.

Although the RMS provides a summary of the residual adverse impacts that could occur from oil and gas development in the region, the actual impacts will vary with the nature and location of specific facilities. Accordingly, specific mitigation actions for each development project will be identified through project-specific NEPA decisions. The RMS lays the groundwork for these decisions to be developed and executed quickly under the umbrella of this landscape-level strategy that takes into account the potential cumulative impacts of development and the long-term trends in the human and natural environments, including the changes brought on by climate change. The compensatory mitigation strategy's goals are derived from input from regional and local stakeholders on values that need to be protected. These goals are to:

- Sustain and enhance access to and use of traditional subsistence use areas.
- Sustain and enhance opportunities and rights for Native peoples to live, practice, and pass on Iñupiaq culture and lifestyle.
- Sustain and enhance the functionality of the ecological system, including land, water, and landscapes that allow for sustainable populations of fish and wildlife and their natural movement and distribution.
- Sustain and enhance the health and safety of the residents.
- Sustain and enhance opportunities for economic and community development, such as job training and local contracting.

The strategy consists of preliminary findings and recommendations on:

- Residual impacts that may warrant mitigation.

- Mitigation actions that can be implemented in the region to compensate for the most problematic residual impacts (i.e., those that may warrant mitigation).

- Methods for estimating the amount of compensatory mitigation that should be assessed for an oil and gas development project.

- How a regional compensatory mitigation fund could be managed.

- How the effectiveness of the strategy might be monitored and adapted at the regional level.

While this strategy is not a Bureau of Land Management (BLM) decision, it will inform future BLM decisions on specific oil and gas development projects on public land in the region (see Section 3). It is designed to complement the other types of mitigation that make up the mitigation hierarchy, whether they are executed by the BLM or by other agencies, and to fill the niche of an overarching, forward-looking strategy that will facilitate more efficient and effective decisions about what should be done to compensate for the residual adverse impacts of oil and gas development in the Northeastern NPR-A.

It is important to acknowledge that development and other activities permitted to occur on public lands have positive benefits. In addition to the broad positive impacts of domestically produced energy fuels, the positive local impacts that might be expected from oil and gas development in the NPR-A, as listed in the Final EIS for GMT1 (BLM 2014) include:

- Increased economic activity in the state, the region, and in the local communities.

- Increased revenues to the State, the region, local communities, and Alaska Native corporations.

- Increased job opportunities for Alaskans.

- Additional indirect impacts resulting from spending of income earned by workers, as well as government spending of revenues for capital and operating programs.

- Increased oil production in the Alaska North Slope that will result in additional secondary economic impacts such as increasing trans-Alaskan pipeline system throughput (and State revenues).

While positive impacts may justify authorization of activities on public lands, they do not relieve the developer of the requirement to mitigate adverse impacts.

1.2 BACKGROUND

In 1923 President Warren Harding set aside the Naval Petroleum Reserve No. 4, a 22.8-million-acre area on Alaska's North Slope, to secure an emergency oil supply for the U.S. Navy. In 1976, in accordance with the Naval Petroleum Reserves Production Act, the administration of the reserve was transferred to the BLM within the Department of the Interior, and the reserve was renamed the NPR-A. The Naval Petroleum Reserves Production Act of 1976 (42 U.S.C. 6501 et seq.), as amended, authorizes the BLM to provide competitive leasing of oil and gas in the NPR-A while protecting and mitigating for impacts to surface resources. The law also provides for designation of special areas containing significant subsistence, recreational, fish and wildlife, or historical or scenic values.

Oil and gas development has been ongoing on Alaska's North Slope since the late 1960s, principally on land owned by the State of Alaska. The BLM offered the first federal oil and gas leases within the NPR-A in 1983, and has conducted 10 lease sales since, including a sale every year since 2010. As of September 2016, there are 212 leases in place in the NPR-A, amounting to more than 1.7 million acres leased (see Figure 1-1). None of the leases on public land have been developed to date.

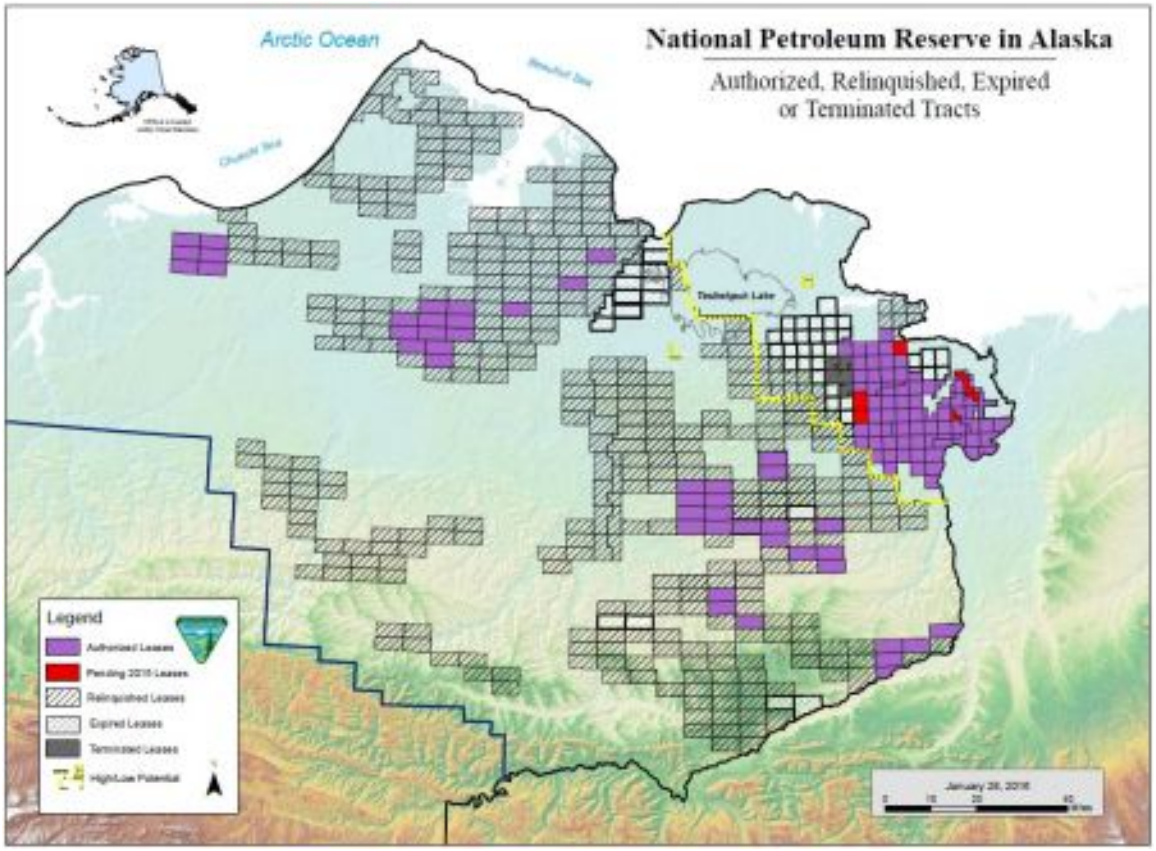

FIGURE 1-1 Authorized, Relinquished, Expired, or Terminated Lease Tracts within the NPR-A (Source: http://www.blm.gov/ak/st/en/prog/energy/oil_gas/npra/npra_leasing.html)

As stated above, BLM's management of the NPR-A is guided by an IAP; the most recent IAP ROD was finalized in 2013 (BLM 2013a). The IAP reaffirmed the role of the NPR-A Subsistence Advisory Panel, a group of tribal representatives who, since 1999, have advised BLM on ways to mitigate impacts from development and other permitted activities. The IAP also established the NPR-A Working Group — made-up of representatives from local governments, Alaska Native Tribes, and Alaska Native Corporations within the North Slope of Alaska — to advise on high-level land management decisions and ensure that land managers have an understanding of a broad spectrum of local concerns, and the recommendations of local residents and institutions.

Greater Mooses Tooth 1 and the Regional Mitigation Strategy for Northeastern NPR-A

Oil and Gas Development in the Northeastern NPR-A

The first leases scheduled to be developed on public land in the NPR-A are part of the ASDP (BLM 2014). The plan, proposed by ConocoPhillips Alaska Incorporated (CPAI), includes five satellite drilling pads — two in the Colville River Delta adjacent to the NPR-A and three in the NPR-A, west of the Colville Delta. The pads are termed CD-3, CD-4, CD-5, CD-6, and CD-7. In the Colville River Delta, CD-3 is on State of Alaska land and CD-4 is on land owned by Kuukpik Corporation, an Alaska Native-owned corporation created under the authority of the Alaska Native Claims Settlement Act (ANCSA) for the village of Nuiqsut. CD-5 is on land conveyed to Kuukpik Corporation within the NPR-A; CD-6 and CD-7 are on lands administered by the BLM in the NPR-A.

ConocoPhillips proposes to place 20 to 30 wells on each pad and to transport the unprocessed, three-phase (oil, gas, and water) drilling product to the Alpine Central Processing Facility (APF-1), located on State land in the Colville Delta east of the NPR-A (see Figure 2-2), via newly constructed pipeline segments connecting production pads with APF-1. Processed oil would be placed in the existing pipeline system for transport to the Trans-Alaska Pipeline System. In November 2004, the BLM finalized an EIS and issued a ROD approving the portions of the ASDP on public land, with stipulations (BLM 2004; 2005).

In 2013, CPAI submitted an application to BLM for a right-of-way (ROW) and related authorizations to construct, operate, and maintain a drill site, access road, pipelines, and ancillary facilities to support development of the GMT1 production pad. The GMT1 pad is referred to as CD-6 in the ASDP EIS (BLM 2004). The name was changed because two production units were established after the ASDP was authorized: the Greater Mooses Tooth unit and the Bear Tooth unit (see Figure 2-1). The proposed GMT1 drill site location and the majority of the associated roads and pipeline route are on BLM-managed lands and will therefore constitute the first oil development on BLM-managed land on the North Slope.

A Supplemental Environmental Impact Statement (SEIS; BLM 2014) was prepared to supplement the ASDP Final EIS. The SEIS evaluates changes in the overall project design and GMT1-specific proposals. The BLM published the SEIS ROD on February 13, 2015. The ROD authorized the construction of GMT1 and implemented the Department of the Interior's direction

on improving mitigation policies and practices. Specifically, the GMT1 Decision included stipulations designed to avoid and/or minimize adverse impacts. The BLM determined that, even if those stipulations were implemented fully and successfully, residual impacts would remain and adversely affect subsistence resources and activities, cultural resources, and environmental justice. To compensate for these residual impacts from the GMT1 development project, the ROD specified that CPAI would provide $8 million to establish a compensatory mitigation fund. This fund was used to facilitate the development and implementation of this RMS through a collaborative, multi-stakeholder process that includes identifying potential mitigation projects to protect areas of critical environmental, subsistence, or cultural significance, restore disturbed sites, and benefit subsistence users most directly impacted by development projects. The fund will also be used to finance mitigation projects to offset the identified residual adverse impacts from GMT1. The BLM is working with stakeholders, including members of the Native Village of Nuiqsut who are the most directly impacted by the GMT1 project, to create an implementation plan for the GMT1 compensatory mitigation fund.

The GMT1 project is the first of several development projects that are likely to occur in the region over the next several decades. The purpose of the RMS is to identify, evaluate, and communicate potential future compensatory mitigation needs and actions in the Northeastern NPR-A in advance of anticipated oil and gas development.

This RMS complements four existing mitigation programs applicable to oil and gas development in the NPR-A:

1. A requirement in law (42 USC §6506a(l)) that the Federal government pay 50 percent of the revenues received from sales, rentals, bonuses, and royalties from oil and gas development in the NPR-A to the State of Alaska to be used for planning, construction, maintenance, and operation of essential public facilities, and other necessary provisions of public service, with priority given to areas most impacted.

2. A subsistence mitigation program established by an agreement between ConocoPhillips and the Kuukpik Corporation as a part of the North Slope Borough (NSB) permitting process.

3. The requirement under Section 404 of the Clean Water Act (administered by the United States Army Corps of Engineers) to mitigate the loss of wetlands.

4. The requirement under Section 7 of the Endangered Species Act (ESA; administered by the United States Fish and Wildlife Service) to mitigate impacts to species listed under the ESA.

1.3 STAKEHOLDER ENGAGEMENT AND INVOLVEMENT IN THE REGIONAL MITIGATION STRATEGY

The RMS is being developed through a transparent and collaborative process involving a wide range of affected stakeholders. A robust stakeholder engagement strategy was used to solicit the knowledge and experience of Alaska Natives, other Federal agencies, State and local governments, residents, scientists, stakeholders, industry, special interest groups, and other interested parties. The strategy included public workshops, government-to-government and community meetings, a substantive and user-friendly website, and multiple opportunities for stakeholders to participate, including nominating mitigation actions/locations and commenting on interim products and the draft RMS.

Specialists from BLM in Alaska, with the support of Argonne National Laboratory, produced a preliminary product for each element of the RMS, which was then presented and discussed in workshops open to the public, and in formal government-to-government consultation and meetings with entities representing the Iñupiat residents of the North Slope. Opportunities for providing written comments were also extended to stakeholders throughout the process. The methods used and content of the RMS incorporated many of the ideas and comments received from the public.

Public workshops were held in Fairbanks, Nuiqsut, and Barrow. Attendees included representatives from Federal, State, and local government agencies; non-governmental organizations; the oil and gas industry; Alaska Natives and leaders of Alaska Native entities; and individual members of the public. The NPR-A Working Group has participated in every workshop, established an RMS sub-committee, and held RMS-specific meetings. The main entities in Nuiqsut (the City of Nuiqsut, the Kuukpik Corporation, and the Native Village of Nuiqsut tribal council) established a resolution to collaborate on the RMS, and the BLM has met with the trilateral committee on three occasions.

Approximately 92 people attended the RMS kickoff workshop held March 31-April 1, 2015, in Fairbanks. During the first workshop, background on RMSs and the compensatory mitigation provisions of the GMT1 SEIS were discussed.

The second set of public workshops was held September 22–25, 2015, in Nuiqsut and Barrow. These workshops included presentation and discussion of a preliminary assessment of potential residual impacts from future oil and gas development, a preliminary set of mitigation goals, and a potential list of criteria for ranking and selecting mitigation actions. Attendees were invited to recommend possible compensatory mitigation sites and actions to be evaluated in the mitigation strategy. Approximately 37 people attended one of two meetings held in Nuiqsut, and 62 people attended in Barrow. The RMS was also discussed at the September 25, 2015, meeting of the NPR-A Working Group, attended by BLM managers and the RMS project team.

The third round of public workshops was held March 8–9, 2016, in Fairbanks (attended by 58 people) and on April 22, 2016 in Nuiqsut (attended by 26). At these workshops, revised versions of the residual impacts, mitigation goals, and the ranking criteria that had been modified based on comments were presented for further discussion. A list of potential mitigation actions

and associated locations received during the October–November 2015 comment period was also presented and discussed, and additional recommendations were recorded.

Workshop summaries and presentations, and preliminary documents are posted on the Alaska RMS project website at: http://www.blm.gov/ak/st/en/prog/NPR-A/RMS.html. Additional materials provided for stakeholder review are also posted on the RMS project website.

Numerous meetings and workshops regarding oil and gas development, including two specific to the development of the RMS, have been conducted in Nuiqsut over the past 13 years. In an effort to 1) better estimate the degree of various subsistence and social impacts; 2) specifically illuminate tensions related to the permitting process; 3) make clearer how some social impacts might be mitigated; and 4) conduct an analysis without creating an undue amount of additional tension, a computer-assisted qualitative analysis of the comments (public testimony) made at BLM public meetings in Nuiqsut was undertaken. The preliminary results were used to inform the development of the RMS. A description of the initiative and the preliminary results can be found in appendix I.

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2 REGIONAL MITIGATION STRATEGY — NORTHEASTERN NPR-A

2.1 DESCRIPTION OF THE REGION

The BLM defines the Northeastern Region of the NPR-A as the area between the Colville River on the east, the Chipp and Ikpikpuk rivers on the west, the Beaufort Sea on the north, and the boundary between the coastal plain and foothills on the south (see Figure 2-1). The region is home to the Iñupiat people, and contains a rich array of natural and cultural resources. These resources, their conditions, and trends are described in Appendices A and B.

The GMT1 ROD (BLM 2015) specified that the general geographic scope of the RMS is the Northeastern NPR-A region and directed the BLM to implement a public process to define a more specific geographic region for the RMS. BLM had initially proposed a firm, fixed-line boundary for the RMS; however, written comments and public comments during stakeholder workshops resulted in a modified approach. Considering a broad region for the RMS provides more flexibility in selecting and siting compensatory mitigation actions, to ensure that they are effective in meeting mitigation goals. Therefore, the RMS applies to a larger region beyond the defined area of reasonable foreseeable development described in Section 2.2. This regional approach is also more suited to the dynamic nature of North Slope resources and resource use than is a fixed-line RMS boundary. The RMS therefore does not focus on whether a development impact is located inside or outside a fixed boundary line on a map, but instead explains the approach the BLM will use to address potential development impacts in future mitigation planning and decision making.

2.2 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR OIL AND GAS DEVELOPMENT

Oil and gas development is a function of many dynamic and interconnected variables, including the known locations and recoverable quantities of oil and gas, extraction and transportation technology, availability and/or feasibility of supporting infrastructure, environmental conditions and trends, and demand for oil and gas, among others.

Projections of oil and gas development in the Northeastern region of the NPR-A were prepared for the ASDP, the IAP, and GMT1, and are included in the cumulative impact analysis sections of the associated NEPA documents. For the RMS, per the GMT1 ROD, the BLM has developed a Reasonably Foreseeable Development Scenario (RFDS) related to projects that are expected to be enabled or assisted by the development of GMT1. The RFDS helps to predict future activities that could result in residual impacts in the region, and helps to set the framework for determining potential mitigation actions. The RFDS is based on currently available information regarding potential future activities in the region.

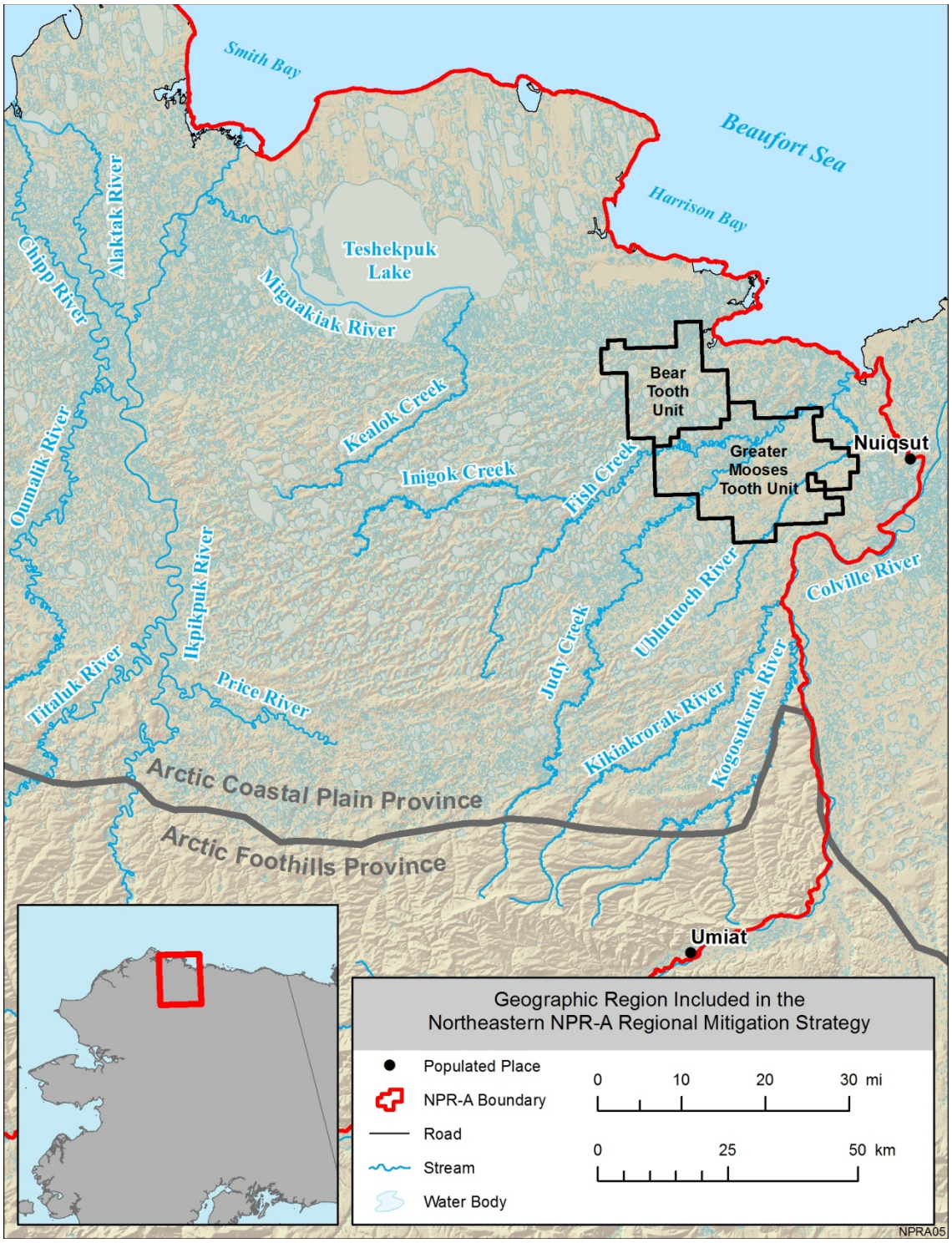

FIGURE 2-1 Geographic Region included in the Northeastern NPR-A RMS

Approach

The RFDS presented herein was derived by updating the 2004 ASPD EIS projection, which is specific to the Northeastern region of the NPR-A. The 2004 projection was updated to reflect the locations of the two known approved or proposed production pads (GMT1 and GMT2) and their associated infrastructure, including roads and pipelines connecting them to the Alpine processing facility. The GMT1 project has been approved, and the GMT2 project is in the permitting process.

The 2004 ASPD reasonably foreseeable future development scenario was updated with data obtained from exploratory drilling; changes in the areas that are available and not available for development as presented in the 2013 IAP (BLM 2013a); current information about the status of infrastructure projects, existing leased areas, and/or production unit boundaries; and updated market trends. Industry representatives suggested that the revised projection of reasonably foreseeable future development should consist of two additional production pads enabled by GMT1 located within the Greater Mooses Tooth and/or Bear Tooth units, within 10 miles of GMT1 or GMT2 infrastructure, and not more than 30 miles from the Alpine Central Processing Facility (see Figure 2-2). The area shown in Figure 2-2 incorporates the information provided by industry, and also includes all leased tracts contiguous to existing oil and gas production units, formerly utilized/unitized areas contiguous to the Bear Tooth Unit that have known reserves, and additional areas recommended by BLM staff with expertise in oil and gas development.

The potential locations of additional production pads are further limited by special protection areas and setbacks from certain lakes and rivers established by the ROD for the IAP (BLM 2013a) and by the ROD for GMT1 (BLM 2015). As is the case with GMT1, GMT2 and the two additional production pads will need to be connected to the Alpine processing facility by pipelines and possibly by roads. The potential for development in two other areas within the Northeastern region of the NPR-A was considered but eliminated from further consideration for the following reasons:

- Potential development in and around Smith Bay was not considered. Although oil and gas resources are thought to occur and leases currently exist in this area, and development could be facilitated by the existence of some limited infrastructure that could serve as a staging area for development activities in the area, the technical challenges of transporting the product to a processing facility appear problematic.

- Potential development near Umiat was not considered. Oil and gas reserves are known to occur in this area, but experts identified significant technical challenges associated with extraction.

Revised Projection

The revised projection is scaled-back from the 2004 projection: the projection includes two production pads and no additional processing facilities, as opposed to 22 production pads

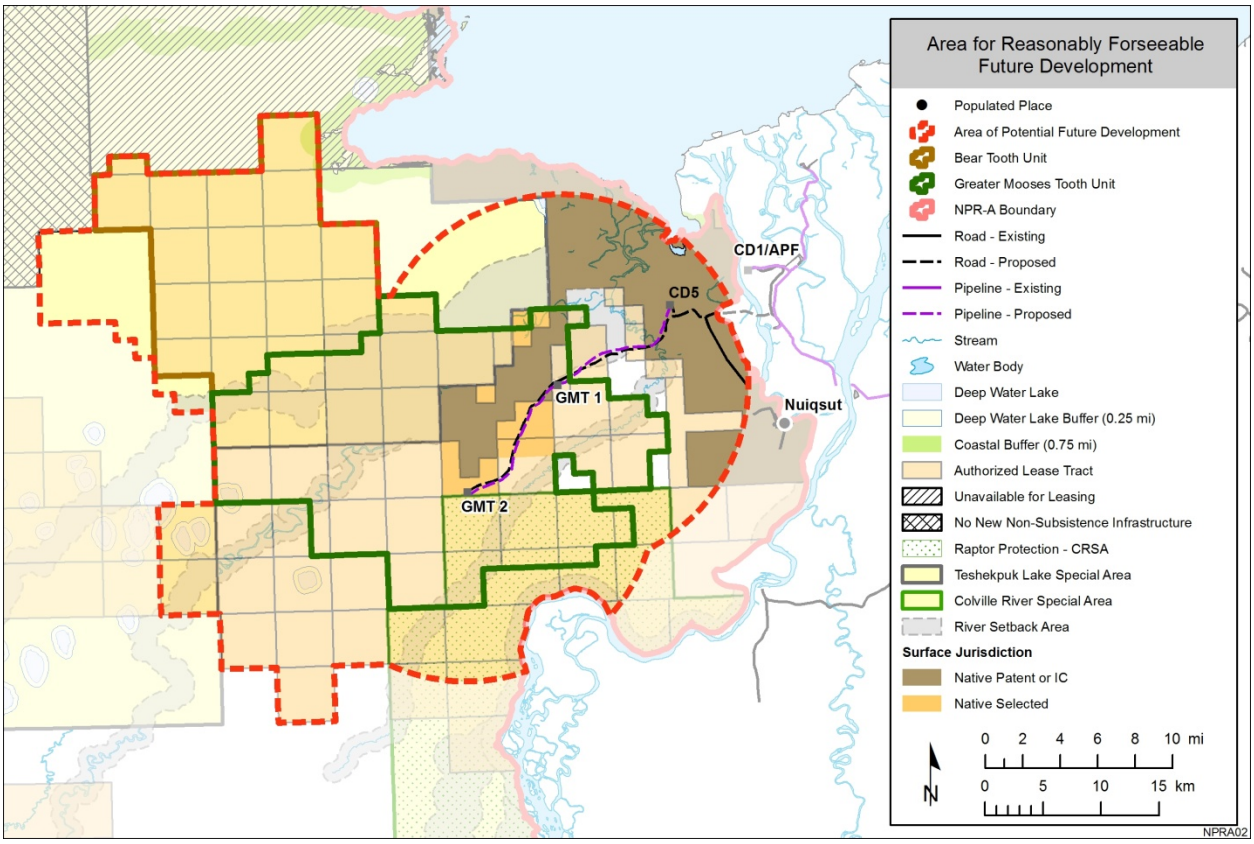

FIGURE 2-2 Reasonably Foreseeable Development Scenario

and two additional processing facilities in the 2004 projection. While the 2004 projection purposely overestimated development to analyze the impacts of a high-development scenario, the revised RFDS is less, reflecting the decreased level of production expected due to changes in market conditions since 2004 and enhancements in technology, including directional drilling. There continues to be much uncertainty associated with developing an estimate of oil and gas development in this region.

It is possible that development in excess of that projected in the revised RFDS could be prompted by changes in the market and/or by new discoveries. However, the RMS assumes that the two additional production pads and associated infrastructure depicted in Figure 2-2 constitute a reasonably foreseeable development scenario for the purpose of estimating the impacts of development. Nonetheless, there is enough flexibility in the RMS to accommodate additional developments should the anticipated amount exceed two. The potential locations of additional production pads may be limited by special protection areas and setbacks from certain lakes and rivers. If actual development levels significantly exceed those predicted in the RFDS, the assumptions used in the RMS would be updated and revised.

Activities Associated with Future Oil and Gas Development

The activities associated with the location, permitting, construction, and operation of oil and gas development include surveys, exploratory drilling, construction of facilities and supporting infrastructure, production drilling, transportation of the product, and ongoing operations and maintenance. More detailed descriptions of these activities can be found in Section 4G.4.4.3 of the ASDP Final EIS (BLM 2004). These activities are the sources of the impacts associated with oil and gas development summarized in Appendix C.

2.3 RESIDUAL ADVERSE IMPACTS

BLM requires that mitigation be used to avoid, minimize, rectify, or reduce over time the environmental impacts of development on lands the BLM manages. Applying these elements of the BLM mitigation hierarchy to future development in the Northeastern NPR-A will lessen, but not completely eliminate, the adverse impacts of development; some residual impacts would occur even with implementation of applicable BMPs and lease stipulations (see Figure 2-3).

A comprehensive summary of potential impacts from oil and gas development is provided in Appendix C. The following methodology was used to identify which of the impacts from oil and gas development in the Northeastern NPR-A under the RFDS (including cumulative impacts) would be residual:

- The BLM RMS project team reviewed the affected environment and impacts presented in the IAP EIS, the ASDP EIS, and the GMT1 SEIS.
  - The RMS project team reviewed the affected environment and the potential direct, indirect, and cumulative impacts for each resource value.
  - The RMS project team evaluated whether more detailed information was currently available that could influence the description of potential impacts from future development.

- The BLM RMS project team evaluated the mitigation measures (BMPs and lease stipulations) specified in the EISs and the associated RODs.
  - The RMS project team reviewed the mitigation measures presented in the IAP, ASDP, and GMT1 NEPA documents and RODs, determined which mitigation measures could be applicable to the actions evaluated under the RFDS that are applicable for the RMS, and determined if there are additional measures that could be implemented to avoid, minimize, rectify, or diminish impacts over time.

- The BLM RMS project team identified the potential residual impacts from future development. These are the impacts that could not be avoided and/or minimized, rectified, or diminished over time, even with full application of the required BMPs and lease stipulations described previously.

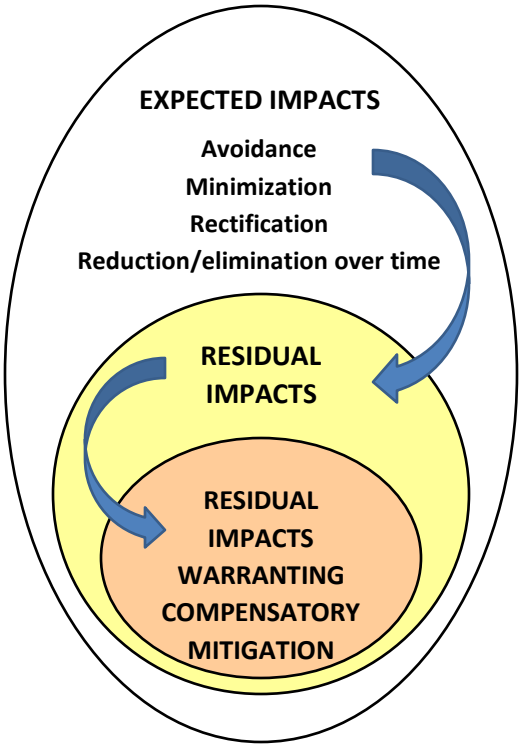

FIGURE 2-3 Impacts, Residual Impacts, and Residual Impacts Warranting Compensatory Mitigation

The Impact Assessment Summary Table (Appendix D) documents the basis for the identification of potential residual impacts under the RFDS. The BLM RMS project team found that development will have residual impacts on the following resources, regardless of the location and nature of the development within the Northeastern NPR-A even if all reasonable avoidance and minimization measures are implemented:

- Subsistence
- Socio-cultural Systems
- Environmental Justice

Impacts to the following resources were found to be potentially unavoidable, even if all reasonable avoidance and minimization measures are implemented. Whether or not the impacts to these resources would be considered residual impacts would depend on the location and nature of the development project.

- Air Quality
- Water Quality
- Public Health
- Birds
- Fish

- Terrestrial Mammals
- Threatened and Endangered Species: polar bear
- Threatened and Endangered Species: spectacled eider
- Cultural Resources
- Visual Resources
- Land Use and Ownership

Finally, impacts to the following resources from future development regardless of where it occurs in the region were identified as minor, negligible, or positive (BLM 2014), and are not further considered in the RMS:

- Climate and Meteorology/ Climate Change – Negligible impacts
- Economy – Positive impacts
- Geology and Mineral Resources – Minor impacts
- Marine Mammals – Negligible impacts
- Oil, Saltwater, and Hazardous Material Spills – Minor impacts, except very low-probability events
- Noise – Minor impacts
- Paleontological Resources – Negligible impacts
- Petroleum Resources – Purpose of development, royalties paid
- Recreation – Negligible impacts
- Sand and Gravel Resources – Minor impacts
- Soils and Permafrost/Physiography and Geomorphology – Minor impacts
- Threatened and Endangered Species: Steller's Eider – No impacts expected
- Transportation – Minor impacts
- Vegetation and Wetlands – U.S. Army Corps of Engineers 404 Wetlands Permit covers this resource

However, while compensatory mitigation for impacts to these resources is not being developed in the RMS, future project-specific impact assessments could identify significant impacts to these resources that may warrant compensatory mitigation.

2.4 RESIDUAL IMPACTS THAT WARRANT REGIONAL COMPENSATORY MITIGATION

Some potential residual impacts from oil and gas development (identified in Section 2.3 above) are likely to warrant compensatory mitigation. Whether an impact warrants compensatory mitigation is based on consideration of applicable mitigation standards, what is appropriate, and the potential for any of the following:

- Residual adverse effects that inhibit achieving compliance with laws, regulations, and/or policies.

- Residual adverse effects that inhibit achieving the applicable land use plan's resource goals, including applicable mitigation standards.

- Residual adverse effects to important, scarce, or sensitive resources that have been previously identified in a mitigation strategy as warranting compensatory mitigation.

- Residual adverse effects to important, scarce, or sensitive resources that are identified through a NEPA process as warranting compensatory mitigation.

If a residual impact meets one or more of the above criteria, then the impact likely warrants compensatory mitigation. To determine which resources are "important, scarce, or sensitive" (as referenced in the 3rd and 4th criteria above), conceptual models of the regional ecosystem and socioeconomic systems (see appendix E) are used to identify resources critical to healthy functioning of these systems, and resource conditions and trends are analyzed at all relevant scales to identify at-risk resources and processes. Analysis determines how the residual impacts of oil and gas development will affect the status and trend of the regional at-risk resources and the significance of the residual impacts in the region.

Based on consideration of the expected impacts from oil and gas development under the RFDS, the following residual impacts are expected to warrant compensatory mitigation through the RMS:

- Subsistence impacts
- Socio-cultural systems impacts
- Environmental justice impacts

Subsistence and socio-cultural resources were found to be subject to major impacts from the GMT1 development, as described in the GMT1 Final SEIS (FSEIS; BLM 2014), largely because the development would take place within a heavily used and historically critical subsistence area. The RFDS indicates that several additional oil and gas facilities and associated infrastructure would be constructed and operated in the future in nearly the same geographic area. Because of this anticipated future development, the direct, indirect, and cumulative impacts on subsistence and socio-cultural impacts would be expected to increase substantially, and thus would warrant compensatory mitigation. The major subsistence and socio-cultural impacts from the GMT1 development, as described in the GMT1 FSEIS, were found to affect a minority population (Alaska Natives) disproportionately, and were thus identified as causing major environmental justice impacts.

Based on preliminary consideration of the expected impacts from oil and gas development under the RFDS, the following impacts may also be residual and adverse, and may therefore be residual impacts that warrant compensatory mitigation for future projects within the region[1]:

- Air quality impacts
- Water quality impacts
- Public health impacts

[1] Any impacts to wetlands would be evaluated through the requirements of Section 404 of the Clean Water Act and administered by the U.S. Corps of Engineers.

- Impacts on birds (e.g., greater white-fronted goose)
- Impacts on fish (e.g., broad whitefish)
- Impacts on terrestrial mammals (e.g., caribou)
- Impacts on polar bears (a threatened and endangered species), except for compensatory mitigation required under the ESA Section 7
- Impacts on spectacled eiders (a threatened and endangered species), except for compensatory mitigation required under the ESA Section 7
- Cultural resource impacts
- Visual resource impacts
- Land use and ownership impacts

Many of these resources are important, scarce, and/or sensitive, but were not found to be subject to major impacts under the GMT1 FSEIS. However, projects under the RFDS could potentially have different and greater or lesser impacts, depending on the exact location of the project and associated infrastructure, and other aspects of the project that would be determined at the time a project-specific impact analysis was conducted. While compensatory mitigation for impacts to these resources is not being developed in the RMS, future project-specific impact assessments could identify significant impacts to these resources that may warrant compensatory mitigation.

2.5 RECOMMENDED COMPENSATORY MITIGATION METHODS

As Inupiat participants pointed out in several workshops and in written comments, subsistence, culture, and environmental justice cannot be separated for the purpose of valuation, and cultural "intactness" is priceless. Notwithstanding, it is important to have a way to assess whether the amount of compensatory mitigation is proportional to the degree of the residual impacts. This section explores two possible approaches: an action-based method and a per-acre fee method.

The action-based method utilizes selected stakeholder-identified actions as the mechanism for compensation to address the residual impacts identified. The per-acre fee method provides a basis for a compensatory mitigation fee. Both of these methods could allow mitigation actions to be bundled together or otherwise strategically placed on the landscape to be commensurate with the identified residual impacts. Whether the action-based method or the per-acre fee method, or a combination of the two, is used, the applicant is encouraged to identify potential compensatory mitigation as early as possible, including in the Application for Permit to Drill. These proposed compensatory mitigation actions will then be evaluated in the NEPA analysis. If necessary, further refinements or updates may result on the basis of the residual adverse impacts that warrant compensatory mitigation identified in the NEPA analysis and through applicant, BLM, and stakeholder input.

Action-Based Methods

According to the action-based method, specific mitigation actions that appear to be proportional to the level of impacts are selected for implementation from a suite of potential compensatory mitigation actions, such as those listed in Table 2-1, which was generated with the involvement of stakeholders. The recommended actions can be proposed either by the applicant as a part of its development proposal, or by the BLM, , local residents, other government entities, or other stakeholders during the NEPA process. Since the entire Northeastern NPR-A is a subsistence-use area, it is expected that, at a minimum, compensatory mitigation may be required for all actions with residual adverse impacts to subsistence, socio-cultural systems, and environmental justice. If residual impacts warranting mitigation are identified for other resources (for example, impacts to terrestrial mammals, fish, or birds), compensatory mitigation actions for those resources should also be proposed and costs identified.

Applicant-Proposed Compensatory Mitigation

All development projects require the submittal of an application, such as an Application for Permit to Drill (APD) or a Right-of-Way application. Based on the proposed development location, baseline resource data, and the application of BMPs, the applicant can make a preliminary assessment of the residual impacts that are likely to result from its proposed development, and, using the criteria found in Section 2.4, whether those impacts warrant compensatory mitigation.

If the applicant determines that such residual impacts warrant compensatory mitigation, the applicant may submit to the BLM proposed action(s) to address the impacts. Table 2-2 and the criteria described in Section 2.8 may be used by the applicant to identify the potential actions that are commensurate with the residual impact identified. The applicant should also explain how the proposed action or actions are commensurate with the identified residual impacts warranting mitigation, and describe the level of local resident input and coordination and stakeholder involvement carried out in determining the actions to propose. The applicant-proposed action(s) would then be considered as part of their proposal in the NEPA analysis in order to determine the adequacy of the compensatory mitigation to offset residual impacts to the anticipated affected resources. Through the NEPA process, the BLM would ensure additional stakeholder involvement through an iterative process of reviewing and assessing the adequacy of the actions to address the impacts identified, including the opportunity to suggest alternative actions that could better address the residual adverse impacts. The Final EIS will include the selected compensatory mitigation actions to be carried in conjunction with the Preferred Alternative.

The decision will include a determination of the required compensatory mitigation action(s). An implementation plan must be submitted by the permittee and approved by the BLM prior to a notice to proceed with construction

TABLE 2-1 Potential Compensatory Mitigation Actions for the RMS

ID	Primary Impact	Mitigation Action
1	SUB	Facilitate access to areas with important subsistence or cultural resource values, including areas that currently have oil and gas activity. Examples include: • Building (completing) a road to provide access from Nuiqsut to the Colville River • Dredging the Nigliq Channel • Building ramps on already constructed roads • Reclaiming roads,pipelines, and other disturbed areas in areas formerly used for subsistence that are currently avoided Potential locations include Colville River Delta/Special Area, Colville River Watershed, Fish Creek, Nuiqsut, or Nigliq Channel. Methods could include conservation easements or other tools.
2	SUB	Reimburse hunters for the additional costs of subsistence hunting that are caused by development (e.g., fuel for longer trips, increased equipment maintenance costs, etc.).
3	SUB	Develop and implement programs to share food among North Slope communities.
4	SUB	Develop and implement programs to safely store food (e.g., community freezers and/or ice cellars).
5	SUB	Manage/control sport hunting. Potential locations: Colville River Delta/Special Area, Colville River Watershed, Teshekpuk Lake caribou herd migration corridors, river crossings and insect relief areas, Teshekpuk Lake Special Area and vicinity.
6	SUB	Develop and implement programs to enhance production of local food sources. • Community greenhouses • Reindeer herding • Harvesting cooperatives • Food preparation and preservation courses • Start-up assistance/office space for local Native food-oriented Pampered Chef consultant
7	CULTURE	Construct cultural centers in impacted communities.
8	CULTURE	Fund cultural camps for youth, preferably through an endowment.
9	CULTURE	Support a whaling captain apprentice program.
10	CULTURE	Support projects that document, teach, and protect culture, history, and language, such as: • Updating the Nuiqsut Paisangich • Establish (ideally in new cultural center) a library with a focus on Inupiat culture that is open year-round • Establish a community-based photojournalism/media institute to train youth in digital photography equipment and techniques, in story production, and in print and on-line journal layout to produce and distribute Uiñiq magazine. This could be affiliated with or be a local chapter of the Alaska Media Institute.

TABLE 2-1 (Cont.)

ID	Primary Impact	Mitigation Action
11	ENV	Protect, restore, or reclaim areas with important environmental, subsistence, or cultural resource values. Potential project locations include: Fish Creek, Judy Creek, Tiŋmiaqsiġvik (Ublutuoch) River, Colville River Delta/Special Area, Colville River Watershed, and Teshekpuk Lake Special Area and vicinity. Protection mechanisms could include conservation easements and voluntary limits on use and occupancy of existing leases; restoration actins may also be appropriate in certain circumstances (see Appendix F of the *Technical Companion* for additional mechanisms).
12	ENV	Continue monitoring of annual survival of the Spectacled Eider on the North Slope.
13	ENV	Identify and protect high-value wetlands (for example, important waterfowl molting areas). Protection measures could include conservation easements and voluntary limits on use and occupancy of existing leases (see Appendix F of the *Technical Companion* for additional mechanisms).
14	ENV	Fund programs to protect against the introduction and proliferation of invasive species. Potential locations: Colville River Watershed, Nuiqsut.
15	ENV	Develop conservation or management plans for the NPR-A, for Special Areas and/or for areas with important environmental, subsistence, or cultural resource values. Potential locations: Colville River Delta/Special Area, Colville River Watershed, Teshekpuk Lake caribou herd migration corridors, river crossings and insect relief areas, Teshekpuk Lake Special Area and vicinity.
16	ENV	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on subsistence species.
17	ENV	Create/expand/enforce special management areas/buffers. Potential locations: Colville River Delta/Special Area, Colville River Watershed, Fish Creek, Teshekpuk Lake caribou herd migration corridors, river crossings and insect relief areas, Teshekpuk Lake Special Area and vicinity, Ikpikpuk River area.
18	ENV	Restore/maintain water flow volume, protect surface water quality. Potential locations: Colville River Delta/Special Area, Colville River Watershed, Fish Creek.
19	ENV	Fund projects to control erosion. • Build breakwaters or causeways Potential locations: Colville River Delta/Special Area.
20	ENV	Collect baseline data and provide ongoing monitoring of ecosystem health and function. • Create a community-based ecosystem monitoring program Potential locations: Colville River Watershed, Fish Creek, Teshekpuk Lake Special Area and vicinity.
21	ENV	Evaluate and predict effects of environmental change in breeding areas on Spectacled Eiders.

TABLE 2-1 (Cont.)

ID	Primary Impact	Mitigation Action
22	ENV	Improve education efforts to eliminate take and the use of lead shot across the range of the Spectacled Eiders.
23	ENV	Continue monitoring Spectacled Eider blood lead levels in areas where information is lacking, such as the North Slope, and monitor lead levels periodically throughout the range of the Eider.
24	HEALTH	Improve air quality monitoring – Work with the local public to develop a monitoring strategy which includes determining monitoring needs. Implement strategy recommendations that may include additional stations, upgrading stations to best available technology, monitoring for a broader suite of pollutants. Include public education and outreach components with monitoring effort.
25	HEALTH	Support health programs in impacted communities, including those designed to address the need for drug/alcohol programs.
26	HEALTH	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on human health. Potential locations: Nuiqsut and Anaktuvuk Pass.
27	COMM	Build recreation centers, teen centers, playgrounds, and/or picnic areas in and around impacted communities.
28	COMM	Provide parking in Deadhorse to facilitate North Slope residents' use of Dalton Highway for transportation.
29	COMM	Assist communities in communicating with levels of government to get issues of concern addressed, such as: • Hire permanent grant writers to submit proposals for impacts mitigation and other grants and to produce grant requests • Assist local entities with obtaining technical and legal expertise to advise them on the permitting process
30	COMM	Support the implementation/expansion of STEM (Science Technology Engineering Math) programs, such as the Alaska Native Science and Engineering Program in impacted communities.
31	COMM	Support the development and implementation of job training programs in North Slope communities.
32	COMM	Develop and implement programs that support local entrepreneurial and economic development in impacted communities.
33	COMM	Fund increased local oversight/monitoring of development activities (e.g., staff, training, funding to contract for technical and scientific expertise).
34	COMM	Pay for engineering/architectural plans to secure sources of construction funding for facilities and infrastructure improvements in impacted communities.

TABLE 2-1 (Cont.)

ID	Primary Impact	Mitigation Action
35	COMM	Fund the development of long-term community development plans for impacted communities.
36	COMM	Build new housing to meet growing demand in impacted communities.

TABLE 2-2 BLM Matrix for Ranking Candidate Regional Mitigation Actions/Projects

Ranking Criteria	Points Possible	Scoring Rubric
Importance	0 to 5	0 to 5 points based on degree of support from tribal governments; other tribal entities; local communities; Federal, State, and local governments; subject matter experts; and the public at large.
Effectiveness	0 to 5	5 points for actions/locations that fully[a] mitigate all of those residual impacts that warrant mitigation. 2-4 points for actions/locations that fully or partially[b] mitigate some of the residual impacts that warrant mitigation. 1 point for partially mitigating one of the residual impacts that warrant mitigation.
Durability	0 to 5	5 points for actions/locations that are a one-time investment[c] and have a high level of certainty that they will last longer than the impacts. 2-4 points for actions/locations that have moderate level of certainty that they will last longer than the impacts and/or require additional funding. 0-1 points for actions/locations that are at risk of failing to last longer than the impacts.
Risk	0 to 3	3 points for a high degree of certainty based on documented results of success in similar situations. 2 points for moderate degree of certainty based on documented results of success in similar situations. 1 point for moderate degree of certainty based on expert opinion. 0 points for high risk proposals.
Feasibility	0 to 3	1 or 0 points each for technical, administrative, and political feasibility.
Timeliness	0 to 3	3 points for projects that are expected to deliver full benefits immediately. 2 points for projects that are expected to deliver benefits that are not immediate, but within a reasonable amount of time after implementation. 1 point for projects that will deliver benefits with a significant delay after implementation.
TOTAL	0 - 24	

[a] Current baseline/trend is either unaffected or is improved.

[b] Adverse impact to baseline/trend is reduced, but not fully restored.

[c] Do not require continuous funding, including operations and maintenance funding, and do not require funding to renew after the project is decommissioned and the impacts cease.

BLM-Determined Compensatory Mitigation

The applicant could choose not to propose a compensatory mitigation action in conjunction with its application. In this situation, the BLM would initiate the NEPA process and preliminarily determine appropriate compensatory mitigation action(s), if any, should residual adverse impacts warranting mitigation be identified during the analysis of alternatives. BLM will consider the list of compensatory mitigation opportunities identified in Table 2-1 as well as the ranking criteria in Table 2-2, and propose compensatory mitigation actions that are commensurate with the identified residual impacts warranting mitigation. The proposed compensatory mitigation actions will be included in the Draft EIS.

Through the NEPA process, BLM will ensure additional stakeholder involvement through an iterative process of reviewing and assessing the adequacy of the actions to address the impacts identified. As part of the Draft EIS review, the actions that would best mitigate for the residual impacts warranting mitigation would be determined in close collaboration with the impacted stakeholders, who would also have the opportunity to suggest alternative actions that may better address the residual adverse impacts. The Final EIS will include the selected compensatory mitigation actions to be carried out in conjunction with the Preferred Alternative.

The decision will include a determination of the required compensatory mitigation action(s). An implementation plan must be submitted by the permittee and approved by the BLM prior to a notice to proceed with construction.

Both of the action-based methods use the cost of the actions to be implemented to determine the compensatory mitigation amount. The cost for each action within the Northeastern NPR-A will correspond to the impacts warranting compensation for that action.

Per-Acre Fee Method

Instead of using the action-based method, applicants may propose a fee as compensatory mitigation to offset residual adverse impacts to affected resources. A compensatory mitigation fee is determined on the basis of a proposed per-acre amount of impact, whether those impacts are from the loss of a traditional harvest area for subsistence use or loss of habitat for an affected resource. The proposed per acre amount of $100–$200 is based on stakeholder recommendations and is comparable to other mitigation amounts required by the North Slope Borough for impacts sufficiently similar to the impacts to subsistence use identified in the RMS. The impact area is determined by the footprint of the infrastructure, plus a 2.5-mile zone around the infrastructure to account for indirect impacts related to the development. This means that along a pipeline or road, the acreage would be calculated by adding 2.5 miles on each side, resulting in a 5-mile wide corridor. The 2.5 mile zone is a conservative estimate of the subsistence use avoidance area made by BLM subject matter experts. While the actual impact zone will vary depending on the resource being mitigated, the 2.5 mile buffer is considered to be a reasonable estimate for determining a mitigation fee.

Using the proposed GMT2 development as an example, the total acreage of the 2.5-mile zone is approximately 34,000. The total acreage multiplied by a $100 per-acre fee equals a compensatory mitigation amount of $3,400,000, or multiplied by a $200 per-acre fee equals a mitigation amount of $6,800,000. This fee would then be utilized to implement appropriate mitigation actions, such as those described in Table 2-1. Which mitigation actions would be implemented would be determined based on the resources found to have residual impacts warranting compensatory mitigation, and through stakeholder involvement.

Other Considerations

Regardless of the method used, any mitigation actions must adequately compensate for the identified residual impacts that warrant compensatory mitigation. The RMS provides a framework for determining compensatory mitigation opportunities and is not a decision document. The RMS is meant to convey the process for determining compensatory mitigation requirements. At the conclusion of any NEPA evaluation for future projects in the Northeastern NPR-A, the BLM-authorized officer will identify the appropriate amount of compensatory mitigation as part of the BLM's project authorization decision.

2.6 MANAGEMENT OF COMPENSATORY MITIGATION FUNDS

Compensatory mitigation funds do not supplement the BLM's operating budget; these funds must be used only for compensatory mitigation actions under the RMS and managed and accounted for separately. Compensatory mitigation funds provided by the developer will be used to offset residual impacts through mitigation actions or specific mitigation projects. The BLM will select management options for mitigation funds that ensure that the funds are managed and expended for the identified purposes and according to applicable law, regulation, and policy. This includes compliance with the BLM's interim regional mitigation policy, draft Manual Section 1794, issued June 13, 2013, which includes guidance for management of funds collected as part of the restoration, acquisition, or preservation portion of the total mitigation obligation by an independent third party (BLM 2013b). BLM Alaska will comply with the most recent departmental mitigation policy by implementing a transparent and effective accounting system to track funds contributed and funds spent, and by establishing a funding mechanism to cover administration, durability, monitoring, and reporting for the investments for the duration of the impacts from development in the NPR-A.

BLM would prefer that an independent third party manage compensatory mitigation funds. An appropriate third party fund manager must be neutral, well-established and provide transparent financial management services, including low management fees and tax-free growth of funds that could result in more financial resources to fund on-the-ground mitigation actions. While it is permissible for the BLM to manage mitigation funds, the agency is discouraged from doing so due to increased workloads on BLM staff and overhead rates for fund management that BLM is required to charge. Third-party managers can provide transparent financial management with low fees, contract administration, and tax-free growth of funds that could result in more

financial resources to fund on-the-ground mitigation actions. Either way, the full cost of managing the funds is included when determining the cost of compensatory mitigation.

The decision document for each project will specify what types of compensatory mitigation actions will be funded and how they will contribute to meeting RMS mitigation goals. A management agreement could be set up between BLM, the entity contributing the mitigation funds, and the BLM-retained third party fund manager (if applicable). The agreement would include the amount of funding BLM is accepting, the outcomes that will be achieved with the funds, discussion of how durability of the mitigation will be ensured, timelines for expending the funds, discussion of how additionality will be ensured, accounting for administrative and contingency fees, and details on reporting requirements.

2.7 POTENTIAL COMPENSATORY MITIGATION ACTIONS

This RMS identifies the types of mitigation actions that can be taken to compensate for residual impacts caused by oil and gas development in the Northeastern NPR-A. The list was derived from stakeholder nominations. The nominations that had been received up to the September 2015 Workshop were presented, discussed, and in some cases combined, edited, or removed from the list of potential compensatory mitigation actions. Actions were removed only if they seemed better suited as actions to respond to other elements of the mitigation hierarchy, such as avoidance or minimization, failed to meet the screening criteria, or failed to support the goals of the RMS.

The public nomination process produced a list of proposed actions that vary in their level of detail. While some of the actions propose specific projects in specific locations (such as the Colville River access road or the cultural center in Nuiqsut), others (such as the proposal to restore water quantity and quality) do not. Many of the proposed actions, particularly those related to protecting natural resources and ecological systems, do not specify a mechanism (or "tool") for how it would be achieved. This is because there are several possible mechanisms that afford different levels of projection. These mechanisms are described in Appendix F. Mechanisms for protecting areas can be 'layered' to achieve the desired outcomes rapidly and to increase the durability of the outcomes over time. The identification and selection of specific actions, mechanism, and locations should be driven by the impacts of a particular project. Therefore, the identification of specific actions, mechanisms, and sites will occur on a project-by-project basis, such as for the GMT1 project.

The identification number that appears in the "ID" column in Table 2-1 is for reference only — it does not imply rank. The proposed mitigation actions have been grouped by the type of impact they would address. These include impacts to the following resources (noted in the table by the following abbreviations):

SUB = subsistence and food security

CULTURE = Iñupiaq culture and lifestyle

HEALTH = human health and safety

ENV = natural resources and systems

COMM = community (including education, economy, and recreational opportunities)

It is recognized that many of these mitigation actions could address impacts to more than one resource. Additional compensatory mitigation actions may be added to Table 2-1 in the future, based on:

- Government-to-government consultations
- Additional nominations from stakeholders
- BLM subject matter expert recommendations
- Other Federal, State, and local government recommendations

The following mitigation actions were nominated by stakeholders, but can be accomplished by including them as conditions of a lease or permit. BLM will consider these recommendations for inclusion in decision documents for future development projects.

- Limit all ground work (research, stick-picking, etc.) to only one summer every three years.

- Limit ground-based disturbances to subsistence activities to only one summer every three years.

- Restrict development activities during sensitive life stages of subsistence wildlife.

- Minimize air and ground traffic during migration and calving.

- Restrict air traffic over important waterfowl and shorebird areas: nesting, brood rearing, and staging, including coastal areas from Nuiqsut to Barrow 3 miles in from the coast.

- Increase monitoring and enforcement of environmental regulation compliance on lands that BLM is leasing.

- Hire local monitors to monitor environmental compliance.

The relationships among the residual impacts, the compensatory mitigation goals, and the proposed actions are summarized in a table presented in Appendix H.

2.8 SCREENING AND RANKING CRITERIA FOR COMPENSATORY MITIGATION ACTIONS

The RMS will include two types of criteria that will be used by BLM to evaluate and select potential compensatory mitigation actions, as shown in Figure 2-4. These *screening and ranking criteria* are described in this section.

Screening Criteria

Screening criteria ensure that the actions being considered are legal and meet three basic elements of BLM compensatory mitigation policy: legality, connection, and additionality. Every potential mitigation action must meet all three criteria to be considered for implementation.

Screening Criteria

Legality: Does the action conform to applicable law, regulation, and policy?

Connection: Does the action reasonably address and is it proportional to the unavoidable impact(s) warranting compensatory mitigation?

Additionality: Is the action demonstrably new or will it occur in the absence of compensatory mitigation ; ?

The screening criteria listed above were applied to the actions listed in Table 2-1. All the listed actions met the screening criteria.

Ranking Criteria

Table 2-1 lists 36 actions that could potentially compensate for impacts of development in the Northeastern region of the NPR-A. Some of these actions could be implemented in multiple locations. The ranking criteria presented below will be used to sort or "rank" the list of mitigation actions according to their potential to most effectively and efficiently address impacts. The points for each of the ranking criteria for each potential mitigation action/project will be awarded according to the scoring rubric presented in Table 2-2. The points will then be summed for each potential compensatory mitigation action/project, and the list re-ordered from most to least points. This was done for the mitigation actions that were nominated as a part of the RMS (see Appendix G). The ranked list is, however, just a recommendation for consideration by those making the decision about mitigation. Other factors, such as opportunities to leverage funds, may

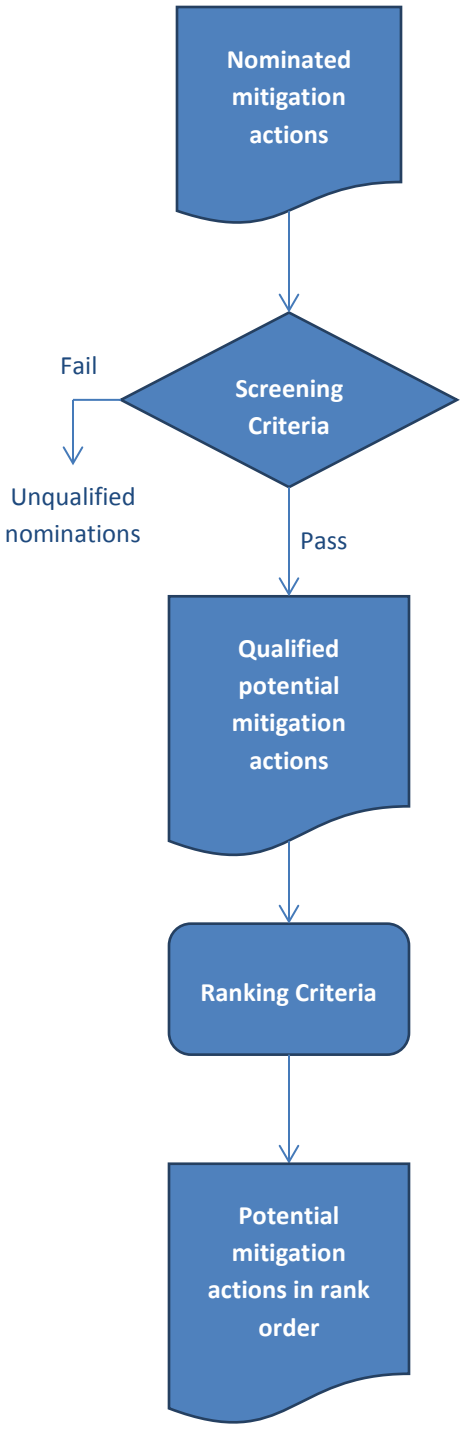

FIGURE 2-4 Screening and Ranking Process

influence the decision about which mitigation action(s) would be most effective for a particularly development project.

Table 2 3 lists the proposed mitigation actions in rank order.

Ranking Criteria

Importance:
How strong is stakeholder support for the action? How strong is the action supported by the people most affected by the impacts, particularly those disproportionately affected?

Effectiveness:
How effective will the action be in achieving the RMS goals?

Durability:
How likely is it that the outcomes of the action will last at least as long as the impacts of development?

Risk:
How certain is it that the desired outcome will be achieved and sustained for the duration of the impacts, particularly in light of external forces such as climate change?

Feasibility:
How practicable is the action in terms of technology, logistics, cost, and time?

Timeliness (e.g., time lag, temporal loss):
How much time is expected to elapse between the time the impacts first occur and the time the full benefits of the action are realized?

This list is meant to provide insight for decision-makers into which potential mitigation actions have the greatest potential to cost-effectively compensate for the residual impacts of oil and gas development that stakeholders feel are of greatest concern. The list is a recommendation only. Decision-makers may select any action from the list, or other actions identified subsequently, based on more detailed analysis, feedback obtained through government-to-government interactions, and/or additional considerations, such as cost-sharing opportunities.

TABLE 2-3 Proposed Mitigation Actions in Rank Order

Points	Action Number	Short Description
20	1	Facilitate access to areas with important subsistence or cultural resource values.
20	2	Reimburse hunters for the additional costs.
20	10	Support projects that document, teach, and protect culture, history, and language.
20	11	Protect, restore or reclaim areas with important environmental, subsistence, or cultural resource values through a no-surface occupancy agreement, conservation easement or other tools
20	13	Identify and protect high-value wetlands.
19	6	Develop and implement programs to enhance production of local food sources.
19	17	Create/expand/enforce special management areas/buffers.
18	5	Manage/control sport hunting.
18	7	Construct cultural centers in impacted communities.
18	8	Fund cultural camps for youth, preferably through an endowment.
18	9	Support a whaling captain apprentice program.
18	18	Restore/maintain water flow volume; protect surface water quality.
16	3	Develop and implement programs to share food among North Slope communities.
16	19	Fund projects to control erosion.
16	24	Improve air quality monitoring.
15	25	Support health programs in impacted communities
15	27	Build recreation centers, teen centers, playgrounds, and/or picnic areas in and around impacted communities.
15	28	Provide parking in Deadhorse.
14	29	Assist communities in communicating with levels of government to get issues of concern addressed and/or to obtain grants to help the communities deal with impacts.
13	12	Continue monitoring of annual survival of the Spectacled Eider on the North Slope.
13	14	Fund programs to protect against the introduction and proliferation of invasive species.

TABLE 2-3 (Cont.)

Points	Action Number	Short Description
13	16	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on subsistence species.
13	20	Collect baseline data and provide ongoing monitoring of ecosystem health and function.
13	22	Improve education efforts to eliminate take and the use of lead shot across the range of the Spectacled Eiders.
13	26	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on human health.
13	30	Support the implementation/expansion of STEM programs.
13	31	Support the development and implementation of job training programs in North Slope communities.
13	32	Develop and implement programs that support local entrepreneurial and economic development in impacted communities.
13	33	Fund increased local oversight/monitoring of development activities.
13	34	Pay for engineering/architectural plans to secure sources of construction funding for facilities and infrastructure improvements in impacted communities.
12	15	Develop conservation or management plans for the NPR-A, for Special Areas, and/or for areas with important environmental, subsistence, or cultural resource values.
12	21	Evaluate and predict effects of environmental change in breeding areas on Spectacled Eiders.
12	23	Continue monitoring Spectacled Eider blood lead levels in areas where information is lacking.
12	35	Fund the development of long-term community development plans for impacted communities.
11	36	Build new housing to meet growing demand in impacted communities.
10	4	Develop and implement programs to safely store food (e.g., community freezers and/or ice cellars).

2.9 ASSESSING EFFECTIVENESS AND ADAPTING MITIGATION ACTIONS

BLM draft mitigation policy (BLM 2013b) directs that mitigation be monitored to verify desired outcomes are being achieved, and where they are not, that it be adapted to improve performance. In order to meet this requirement while minimizing cost, the monitoring recommended for assessing the overall effectiveness of compensatory mitigation in the Northeastern NPR-A will rely to the greatest extent possible on data already being collected by the BLM or other entities.

The potential monitoring scales identified in BLM policy are: fine, mid, and broad. Fine-scale monitoring applies to compensatory mitigation sites, while broad-scale monitoring is for a large geographic area, such as an ecosystem. Mid-scale monitoring is for areas in between. BLM guidance identifies several important pieces of information for a monitoring system (BLM 2016):

- The baseline conditions of potentially affected resources.
- The reasonably foreseeable impacts and how they are expected to affect baseline conditions at different spatial scales.
- How management actions, such as compensatory mitigation actions, are expected to affect baseline conditions.
- The external change agents that could potentially affect the desired outcome(s).

Because the specific mitigation actions that will be implemented are not identified until a specific development project is proposed, and because the residual impacts that may occur (depending on the nature and location of the development) are identified in the associated NEPA analysis, the RMS focuses on broad-scale effectiveness monitoring. Subsequent mid- and fine-scale monitoring plans will be developed as specific development projects are analyzed, and will be nested within the broad-scale effectiveness monitoring framework.

Regional-Level Effectiveness Monitoring for the Northeastern NPR-A

The mitigation standards and resource goals described in Section 2.7 articulate high-level desired outcomes that address the residual adverse impacts that are expected to occur, or might occur, depending on the nature and location of development. Thus, they are used as the foundation for a regional-level effectiveness monitoring framework described below. For each resource goal/mitigation standard, the framework, summarized in Table 2-4 presents potential measures, potential indicators of success, and potential external factors that could alter the outcome.

At this writing, the potential effectiveness measures presented in Table 2-4 have not been reviewed with stakeholders. Between this draft and the final RMS, the BLM will work with stakeholders to identify a suite of measures that could provide insight into the effectiveness of mitigation actions (regardless of what they entail) that are aimed at offsetting the impacts to subsistence, socio-cultural resources, and environmental justice — the residual impacts that will occur regardless of the location and nature of specific development. The BLM, working with stakeholders, will also identify the appropriate monitoring scale(s).

TABLE 2-4 Potential Measures, Indicators of Success, and External Factors

Goal/Mitigation Standard	Potential Effectiveness Measures	Potential Indicators of Success (Referencing Baseline)	Potential External Factors that Would Require Control
Sustain and enhance access to and use of traditional subsistence use areas	Annual harvest Hunting cost per unit Hunting time per unit	Harvest until needs are met, then steady Costs down Time down	Market forces that effect the cost of fuel, vehicles, equipment, etc. Other conditions or activities that affect wildlife populations and movement (e.g., disease, climate change, other development)
Sustain and enhance opportunities and rights for Native peoples to live, practice, and pass on Iñupiaq culture and lifestyle.	Population of village Participation rate in key cultural events	Population up Participation rates up	Other factors that result in out-migration (e.g., economics). Other factors that discourage participation.
Sustain and enhance the functionality of the ecological system, including land, water, and landscapes that allow for sustainable populations of fish and wildlife and their natural movement and distribution.	Populations of key subsistence species Acres by ecological condition class	Populations in natural equilibrium Overall ecological condition improving	Other conditions or activities that affect wildlife populations and movement (e.g., disease, climate change, other development). Non-oil development that degrades ecological condition.
Sustain and enhance the health and safety of the residents.	Longevity Incidence of selected diseases or conditions per capita (e.g., asthma, addiction)	Longevity increasing Incidence decreasing	External factors that affect health and/or safety (e.g., drug-resistant diseases, health care costs, decreasing air quality from non-oil development, etc.)
Sustain and enhance opportunities for economic and community development, such as job training and local contracting.	Unemployment rate Graduation rates Ratio of per capita income and cost of living	Unemployment rate decreasing Ratio increasing Graduation rate increasing	External economic factors: market dynamics, tax policy, cost of goods and services. Corporate policy regarding hiring locals. External social factors (e.g., quality of schools).

The BLM mitigation policy recognizes that monitoring can require a significant commitment of resources, and suggests the "rule of reason" be applied when identifying the type, extent, and duration of effectiveness monitoring for mitigation measures. The policy further directs that effectiveness monitoring should be incorporated into existing monitoring programs, where appropriate. Thus, the goal in selecting effectiveness monitoring measures is to identify a small number for which current and historical data are available or could be collected efficiently, and for which external factors can be reasonably controlled. These measures could then serve as indicators of overall conditions in the Northeastern NPR-A, much as vital signs do for human health. These measures could be complied periodically and serve as a "report card" on how effective mitigation actions are in achieving the desired outcomes across the landscape and over time.

Adaptive Management

Adaptive management is a systematic and cyclical process for applying the lessons learned from ongoing experiences to increase the effectiveness of achieving a desired outcome. It requires:

- Clear and measurable articulation of the interim and ultimate desired outcome(s) and when they are expected to be realized.
- The identification and documentation of the assumptions that underlie management actions that are designed to achieve the desired outcome(s).
- A monitoring system designed to track progress toward the achievement of the desired outcomes and related efficiency measures (such as cost).
- Regular evaluation of performance by comparing actual results with expected results.
- Modification of underlying assumptions and recalibration of projections, if necessary.
- Identification and analysis of modifications that might be made to improve performance.
- Implementation of modifications.

Adaptive management, as it applies to compensatory mitigation, should be applied to mitigation actions. Since mitigation actions are identified in project-specific NEPA analysis, it follows that the development of an adaptive management strategy must occur after project-specific NEPA analysis. Therefore, it is recommended that an adaptive management strategy that includes the first four elements listed above be developed for each specific mitigation action selected for implementation.

3 IMPLEMENTATION

The BLM will use the RMS to guide the process of identifying, implementing, and monitoring mitigation actions to compensate for development impacts in the Northeastern NPR-A. While this strategy is not a BLM decision, it will inform future BLM decisions on specific oil and gas development projects on public land in the region. The RMS is designed to complement the other types of mitigation that make up the mitigation hierarchy, whether they are executed by BLM or by other agencies, and to fill the niche of an overarching, forward-looking strategy that will facilitate more efficient and effective decisions about what should be done to compensate for the residual adverse impacts of oil and gas development in the Northeastern NPR-A.

The RMS will support the NEPA and permit decision processes associated with processing APDs or other similar development authorization requests. Receipt of a complete APD by BLM triggers a NEPA process to assess and document the impacts of the proposed action. The impact assessment includes, but is not limited to:

- Identification of the affected resources for several project alternatives. Often, alternatives are formulated by altering the location and/or size of the footprint of the project, both of which address the first level of the mitigation hierarchy[3] — to avoid adverse impacts, if possible.

- An assessment of how resources would be affected under each alternative — specifically, how the baseline conditions and trends would be altered by the alternative over its lifetime. The projected baseline for each impacted resource incorporates the effects of external forces, such as climate change.

- An assessment of cumulative impacts, based on the impacts of existing development and on a reasonably foreseeable future development.

The RMS includes the following information that will help in the NEPA process:

- Baseline conditions and trends of resources in the region.[4]

- A reasonably foreseeable development scenario (RFDS) that can contribute to the assessment of cumulative impacts.

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3 BLM will implement the mitigation hierarchy process to address impacts to resources. First, BLM will seek to avoid impacts (e.g., by altering project design, location, or timing, or declining to authorize the project). Then, BLM will seek to minimize, rectify, and reduce or eliminate impacts over time (e.g., through project modifications, permit conditions, interim and final reclamation, etc.). Generally, only after these mitigation steps are taken, may BLM seek to compensate for some or all of the remaining impacts (i.e., unavoidable adverse impacts). Some impacts may be considered acceptable and would not require mitigation.

4 See Appendixes A and B for a summary of conditions and trends for ecological, cultural, and socioeconomic resources.

- Residual impacts that *will* occur with development in the region.
- Residual impacts that *could* occur with development.
- Criteria for identifying impacts that warrant compensatory mitigation.
- A stakeholder-nominated list of potential mitigation actions (and suggested locations) that could potentially compensate for the impacts specific to the proposed development.
- Screening and ranking criteria to help prioritize the mitigation actions and locations that would be most effective in addressing impacts.

The RMS will support the BLM's permit decision process by providing:

- A method for determining a compensatory mitigation amount.
- A process for selecting compensatory mitigation actions for implementation.
- Recommendations for mitigation fund management.

BLM will use the broad-scale effectiveness monitoring strategy as a starting point for developing mid- and fine-scale monitoring plans for permitted projects, to evaluate the success of any compensatory mitigation that was required and in adapting as needed to optimize success.

4 REFERENCES

BLM (Bureau of Land Management) 2004. *Alpine Satellite Development Plan, Final Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Sept. Available at: http://www.blm.gov/eis/AK/alpine/dspfeisdoc.html.

BLM 2005. *Northeast National Petroleum Reserve – Alaska Final Amended Integrated Activity Plan/Environmental Impact Statement*. Jan. Available at: http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/ne_npra_feis.html.

BLM 2012. *National Petroleum Reserve – Alaska Final Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Nov. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2013a. *National Petroleum Reserve – Alaska Integrated Activity Plan Record of Decision*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Feb. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2013b. *Interim Policy, Draft – "Regional Mitigation" Manual Section – 1794*. Instruction Memorandum No. 2013-142. U.S. Department of the Interior, Bureau of Land Management, Washington, DC.

BLM 2014. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Oct. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

BLM 2015. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project, Record of Decision*. U.S. Department of the Interior, Bureau of Land Management. Feb. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

BLM 2016. *Monitoring for Adaptive Management*. Available at: http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/Monitoring_for_Adaptive_Management.html.

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5 GLOSSARY

***Adaptive management*:** a system of management practices based on clearly identified outcomes and monitoring to determine whether management actions are meeting desired outcomes; and, if not, facilitating management changes that will best ensure that outcomes are met or re-evaluated. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain.

***Additionality*:** action improves the baseline conditions of the impacted resource and is demonstrably new and would not have occurred without the compensatory mitigation measure (i.e. they go beyond existing commitments by agencies and/or developers).

***Avoidance*:** avoiding the impact altogether by not taking a certain action or parts of an action (40 CFR 1508.20(a)).

***Baseline*:** the pre-existing condition of a resource, at all relevant scales, which can be quantified by an appropriate attribute(s). During environmental reviews, the baseline is considered the affected environment that exists absent the project's implementation, and is used to compare predictions of the effects of the proposed action or a reasonable range of alternatives.

***Best management practices (BMPs)*:** state-of-the-art, efficient, effective, and practicable mitigation measures for avoiding, minimizing, rectifying, and reducing or eliminating impacts over time. BMPs for oil and gas development in Alaska are identified in BLM's Western Oil and Gas Plan and Restoration Design Energy Project.

***Change agents*:** an environmental phenomena or human activity that can alter or influence the future condition and/or trend of a resource. Some change agents (e.g., roads) are the result of direct human actions or influence; others (e.g., climate change, wildland fire, and invasive species) may involve natural phenomena or be partially or indirectly related to human activities.

Coarse filter: elements such as vegetation communities, ecosystems, or land classes for planning and management across landscape- and regional-level management units.

***Compensation*:** compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20(e)).

***Compensatory mitigation*:** actions taken to compensate for (or offset) some of the residual impacts of an authorized land-use; it may include monetary payments made towards accomplishing the offsetting actions or projects.

***Compensatory mitigation obligation*:** the compensatory mitigation measures required by the BLM to mitigate for residual effects to resources from a land use activity.

***Compensatory mitigation measure*:** an action that results in the restoration, establishment, enhancement, and/or preservation of resources in order to offset a residual effect.

***Compensatory mitigation site*:** the areas where compensatory mitigation measures are located.

Conservation elements: resources with regional conservation importance, including species, species assemblages, ecological systems, habitats, physical resources (e.g., air, soils, and hydrology), cultural resources, and visual resources.

Cumulative Effects: the impact on the environment that results from the incremental impact of the action when added to other past , present, and reasonably foreseeable future actions, regardless of which agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)

Design features: required measures or procedures incorporated into the proposed action or alternatives that could avoid, minimize, mitigate, or otherwise reduce adverse impacts of a project proposal. Design features for oil and gas development in Alaska are identified in BLM's Western Oil and Gas Plan and Restoration Design Energy Project.

***Durability*:** maintaining the effectiveness of a mitigation measure and/or a compensatory mitigation site for the duration of the impacts from a land use activity, including resource, administrative/legal, and financial considerations.

***Duration of the impact*:** the temporal extent of resource impacts resulting from permitted actions. The duration of some impacts may be indefinite or perpetual.

***Effective*:** produces the desired outcome.

***Effects*:** the adverse direct, indirect, and cumulative impacts from a land use activity; the words "effects" and "impacts" are synonymous as used in this document.

***Enhancement*:** the manipulation of resources to heighten, intensify, or improve a specific resource.

Environmental Justice: 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.

Fine filter: meant to complement the coarse filter by targeting species with requirements that will not be met through the broad brush of dominant vegetation communities — rare, threatened, or endangered species; wildlife species of management interest; or those species that consistently use ecotones or multiple habitats on a diurnal or seasonal basis.

Goal (regional goal or land use plan goal): a broad statement of a desired outcome. Goals are usually not quantifiable and may not have established time frames for achievement.

***Impacts*:** the adverse direct, indirect, and cumulative effects from a land use activity; the words "effects" and "impacts" are synonymous as used in this document.

***Landscape*:** a geographic area encompassing an interacting mosaic of ecosystems and human systems that is characterized by a set of common management concerns. The landscape is not defined by the size of the area, but rather by the interacting elements that are relevant and meaningful in a management context.

***Minimization*:** minimizing impacts by limiting the degree or magnitude of the action and its implementation (40 CFR 1508.20(b)).

***Mitigation*:** includes avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

***Mitigation desired outcome*:** a clearly defined and measurable result of a compensatory mitigation action.

***Mitigation fund (i.e., an in-lieu fee fund)*:** an arrangement facilitated by a sponsor whereby resources are restored, established, enhanced, and/or preserved, by pooling and spending funds from a single or multiple authorized land users, for the purpose of compensating for residual effects to resources from land use activities. In general, a mitigation fund accepts funds for compensatory mitigation from authorized land users whose obligation to provide compensatory mitigation is then transferred to the mitigation fund sponsor.

***Mitigation hierarchy*:** see *Mitigation*, the process and order of preference for the application of mitigation, i.e., avoidance, minimization, remediation, reduction over time, and/or compensation, in that order.

***Mitigation strategy*:** a document that identifies, evaluates, and communicates potential mitigation needs and mitigation measures in a geographic area, at relevant scales, in advance of anticipated land use activities.

***NEPA process/analysis*:** analysis prepared pursuant to the National Environmental Policy Act, such as a planning- or project-level Environmental Assessment (EA) or Environmental Impact Statement (EIS).

***No net loss*:** when mitigation results in no negative change to baseline conditions (e.g., fully offset or balanced).

***Objective (regional objective or land use plan objective)*:** a description of a desired outcome for a resource in a land use plan. Objectives can be quantified and measured and, where possible, have established time frames for achievement.

***Onsite mitigation*:** mitigation implemented in the project area.

Operations and maintenance: a budgeting term including costs of operation and maintenance of, for example, a mitigation feature.

Preservation**:** the removal of a threat to, or preventing the decline of, resources. Preservation may include the application of new protective designations on previously unprotected land or the relinquishment or restraint of a lawful use that adversely impacts resources.

Proponent-responsible compensatory mitigation**:** resources that are restored, established, enhanced, and/or preserved by an authorized land user (or an authorized agent or contractor), for the purpose of compensating for residual effects to resources from land use activities.

Resources (and their values, services, and/or functions)**:** *resources* are natural, social, or cultural objects or qualities; *resource values* are the importance, worth, or usefulness of resources; *resource services* are the benefits people derive from resources; and *resource functions* are the physical, chemical, and/or biological processes that involve resources.

Restoration**:** the manipulation of degraded resources in order to return the resources to an un-degraded condition.

Setback: a distance measured from a named ground feature, such as a river or lake, in which certain activities or structures would not be allowed. All setback distances are to be measured at the time of the application for a permit for a development. In addition, facility development along the coast would be required to be designated to maintain the prescribed setback distance for the anticipated life of the facility.

Socio-Cultural Impacts: Effects relating to or including a combination of social and cultural impacts. As described in NEPA, "social impacts" are the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society. The term “cultural impacts” involves changes to the norms, values, and beliefs that guide traditions and customs.

Subsistence: A way of life that involves the harvest, preparation, distribution, and consumption of wild resources for food and other cultural purposes

Residual impacts**:** any adverse reasonably foreseeable effects that remain after the application of the first four steps in the mitigation hierarchy; also referred to as residual impacts.

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APPENDIX A:

ECOLOGICAL RESOURCES, CONDITIONS, AND TRENDS

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APPENDIX A:

ECOLOGICAL RESOURCES, CONDITIONS, AND TRENDS

The NPR-A is located on the North Slope of Alaska. The total area of the NPR-A is 36,300 mi^2 (94,000 km^2). The Northeastern region of the NPR-A consists of two ecoregions as defined by Omernik (1987): the Arctic Coastal Plain and the Arctic Foothills (Figure A-1). The Arctic Coastal Plain represents about 60% of the northeastern region, whereas the Arctic Foothills represents about 40% of the northeastern region. A summary of these ecoregions, as described in the North Slope Rapid Ecoregional Assessment (REA; Trammell et al. 2015), is provided in Table A-1.

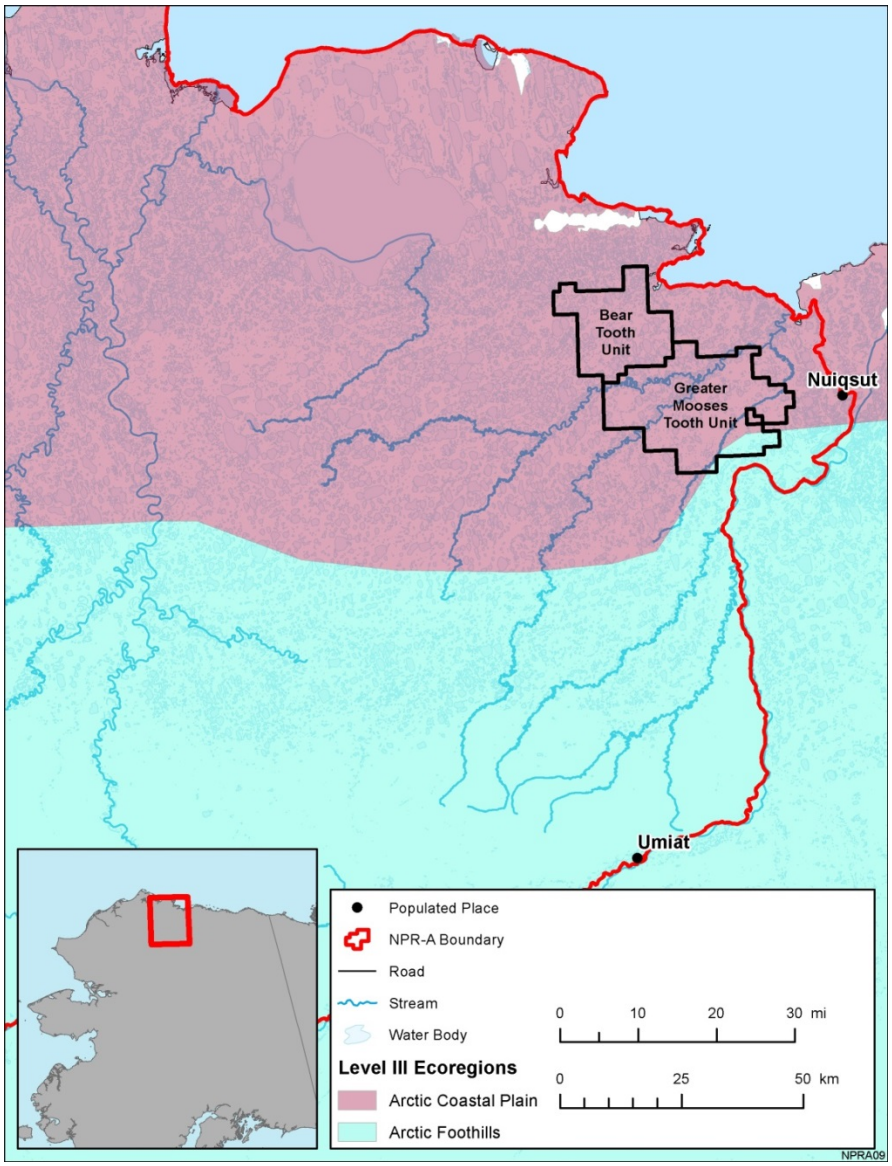


FIGURE A-1 Ecoregions of the Northeastern NPR-A

TABLE A-1 Summary of Level III Ecoregions in the NPR-A[a]

Ecoregion Name	Description	Approximate Percentage in the NPR-A (%)	Approximate Percentage in the Northeastern NPR-A (%)
Arctic Coastal Plain	A low, gradually rising plain characterized by poor drainage, wetlands, and many lakes that cover up to 50% of the surface. The region has Arctic climate conditions and is underlain by thick, continuous permafrost.	41.3	60.5
Arctic Foothills	A transition between the flat, low-lying Arctic Coastal Plain to the north and the steep mountainous Brooks Range to the south. The region consists of rounded hills and plateaus. Drainage is better and more defined than the Arctic Coastal Plain, with less saturated soils and fewer lakes. Thick permafrost underlies the region.	49.3	39.5
Brooks Range	Gently rolling hills and broad exposed ridges that extend along the northern flank of the Brooks Range. Narrow valleys and glacial moraines and outwashes are interspersed among long, straight ridges and buttes composed of tightly folded sedimentary rock. A dry, polar climate dominates the region, although it is slightly warmer and wetter than the Coastal Plain. Permafrost is thick and continuous.	9.4	0[b]

[a] Distribution data source: Omernik (1987). Description source: North Slope REA (Trammell et al 2015).

[b] The Brooks Range Ecoregion does not occur in the Northeastern NPR-A.

Previous NEPA evaluations have described the presence of ecological resources in the Northeastern NPR-A (e.g., BLM 2008, 2012, 2014). The presence and distribution of ecological resources in the NPR-A are largely related to the physical environment, such as climate, hydrology, and soils. As discussed in the IAP EIS for the Northeastern Planning Area of the NPR-A (BLM 2008), water resources in the region consist mainly of rivers, shallow discontinuous streams, lakes, and ponds (Figure A-2). Wetlands comprise more than 95% of the northeastern region and range from seasonally saturated to permanently flooded wetlands. Patterned oriented thaw lakes occur throughout much of the project area and Arctic Coastal Plain (BLM 2008, 2012). Wetland functions identified in the Alpine Satellite Development Plan Area include fish and wildlife habitat, production and export of organic matter, nutrient removal, sediment/toxicant retention, flood moderation, and sediment/shoreline stabilization (BLM 2008, 2012).

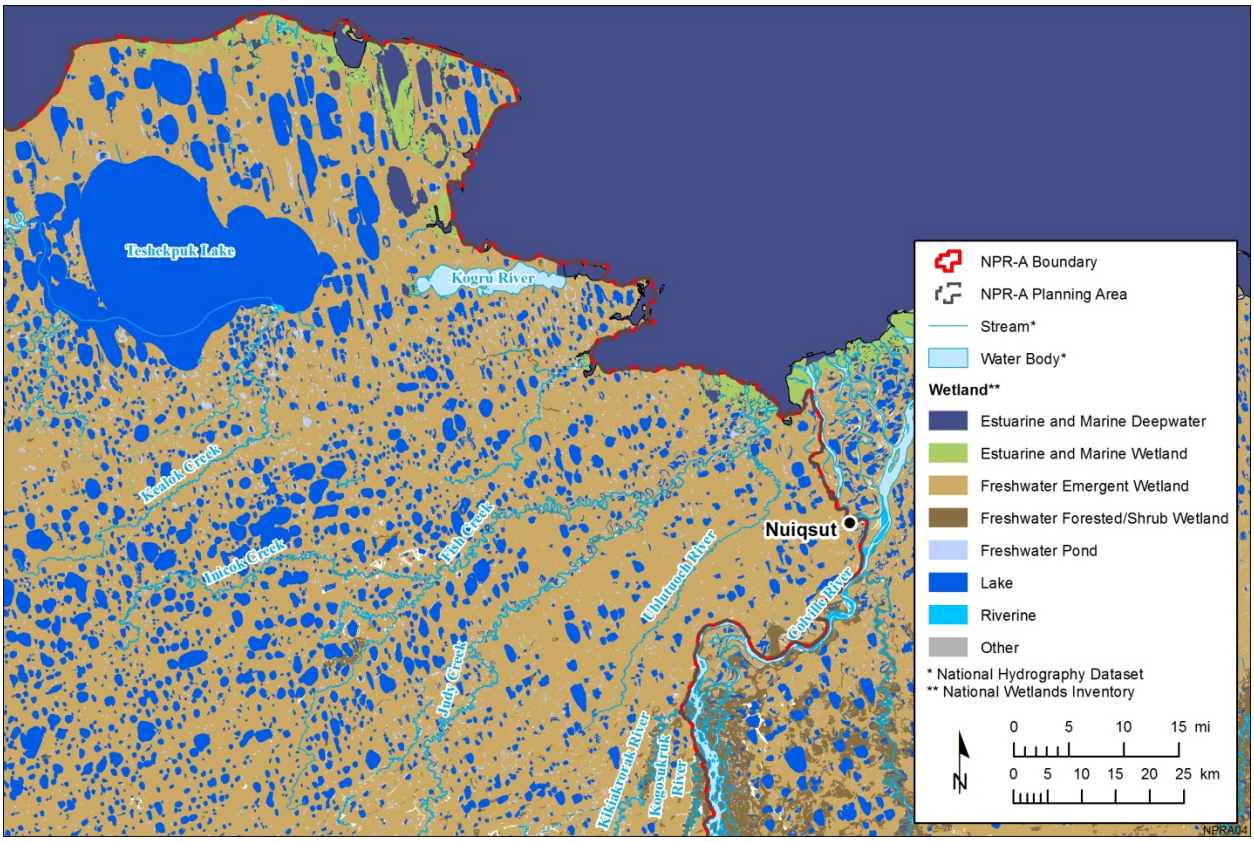


FIGURE A-2 Hydrologic Features in the Northeastern NPR-A

Vegetation in the region is largely influenced by soil conditions and hydrology. Soils in the region are underlain by permafrost, or permanently frozen ground (BLM 2008). Permafrost is continuous throughout the region and, as a result, creates soil conditions that are continuously cold and water-saturated. Depth of permafrost ranges from the surface down to about 650 to 2,130 ft on the North Slope (National Research Council 2003). Permafrost forms a confining barrier that prevents infiltration of surface water and may keep the active layer of soils saturated. The vegetation that grows in these environments is adapted to tolerate these Arctic conditions and primarily consists of dwarf shrubs, herbaceous plants, lichens, and mosses, which grow close to the ground (BLM 2008, 2012). The dominant landcover classes in the Northeastern NPR-A (in order of dominance) are: moist tundra, open water, and shrubs (Table A-2). Together, these three landcover types comprise approximately 80% of the region.

There are 10 plant species classified as sensitive or rare that could occur in the Northeastern NPR-A, and all of these species are considered to be BLM-Sensitive species. Five of these species have been found in the region of the Greater Mooses Tooth 1 project area: Alaskan bluegrass (*Poa hartzii* ssp. *alaskana*), oriental junegrass (*Koeleria asiatica*), Drummond's bluebell (*Mertensia drummondii*), whitlow-grass (*Draba pauciflora*), and circumpolar cinquefoil (*Potentilla stipularis*) (BLM 2008, 2014). Although non-native invasive plant species have not been documented in the Northeastern Planning Area, common dandelion (*Taraxacum officinale*), a non-native species, is known to occur in other areas of the North Slope.

TABLE A-2 Vegetation Communities of the Northeastern NPR-A

Landcover Class	Characteristics	Percent of NPR-A[a]	Percent of Northeastern NPR-A[b]
Water	>80% water	9.4	21.4
Ice	≥60% ice	0.6	2.2
Clear water	Depth >3.3 ft (1 m) and no turbidity	5.0	10.8
Turbid water	Depth ≤3.3 ft (1 m) or turbid	3.8	8.4
Aquatic	**>50% but <80% water and >4 in. (10 cm) deep**	1.9	4.2
Water sedge	>15% water sedge	1.6	3.8
Pendent grass	>15% pendent grass	0.3	0.4
Flooded tundra	**>25% but <50% water and <4 in. (10 cm) deep**	6.0	9.2
Low centered polygons	≥5% sedge/grass	3.7	6.5
Non-patterned	<5% sedge/grass	2.3	2.7
Wet tundra	**>10% but <25% water**	4.4	5.0
Moist tundra	**<10% water, <40% shrub (mostly sedges, grasses, rushes, and moss/peat/lichen)**	31.2	40.8
Sedge/grass meadow	≥50% sedge/grass and <40% tussock cottongrass	5.2	10.1
Tussock tundra	≥40% tussock cottongrass	25.0	29.1
Moss/lichen	≥50% moss and/or lichen	1.0	1.6
Shrub	**<5% water and >40% shrub**	44.1	17.3
Dwarf	≤12 in. (30 cm) in height	40.4	15.5
Low	>12 in. (30 cm) but <4.9 ft (1.5 m) in height	3.7	1.7
Tall	≥4.9 ft (1.5 m) in height	0.01	0.1
Barren ground	**0–30% vegetation**	2.7	2.2
Sparsely vegetated	10–30% vegetated	1.3	0.5
Dunes/dry sand	<10% vegetation and <10% wet sand, mud, or rock	0.3	0.7
Other	<10% vegetation and ≥10% wet sand, mud, or rock	1.1	1.0

[a] Source: BLM 2012.

[b] Source: BLM 2008.

There are many species of fish, birds, and mammals that reside in the Northeastern NPR-A throughout all or parts of the year. Many of these species are important for their subsistence uses. A summary of fish and wildlife species that could occur in areas available for oil and gas leasing or that may be affected by oil and gas operations enabled or assisted by the development of GMT1 (based on the reasonably foreseeable development scenario presented in Section 2.2) is provided in Table A-3. This table includes species important for their subsistence uses and sensitive or rare species (e.g., those listed under the Endangered Species Act).

TABLE A-3 Summary of Fish and Wildlife Resources in the RMS Region[a]

Fish and Wildlife Species	Status	Potential for Residual Impacts from the Reasonably Foreseeable Development Scenario?[b]
Arctic cisco (*Coregonus autumnalis*)	Key subsistence species in the region	Maybe – Minor impacts may occur, including injury at water use intakes, physical habitat changes, pollution, and barriers to fish movement.
Arctic grayling (*Thymallus arcticus*)	Key subsistence species in the region	Maybe – Minor impacts may occur, including injury at water use intakes, physical habitat changes, pollution, and barriers to fish movement.
Broad whitefish (*Coregonus nasus*)	Key subsistence species in the region	Maybe – Minor impacts may occur, including injury at water use intakes, physical habitat changes, pollution, and barriers to fish movement.
Greater white-fronted goose (*Anser albifrons*)	Regionally important species identified by stakeholders	Maybe – Minor impacts may occur, including impacts to bird behavior, nesting, brood-rearing, foraging, and molting, noise disturbance, and displacement from habitats.
Spectacled eider (*Somateria fischeri*)	Rare species (ESA threatened)	No.
Caribou (*Rangifer tarandus*)	Key subsistence species in the region	Negligible to minor impacts may occur, including physical habitat changes, collision-related mortality, noise disturbance, and obstruction of movements by roads, pipelines, and spills.
Polar bear (*Ursus maritimus*)	Rare species (ESA threatened)	Maybe – Minor impacts may occur, including habitat loss/alteration, disturbance or displacement of denning females and cubs, incidental harassment of individuals, and mortality due to collisions or self-defense.

[a] Sources: BLM 2008, 2012, 2014.

[b] See Section 2.2.

As reported in previous planning documents (e.g., BLM 2008, 2012, 2014), subsistence fish or wildlife species include the Arctic cisco (*Coregonus autumnalis*), Arctic grayling (*Thymallus arcticus*), broad whitefish (*Coregonus nasus*), greater white-fronted goose (*Anser albifrons*), and caribou (*Rangifer tarandus*). Along with subsistence species, there are two species listed as Federally Threatened or Endangered under the ESA that could occur in areas available for oil and gas leasing or may be affected by oil and gas operations enabled or assisted by the development of GMT1. These species include the spectacled eider (*Somateria fischeri*), a bird species listed as threatened under the ESA, and the polar bear (*Ursus maritimus*), a marine mammal listed as threatened under the ESA.

Regional-Level Ecological Conditions and Trends

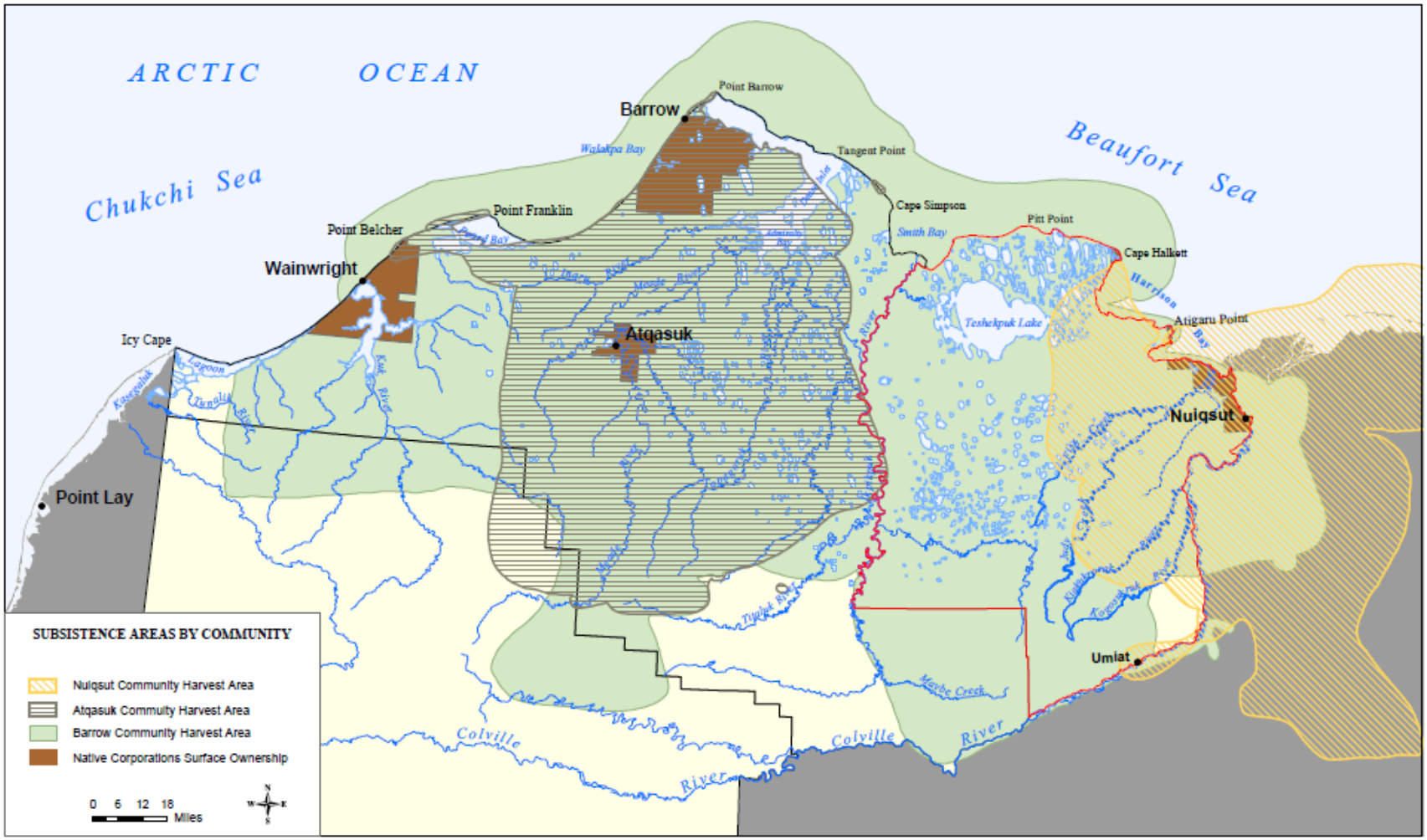
The draft North Slope REA (Trammell et al. 2015) presents a framework for determining the condition and trends of various resource values and conservation elements in the ecoregion. Studies on fish and wildlife populations in the RMS region also provide information on the status and trends for some species listed in Table A-3. The North Slope REA defines conservation elements as resources of conservation concern within an ecoregion. These elements could include habitat or populations for plant and animal taxa, such as threatened and endangered species, or ecological systems and plant communities of regional importance. A list of conservation elements could also include other resource values, such as soils; scenic viewsheds; or designated sites of natural, historical, or cultural significance. A full list of conservation elements evaluated in the North Slope REA can be found in Section 2.2 of the REA.

The North Slope REA forecasted trends in the ecoregion by modeling current and future distributions of change agents. The four change agents modeled for the ecoregion included: (1) abiotic, anthropogenic, and biotic factors such as climate change, fire, soil thermal dynamics (permafrost); (2) human development; (3) subsistence use; and (4) invasive species. In addition, the REA evaluated trends in landscape integrity across the ecoregion through the development of a Landscape Condition Model. This model was built from spatial datasets on human development, and the results provided a quantitative measure of the human footprint on the landscape. Landscape Condition Models are often used as general indicators of ecological integrity over broad spatial scales. Trends in subsistence, modeled change agents, and landscape condition for the North Slope ecoregion are summarized in Table A-4 and in Figures A-3 through A-7.

TABLE A-4 Trends in Change Agents and Landscape and Ecological Integrity across the North Slope Ecoregion[a]

Modeled Attribute	Summary of Future Trends	Figure
Subsistence	Forecast not provided in the REA. However, increased population may increase total harvest but lower per capita harvest amount. Currently subsistence food consumption makes up between half and three-quarters of all food consumed by Alaska Native households.	Figure A-4
Change Agents		
Climate Change (cliomes)	Cliomes are projected to shift northward and become warmer over time. The colder Arctic cliome (Cliome 3) is expected to decline substantially in area by 2060. Reductions of some cliomes suggest that Arctic climates may become milder and wetter in interior regions.	Figure A-5
Fire	Most of the North Slope is expected to remain relatively free of fire in the future (e.g., through 2100). However, fire frequency may increase in some portions of the Brooks Range.	No Figure
Permafrost	Permafrost is expected to warm with some thawing of discontinuous portions of permafrost. Mean annual ground temperatures are expected to warm across the region.	Figure A-6
Human Development	The resident population is expected to increase by more than 50% (from 2013 estimate) by 2060. Oil and gas infrastructure includes development at the Greater Mooses Tooth region and a pipeline connecting offshore activities to Point Thomson by 2040.	No Figure
Invasive Species	The RMS region is currently resistant to invasion by nonnative plant species. By the 2060s, however, the region may become vulnerable to invasions of extremely cold-tolerant species.	Figure A-7
Landscape and Ecological Integrity		
Landscape Condition	Overall landscape condition expected to remain very high throughout most of the North Slope (by 2040). Landscape condition expected to lower in areas of current and future oil and gas developments, roads, and pipelines.	Figure A-8

[a] Source: North Slope Rapid Ecoregional Assessment (Trammell et al. 2015).



Source: Pedersen 1979; Hoffman, Libbey, and Spearman 1988; and SRBA, 1989a.

FIGURE A-3 Example Map of Subsistence Use Areas in the Region (Source: BLM 2008)

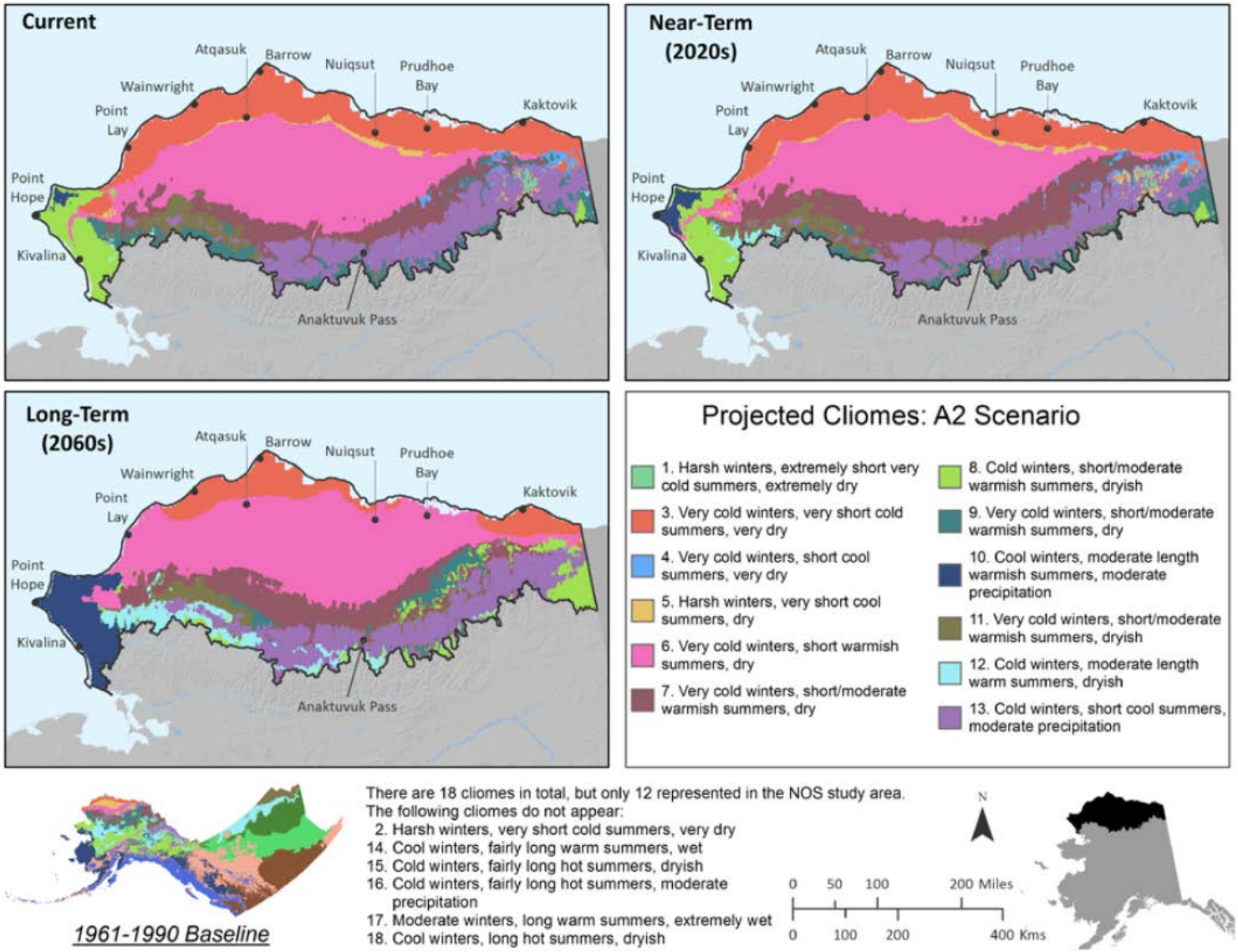


FIGURE A-4 Projected Cliome Shifts over Time in the North Slope (Source: Trammell et al. 2015)

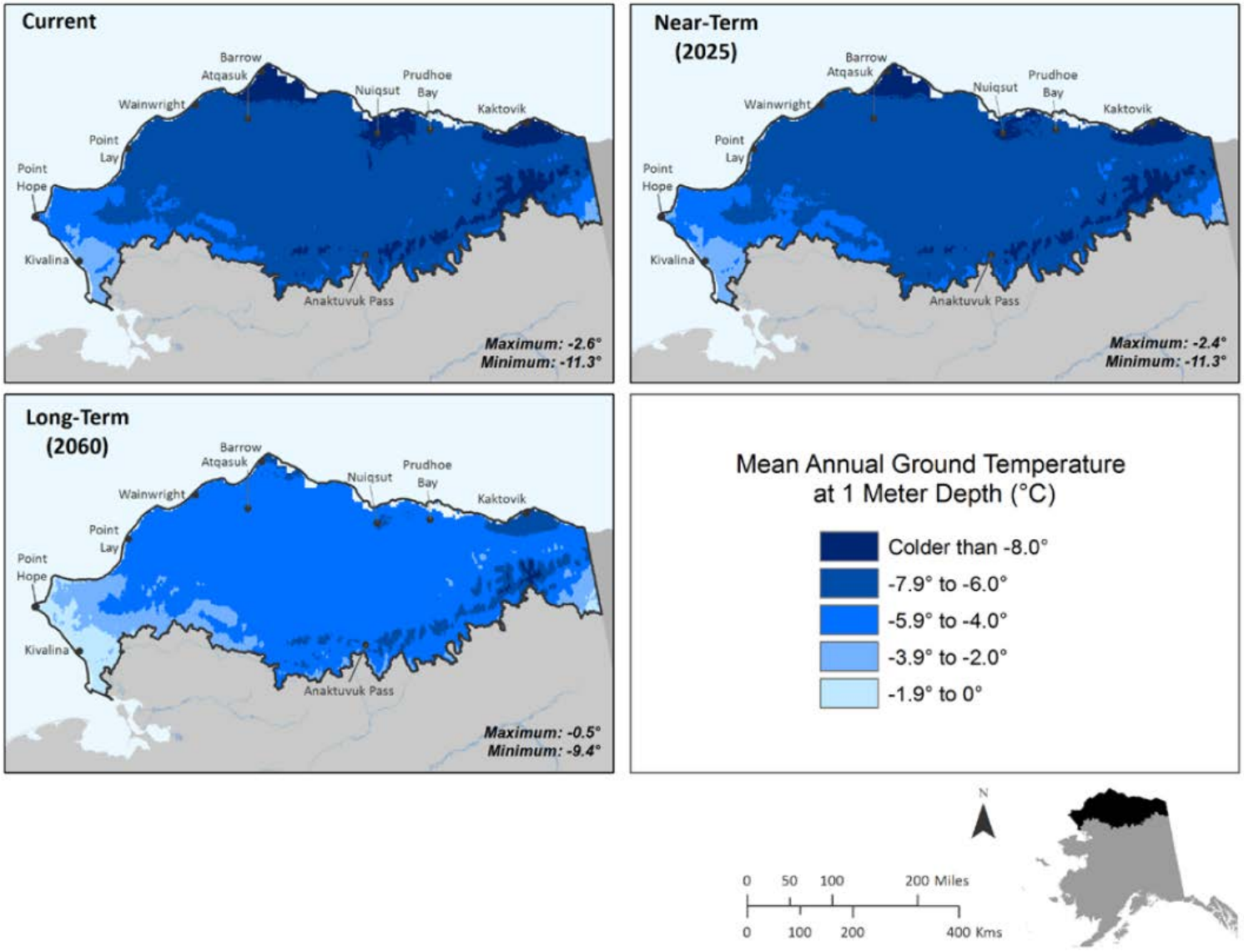


FIGURE A-5 Mean Annual Ground Temperature Projections in the North Slope (Source: North Slope REA; Trammell et al. 2015)

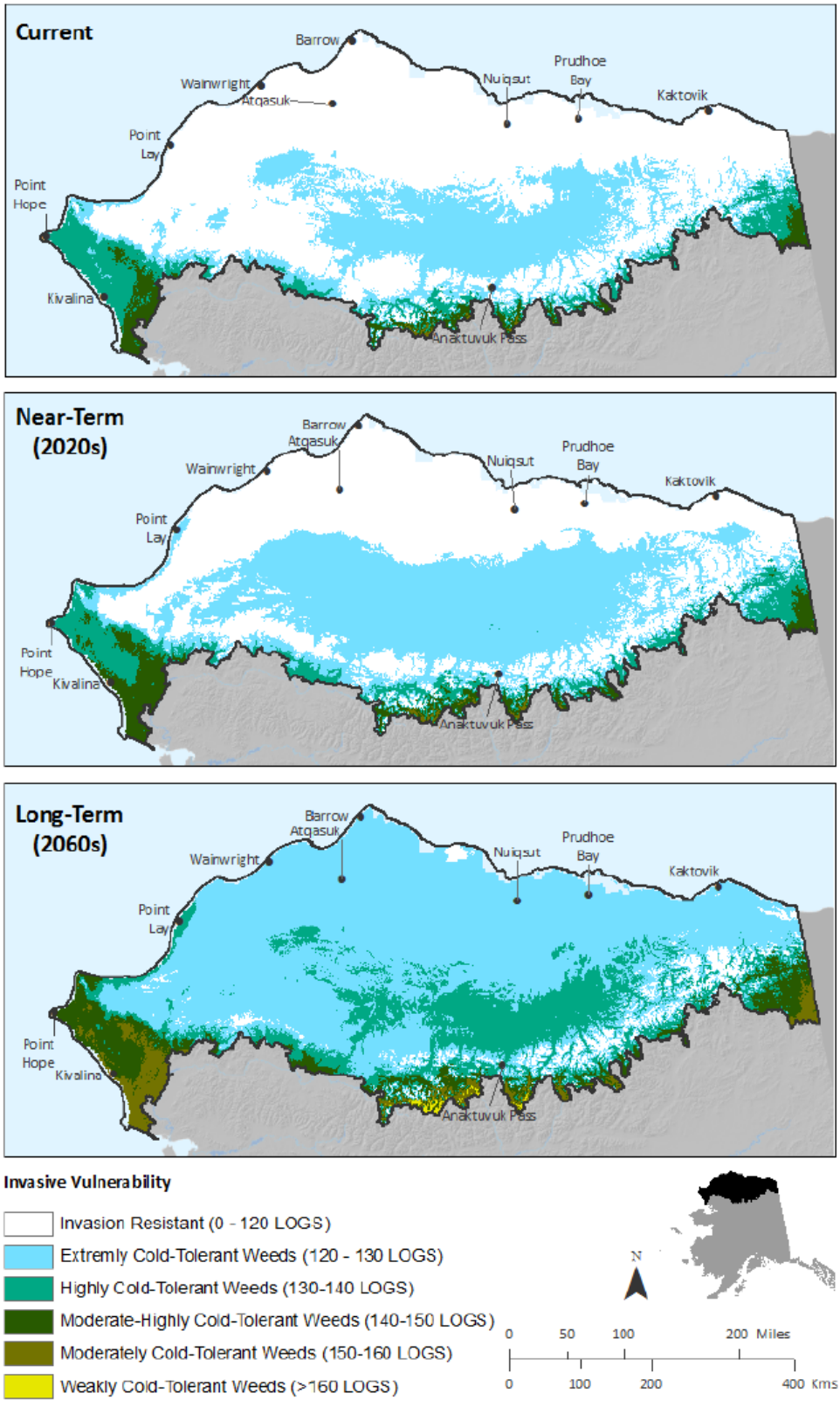


FIGURE A-6 General Plant Invasion Vulnerability across the North Slope (Source: North Slope REA; Trammell et al. 2015)

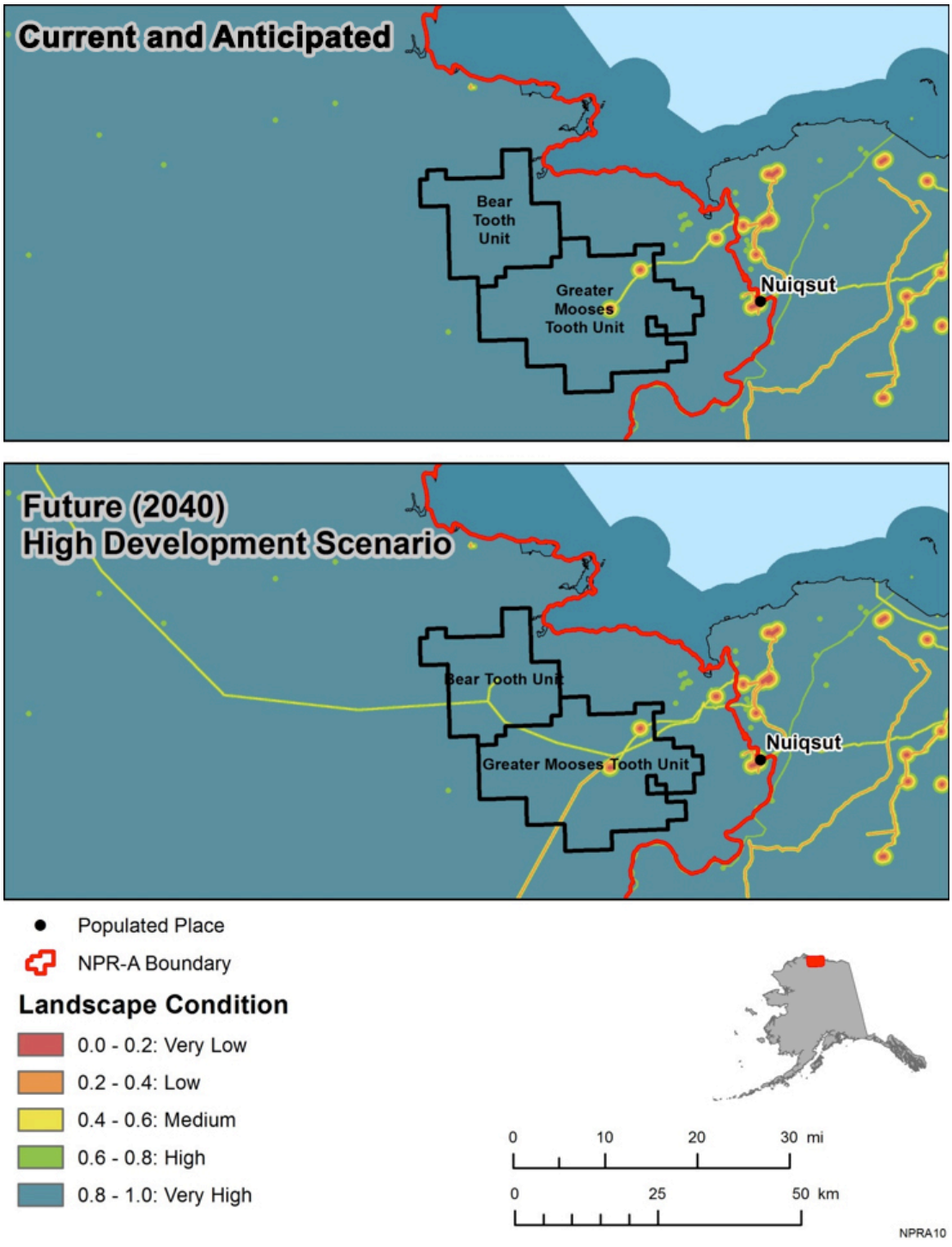


FIGURE A-7 Current (2015) and Future (2040) Landscape Condition in the RMS Region (Source: North Slope REA; Trammell et al. 2015)

Resource-Specific Ecological Conditions and Trends

This section includes information on the condition and trends for the following ecological resources: wetlands and the seven fish and wildlife species identified in Table A-3: Arctic cisco, Arctic grayling, broad whitefish, greater white-fronted goose, spectacled eider, caribou, and polar bear. Information on condition and trends was obtained from various sources, including the North Slope REA (Trammell et al. 2015), past NEPA assessments, and population studies.

Wetlands

Baseline Conditions. Wetlands comprise upwards of 75% of the Northeastern NPR-A, with major vegetation types being wet sedge meadow tundra, tussock tundra, and moist sedge-shrub tundra. Water bodies (lakes, ponds, streams, and rivers, including associated river gravels and beaches) comprise another 20% of the area (BLM 2014). Over 94% of the wetland habitats within the Northeastern NPR-A are considered to be in the "very high" landscape condition class (Trammel et al. 2015).

Trends. Climate change will be the major factor that could potentially affect wetland habitats within the Northeastern NPR-A. Nevertheless, by 2040 it is concluded that 93% or more of the wetland types will remain in a "very high" landscape condition class (Trammel et al. 2015). Some wetlands may dry out under a warming climate due to loss of permafrost and from evaporation due to an increase in the ice-free season. Vegetation may also shift toward more shrub species at the expense of grass and sedge species (BLM 2012). Impacts to wetlands from oil and gas development, operation, and accidental spills would include long-term destruction and alteration of wetlands. Subsequent recovery of wetlands could take up to two decades (BLM 2012).

Arctic Cisco (*Coregonus autumnalis*)

Baseline Conditions. The Arctic cisco (Qaaktaq) is an anadromous fish species that has a nearly circumpolar distribution in Arctic waters. During summer, they are one of the most abundant species in nearshore waters of the Beaufort Sea (USFWS 2015a). The Arctic cisco is a pelagic feeder on crustaceans and small fishes. Within the Northeastern NPR-A, the Arctic cisco is limited to coastal waters during summer and the lower Colville River Delta during winter (BLM 2012). Most of the Colville River watershed and the lakes, ponds, and stream systems in Northeastern NPR-A are not important habitats for the species. The Colville River is the only drainage west of the Mackenzie River, Canada, which is large and deep enough to support substantial overwintering populations of Arctic cisco subadults and adults. Most, if not all, individuals in Alaska originate from spawning grounds in the Mackenzie River system (BLM 2008). They return to the Mackenzie River system when they reach sexual maturity at about age seven (BLM 2012). It is the principal species targeted in the fall subsistence and commercial fisheries that operate in the Colville River Delta (BLM 2008).

Trends. Potential effects on fishes (including the Arctic cisco) from oil and gas exploration, development, and production include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes, point and non-point discharges, increased turbidity and sedimentation, and barriers to fish movement (BLM 2012). Subsistence activities for fish (in the vicinity of Barrow) occur from June through November with highest levels occurring from July through October (Trammell et al. 2015). Climate change may affect fish species in several ways: a reduction in age at maturity and shift in spawning season, potential increase in susceptibility to diseases and parasites, increased availability and effects of contaminants, and reduced quality of spawning habitats and aquatic food base from increased erosion and sedimentation. However, permafrost thaw may increase nutrient inputs which may directly or indirectly increase food base abundance. Increased winter precipitation could potentially increase overwinter habitat, but also increase run-off and sedimentation. Thus, the long-term effect of climate change on fishes (including the Arctic cisco) remains unclear (Trammel et al. 2015).

Arctic Grayling (*Thymallus arcticus*)

Baseline Conditions. The Arctic grayling (Sulukpaugaq) is the most widespread fish species in the NPR-A; occurring throughout all of the major river drainages, including many small tributaries and lakes (BLM 2012). It spawns in small rivers and lake tributaries over areas of sandy gravel and, when stream habitat is not available, in larger substrates in rivers and lakes (USFWS 2015a). Adults feed primarily on invertebrates and may undertake extensive inter- and intra-drainage movements between overwintering sites (deep pools, lakes, spring-fed areas) and summer feeding habitats following reproduction (USFWS 2015a). The Arctic grayling tolerates low dissolved oxygen levels which allow it to survive long winters in areas where many other fish would die (ADFG 2016).

Trends. Throughout Alaska, most Arctic grayling stocks are healthy and isolated from most anthropogenic threats (ADFG 2016). The two biggest threats to the Arctic grayling are climate change and oil and gas development (ADFG 2016). Potential effects from oil and gas exploration, development, and production include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes, point and non-point discharges, increased turbidity and sedimentation, and barriers to fish movement (BLM 2012). Subsistence activities for fish (in the vicinity of Barrow) occur from June through November with highest levels occurring from July through October (Trammell et al. 2015). Climate change may affect fish species in several ways: a reduction in age at maturity and shift in spawning season, potential increase in susceptibility to diseases and parasites, increased availability and effects of contaminants, and reduced quality of spawning habitats and aquatic food base from increased erosion and sedimentation. However, permafrost thaw may increase nutrient inputs which may directly or indirectly increase food base abundance. Increased winter precipitation could potentially increase overwinter habitat, but also increase run-off and sedimentation. Thus, the long-term effect of climate change on fish (including the Arctic grayling) remains unclear (Trammel et al. 2015).

Broad Whitefish (*Coregonus nasus*)

Baseline Conditions. The broad whitefish (Aanakliq) is common in all NPR-A watersheds that drain into the Beaufort Sea, and it is the most abundant anadromous fish species in adjacent coastal waters (BLM 2012). Populations may exhibit either anadromous or freshwater life histories (USFWS 2015a). Most individuals stay within a river system where they target small streams and lakes for summer feeding while overwintering in deep pools or brackish water (ADFG 2016). Spawning occurs from fall to early winter. Broad whitefish are primarily benthic feeders. In some locations, feeding may cease between fall spawning and the following spring (ADFG2016).

Trends. Subsistence activities for fish (in the vicinity of Barrow) occur from June through November with highest levels occurring from July through October (Trammell et al. 2015). Potential effects from oil and gas exploration, development, and production include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes, point and non-point discharges, increased turbidity and sedimentation, and barriers to fish movement (BLM 2012). Climate change may affect fish species in several ways: a reduction in age at maturity and shift in spawning season, potential increase in susceptibility to diseases and parasites, increased availability and effects of contaminants, and reduced quality of spawning habitats and aquatic food base from increased erosion and sedimentation. However, permafrost thaw may increase nutrient inputs which may directly or indirectly increase food base abundance. Increased winter precipitation could potentially increase overwinter habitat, but also increase run-off and sedimentation. Thus, the long-term effect of climate change on fishes (including the broad whitefish) remains unclear (Trammel et al. 2015).

Greater White-fronted Goose (*Anser albifrons*)

Baseline Conditions. The Greater White-fronted Goose (Nigliq) is a common species along the Arctic coast and is an important subsistence species. It arrives in the Northeastern NPR-A from mid-May to early June, egg laying occurs early June to late June, brood rearing occurs late June to early September, adult molt occurs mid-July to mid-August, and fall migration occurs from mid-August to early September (BLM 2008). One of the largest Greater White-fronted Goose concentrations in the NPR-A occurs to the north, east, and west of Teshekpuk Lake (BLM 2012). Densities across the Arctic Coastal Plain range as high as 41 birds/mi^2 (BLM 2014). The long-term population for the Greater White-fronted Goose (1986-2013) averaged 63,098 breeding birds (population growth rate 1.079) and 133,056 total birds (population growth rate 1.043), while its short-term population (2004-2013) averaged 112,550 breeding birds (population growth rate 1.134) and 200,764 total birds (population growth rate 1.101) (Stehn 2014). The Teshekpuk Lake Traditional Survey Area is an important area for molting geese including the Greater White-fronted Goose. In the 2014 survey, 34,199 adult Greater White-fronted Goose adults and 15,112 goslings were observed. These geese are believed to nest on the Arctic Coastal Plain of Alaska (Wilson 2015). Post-breeding birds favor deep, open lakes during the molt (BLM 2012).

Trends. The annual population estimates for the Greater White-fronted Goose in the Arctic Coastal Plain (Stehn 2014) indicate a positive trend in population growth. Within the Teshekpuk Lake Traditional Survey Area, the Greater White-fronted Goose population has increased by 10% between 1982 and 2014 (Wilson 2015). The importance of this area to molting geese is one of the primary reasons that the area is protected from oil development (BLM 2008, 2014). Threats to the Greater White-fronted Goose include loss of wetlands at migratory stopovers, change in breeding habitat due to climate change effects, potential negative effects from oil and gas exploration and drilling, and potential increases in predation if industrial and community development provide opportunities for increases in predator populations near nesting grounds (BLM 2012). Activities related to oil and gas exploration, development, and production could cause potential disturbance, habitat loss, and mortality. Such impacts would be additive to impacts caused by non-oil and gas activities (BLM 2012). Subsistence activities for birds (in the vicinity of Barrow) occur from May through October with highest levels occurring from June through August (Trammell et al. 2015). Currently, 81.8% of Greater White-fronted Goose habitat is in "very high" condition, dropping to 77.88% by 2040 under the "high development" scenario. As they are loyal to breeding and molting sites, they may not be able to readily relocate if development or disturbance effects impact existing sites (Trammel et al. 2015).

Generally, increased summer temperatures associated with climate change could lead to conversion of aquatic and wetland habitats to drier habitats, resulting in a loss of habitat quantity and quality (BLM 2012). However, the Greater White-fronted Goose may also benefit from climate change. Warmer summers may increase juvenile survival rates, and an increase in the number of ice-free days may lengthen the breeding season and decrease juvenile mortality. Permafrost thaw may increase general use of thermokarst terrain, and increased primary production may lead to an increase in the food supply. However, changes in seasonal vegetation may reduce high-nutrient forage availability, while spring storm events and precipitation levels may affect juvenile mortality and reproductive success (Trammel et al. 2015).

Spectacled Eider (*Somateria fischeri*)

Baseline Conditions. The Spectacled Eider (Qavaasuk) was listed as threatened in May 1993 due to a 94 to 98% decline of its principal breeding range in Alaska and a continuing decline in the number of breeding birds in Alaska by about 14% per year (USFWS 1993). Critical habitat does not occur on the North Slope (USFWS 2001). From November through March or April, the Spectacled Eider inhabits the central Bering Sea (USFWS 2010a). The Spectacled Eider breeds primarily along coastal areas of western and northern Alaska and eastern Russia (BLM 2012). The estimated population on the Arctic Coastal Plain for 1992 through 2012 was 7,158 birds with a slightly negative average annual population growth rate (Stehn et al. 2013). The long-term population for the Spectacled Eider (1992–2013) averaged 6,951 breeding birds (population growth rate 0.998) and 7,201 total birds (population growth rate 0.997), while its short-term population (2004–2013) averaged 6,698 breeding birds (population growth rate 1.0) and 7,091 total birds (population growth rate 0.984) (Stehn 2014). Highest concentrations occur within about 40 mi of the coast between Barrow and Wainwright, and north and northeast of Teshekpuk Lake (BLM 2014). In Alaska, nests occur discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada (USFWS 2010a). Preferred nesting habitat

is large shallow productive thaw lakes, often with convoluted shorelines and/or small islands (BLM 2012). Most nests occur within 10 ft of shallow ponds or lakes (USFWS 2010a). Highest breeding season densities occur northeast of Teshekpuk Lake at 0.82 birds/mi^2 (BLM 2008). Hens and broods feed in freshwater ponds and wetlands, while males return to the sea. Non-breeding females move to molting areas in July while successful nesters do so in August/September. Molting areas do not occur in the Beaufort Sea (USFWS 2010a).

Trends. The Spectacled Eider population declined significantly between the 1960s and 1990s, but the cause of the decline remains unknown. Lead poisoning from ingestion of spent shot has been a significant source of mortality in Alaska. Since the 1990s, the population appears to have stabilized (ADFG 2016). The annual population estimates for the Spectacled Eider in the Arctic Coastal Plain indicate a slightly declining population trend (Stehn 2014). Development on the Arctic Coastal Plain is not expected to be a significant threat to the Spectacled Eider, as only a small proportion of its range is within or near proposed development areas. Activities related to oil and gas exploration, development, and production could cause potential disturbance, habitat loss, and mortality. Such impacts would be additive to impacts caused by non-oil and gas activities (BLM 2012). All future developments in Alaska will require Section 7 consultation under the ESA, which will evaluate effects to the species and its habitat and allow for mitigation and reduction of potential adverse effects (USFWS 2010a).

Generally, increased summer temperatures associated with climate change could lead to conversion of aquatic and wetland habitats to drier habitats, resulting in a loss of habitat quantity and quality (BLM 2012). Climate change is also likely to increase ocean acidification, affecting marine food webs in Spectacled Eider habitats (USFWS 2010a). Increased vessel traffic in Arctic waters may increase the likelihood of fuel spills, disturbance, and collisions. Increasing coastal erosion rates pose a risk of direct loss of nesting habitat. Terrestrial warming may also affect breeding habitats (USFWS 2010a). Climate change and anthropogenic influences on predator populations may increase predation in the areas where Spectacled Eiders breed. Harvests may be a threat, particularly along the Arctic Coastal Plain where population surveys indicate a slightly decreasing trend (USFWS 2010a); at a minimum, subsistence harvests may hinder species recovery (ADFG 2016). Subsistence activities for birds (in the vicinity of Barrow) occur from May through October, with highest levels occurring from June through August (Trammell et al. 2015). A catastrophic event (e.g., large oil spill) during the winter or molting periods when Spectacled Eiders congregate in large flocks could have a major impact on the entire population (ADFG 2016). As mentioned, the Beaufort Sea in the area of the Northeastern NPR-A is not used by Spectacled Eiders during molting or winter.

Caribou (*Rangifer tarandus*)

Baseline Conditions. Most caribou (Tuttut) occurring within the Northeastern NPR-A belong to the Teshekpuk Herd which has great importance for subsistence use (BLM 2014). Most individuals migrate from their winter range across northern Alaska to the Teshekpuk Lake area during May. Calving grounds are primarily in the northern portion of the Northeastern NPR-A near Teshekpuk Lake (BLM 2008). The Teshekpuk Lake area is also important as summer range because of prevailing winds and proximity to the coast, river deltas, and lake edge that

provide insect-relief habitat and adjacent forage. Overall, the summer range extends from Barrow to the Colville River (BLM 2008). Some individuals are present year-round in the Teshekpuk Lake area, but most winter on the coastal plain of the NPR-A (BLM 2008). Caribou densities in the area are low in spring, moderately high during calving, high in late June, and low in August (BLM 2014).

Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators (USFWS 2015a). In Arctic areas, caribou reproduction is highly synchronous and most calving occurs in a two- to three-week period (USFWS 2015a). Post-calving summer aggregations harassed by insects move towards the Arctic coast or to higher elevations in the mountains to find relief. By August, the large aggregations break into widely dispersed small groups that move slowly toward winter ranges. Breeding takes place during this time, and by mid-November the caribou arrive at winter ranges (USFWS 2015a).

Trends. Caribou throughout the circumpolar Arctic were experiencing population declines, but many herds in North America are now increasing or are stable (USFWS 2015a). The Teshekpuk Herd population size appears to be in decline due to low and declining calf production, poor calf survival, and high adult mortality rates likely related to poor summer and winter nutrition and difficult winters, and high levels of predation of calves in winter (BLM 2014). However, caribou are somewhat cyclic in number and the timings of increases and declines are not very predictable. Climate, population density, predation, and disease outbreaks determine whether most herds increase or decrease (ADFG 2016). Subsistence activities for caribou (in the vicinity of Barrow) occur throughout the year, except for May, with high levels of subsistence activity occurring from July through October (Trammell et al. 2015).

Oil and gas exploration, development, and production may impact caribou through habitat loss and alteration, disturbance, habitat fragmentation, mortality, and altered survival or productivity (BLM 2014). Disturbance of maternal groups on calving grounds may interfere with bond formation (first 24 hours following birth) and can increase calf mortality (USFWS 2015a). The Alpine Satellite Development Plan area is not a concentrated calving area for the Teshekpuk Herd (BLM 2014).

Climate change will impact caribou herds of the North Slope, but not uniformly because weather patterns and the variety of terrain occupied across the region are complex. Deep snow or icing events in winter may affect spring migration. Warmer temperatures and longer growing seasons could increase the availability of summer forage, but mismatches between emergence of nutritious forage and arrival of caribou on calving grounds could occur. Increasing temperatures may lead to shrub encroachment that may reduce lichen cover for caribou, although earlier spring thaws may increase plant biomass during calving. Warming climate and increased precipitation may alter insect abundance and timing, possibly affecting caribou body condition (Trammell et al. 2015; USFWS 2015a). Currently, 90.9% of the Central Arctic herd's range is in "very high" condition, dropping to 90.2% by 2040 under the "high development" scenario (Trammel et al. 2015).

Polar Bear (*Ursus maritimus*)

Baseline Conditions. The polar bear (Nanuq) was designated as a threatened species under the ESA in May 2008 due to loss of sea ice habitat caused by climate change (USFWS 2008). The primary constituent elements of critical habitat are sea ice habitat, terrestrial denning habitat, and barrier island habitat (USFWS 2010b). The Beaufort Sea coastline, creek and river drainages, and bluffs along the lakes throughout NPR-A provide important areas for polar bear resting, feeding, denning, and seasonal movements (BLM 2012). Polar bears typically occur on broken sea ice in areas with abundant ring or bearded seals (USFWS 2015b). Sea ice, the primary habitat for polar bears, function as a platform on which to hunt and feed, seek mates and breed, travel to terrestrial maternity denning areas, den, and make long-distance movements (USFWS 2015b). Winter dens are excavated by pregnant females in stable pack ice or onshore in large drifts along drainages; while males and non-pregnant females remain active throughout winter on the ice pack (USFWS 2015b). Polar bears in the Northeastern NPR-A are part of the Southern Beaufort Sea subpopulation that ranges from Icy Cape (west of Point Barrow, Alaska) to Pearce Point (east of Paulatuk, Canada). They spend most of their time in shallow waters over the continental shelf, on areas with greater than 50% ice cover (USFWS 2015b).

Trends. The current global polar bear population is estimated at 20,000 to 25,000 (USFWS 2015b) with the population of the Southern Beaufort Sea subpopulation estimated at about 900 animals in 2015 (ADFG 2016). This is down from the valid population estimate of 1,526 provided by Regehr et al. (2006). Overhunting in the early 1960s resulted in population declines in the Southern Beaufort Sea subpopulation. Following passage of the Marine Mammal Protection Act in 1972, the population increased and likely stabilized in the 1990s. From 2001 to 2006, there was a negative rate of population growth and declining recruitment, survival, body condition, and size, suggesting that the population is declining (USFWS 2015b). Conservation concerns for the Southern Beaufort Sea subpopulation include loss of sea ice habitat due to climate change, potential overharvest, and current and proposed human activities including industrial activities in the nearshore and offshore environment (USFWS 2015b). Overharvest could hasten the decline or prevent and/or slow population recovery (Allen and Angliss 2015). Subsistence activities for polar bears (in the vicinity of Barrow) occur January through March and in May and June, with high levels of subsistence activity occurring in May (Trammell et al. 2015).

Lethal takes of individuals from the South Beaufort Sea subpopulation related to the oil and gas industry are rare (Allen and Angliss 2015). Authorized nonlethal, incidental unintentional take of polar bears (e.g., disturbance) during year-round oil and gas exploration, development, and production in the Beaufort Sea and the adjacent north coast of Alaska has been approved from August 3, 2011, to August 3, 2016. The analysis found that oil and gas activities would have a negligible impact on polar bears during this period. Only a small number of bears are likely to be affected by a large oil spill in Arctic waters with only a negligible impact (USFWS 2011).

The decline of sea ice habitat due to climate change is the primary threat to polar bears. The population may face severe declines if sea ice loss continues (USFWS 2015b). Sea ice normally provides a platform for hunting and feeding, seeking mates and breeding, movement to

terrestrial maternity denning areas and occasionally for maternity denning, for resting, and for long-distance movements (BLM 2012). Thinning ice has apparently led to a shift from denning on sea ice to denning on land in eastern Alaska (USFWS 2015b). Continuing sea ice loss will also exacerbate other current or potential sources of polar bear mortality particularly declines in marine prey base; but also subsistence harvesting, defense-of-life removals, disease, take from oil and gas activities, loss of denning habitat, contamination from spills, and disturbance due to increased shipping in the Arctic (USFWS 2015b). Survival rates >93% for adult females are essential to sustain polar bear subpopulations (Regehr et al. 2015).

APPENDIX A REFERENCES

ADFG (Alaska Department of Fish and Game). 2016, *Animals*. Available at: http://www.adfg.alaska.gov/index.cfm?adfg=animals.main.

Allen, B.M., and R.P. Angliss, 2015. *Alaska Marine Mammal Stock Assessments. 2014*, U.S. Department of Commerce, NOAA Technical Memo, NMFS-AFSC-301.

BLM (Bureau of Land Management) 2008. *Northeast National Petroleum Reserve – Alaska Final Supplemental Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. May. Available at: http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npr-a_final.html.

BLM 2012. *National Petroleum Reserve – Alaska Final Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Nov. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2014. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Oct. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

National Research Council, 2003. *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*. Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, Board of Environmental Studies and Toxicology, Polar Research Board, Division of Earth and Life Studies. The National Academies Press, Washington, D.C.

Omernik, J.M., 1987. "Ecoregions of the Conterminous United States, Map (scale 1:7,500,000)," *Annals of the Association of American Geographers* 77:118-125.

Regehr, E.V., S.C. Amstrup, and I. Stirling, 2006. *Polar Bear Population Status in the Southern Beaufort Sea*. U.S. Geological Survey Open-File Report 2006-1337.

Regehr, E.V., R.R. Wilson, K.D. Rode, and M.C. Runge, 2015. *Resilience and Risk – A Demographic Model to Inform Conservation Planning for Polar Bears*. U.S. Geological Survey Open-File Report 2015-1029.

Stehn, R.A., W.W. Larned, and R.M. Platte, 2013. *Analysis of Aerial Survey Indices Monitoring Waterbird Populations of the Arctic Coastal Plain, Alaska, 1986-2012*. Unpublished Report by the U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage and Soldotna, Alaska.

Stehn, R.A., 2014. *Analysis of Aerial Survey Indices Monitoring Waterbird Populations of the Arctic Coastal Plain, Alaska, 1986-2013*. Unpublished Report by the U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage and Soldotna, Alaska.

Trammell, E.J., M.L. Carlson, N. Fresco, T. Gotthardt, M.L. McTeague, and D. Vadapalli, (eds.), 2015. *North Slope Rapid Ecoregional Assessment*. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. July.

USFWS (U.S. Fish and Wildlife Service) 1993. "Endangered and Threatened Wildlife and Plants; Final Rule to List Spectacled Eider as Threatened," *Federal Register* 58(88):27474-27480.

USFWS 2001. "Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Spectacled Eider," *Federal Registe*r 66(25):9146-9185.

USFWS 2008. "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Polar bear (*Ursus maritimus*) throughout Its Range," *Federal Register* 73(95):28212-28303.

USFWS 2010a. *Spectacled Eider (*Somateria fischeri*) 5-Year Review: Summary and Evaluation*. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. August 23.

USFWS 2010b. "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Polar bear (*Ursus maritimus*) in the United States." *Federal Register* 75(234):76086-76137.

USFWS 2011. "Marine Mammals; Incidental Take during Specified Activities." *Federal Register* 76(149):47010-47054.

USFWS 2015a. *Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan – Final Environmental Impact Statement*. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska and Alaska Regional Office, Division of Conservation Planning and Policy, Anchorage, Alaska. January.

USFWS 2015b. *Polar Bear (*Ursus maritimus*) Conservation Management Plan, Draft*. U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska.

Wilson, H.M., 2015. *Teshekpuk Lake Area Molting Goose Survey, 2014*. Available at: http://www.fws.gov/alaska/mbsp/mbm/waterfowl/surveys/pdf/Tesh_report_2014.pdf.

APPENDIX B:

SUBSISTENCE AND SOCIO-CULTURAL RESOURCES, CONDITIONS, AND TRENDS

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APPENDIX B:

SUBSISTENCE AND SOCIO-CULTURAL RESOURCES, CONDITIONS, AND TRENDS

Other NEPA documents describe in detail the existing cultural and socio-cultural resources and values present within the Northeastern (NE) NPR-A in their Affected Environment sections (e.g., BLM 2004 [Alpine FEIS, Sept. 2004], BLM 2005 [Amended NE NPRA IAP EIS, Jan. 2005], BLM 2008 [Supplemental IAP-EIS, May 2008], BLM 2012 [Final IAP EIS, Nov. 2012], and BLM 2014 [Alpine GMT1 FSEIS, Oct. 2014]). The information on cultural and socioeconomic resources presented in this section is largely summarized from information contained in these documents.

The Iñupiat are the resident population affected by oil and gas development in the region. The traditional homeland of the Iñupiat includes the Brooks Range, its foothills, and the river valleys that run toward the coastal plain and the Arctic coast. The coastal zone includes open waters of the Chukchi and Beaufort Seas in the summer and nearshore ice in winter. This area encompasses most of the North Slope from the coast south to just past Anaktuvuk Pass, as far west as Point Hope, and as far east as the Canadian border. Prior to sustained contact with Euro-Americans, the Iñupiat moved seasonally between these environments to hunt, trade, or join celebrations. Through centuries, the Iñupiaq way of life included unrestricted freedom of movement throughout the North Slope in order to harvest important subsistence resources. They also developed distinct socio-cultural customs with an emphasis on sharing and hospitality (BLM 2012; Brown 1979).

Contemporary Iñupiaq villages are located throughout the North Slope in Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, Wainwright, Kaktovik, Point Hope, and Point Lay. Today these villages have the benefits of modern education, health and government services, and vehicular transportation. Modern technologies (electricity, gas, snow machines, and all-terrain vehicles) have reduced the time required to conduct a hunt or harvest, but have not reduced the reliance on traditional subsistence practices for food or the importance of these activities to the culture. Physical evidence of these practices includes the hundreds of Native allotments and hunting and fishing camps and cabins that are located along the coast and major rivers in traditionally used sites across the North Slope. Access to and use of these sites and the land around them is commonly the most highly valued aspect of life for North Slope Iñupiat.

Nuiqsut

Nuiqsut, population approximately 449, is the community closest to the area expected to be developed in the NE NPR-A. Nuiqsut was re-settled in 1973,[1] when 27 Iñupiat families left

[1] An earlier village in the vicinity was abandoned in the late 1940s because it had no school (DCCED 2016, online community database https://www.commerce.alaska.gov/web/).

Barrow and returned to their traditional hunting and fishing areas in the Colville Delta to live by more traditional cultural values. The Colville Delta area had been a gathering and trading place for the inland and coastal Iñupiat for centuries (BLM 2012; Brown 1979). The ANCSA village corporation for Nuiqsut is the Kuukpik Corporation, and the ANCSA Regional Corporation is the Arctic Slope Regional Corporation, and the local tribal government is the Native Village of Nuiqsut.

The Nuiqsut Cultural Landscape. Cultural landscapes are living and continually evolving spaces that reflect the relationship between a group of humans, their resources, and their environment. The Nuiqsut Heritage Cultural Plan (Brown 1979) defines four important characteristics of the Nuiqsut Cultural Landscape: areas of historical extended use; aboriginal trade routes; traditional land use inventory (TLUI) sites, and areas of current intensive subsistence use (Brown 1979). The Nuiqsut Heritage Cultural Plan describes the landscape as

> *"…a complicated geography that can be shown on a map only if the boundary is a shifting horizon. It is a composite of places and events that people have directly experienced or heard about in songs and stories passed down through generations. Here, in this landscape — recalled in memory culture — is the history, the knowledge, the spirit of thousands of years of the Iñupiat experience."* (Brown 1979)

While it is difficult to determine the exact geographic extent of the Nuiqsut Cultural Landscape, the GMT1 SEIS (BLM 2014) mapped the geographic extent of the cultural landscape based on the historical extended use area documented by Brown (1979) and the contemporary use areas documented by Pedersen (1986), the Alaska Heritage Resource Survey, the Iñupiat Heritage and Language Center's Traditional Land Use Inventory database, and more recent information collected by Stephen R. Braund and Associates (SRB&A 2010a, 2010b, 2011, and 2013a, 2013b). The cultural landscape encompasses the area from as far northwest as Barrow, as far south as Anaktuvuk Pass, and as far east as Kaktovik. It encompasses overland areas and coastal and nearshore areas of the Beaufort Sea as well as Teshekpuk Lake and portions of Fish Creek and the Colville, Itkillik, and Anaktuvuk river corridors (BLM 2014).

The Iñupiat in Nuiqsut are closely tied to the land and sea and their cultural survival depends on the availability of fish and game and access to traditional sites throughout the area. Travel routes, historic and contemporary camping locations, cabins, sod houses, grave sites, drying racks, storage cellars, and subsistence use areas are all located within the area. These places are "both old and new, sacred and useful," and provide a spiritual link between the Iñupiat, their ancestors, and the land (Brown 1979; Iñupiat Community of the Arctic Slope 1979).

While hunting and fishing, traditional knowledge is passed from person to person and generation to generation, through the telling of oral histories, storytelling, and physical activities (Brown 1979; Iñupiat Community of the Arctic Slope 1979). Continuing these practices maintains cultural identity and Iñupiat ties to the landscape (BLM 2014).

Subsistence Resources. Residents of Nuiqsut, the "Kuukpikmiut" or "People of the Lower Colville River," harvest fish and game on a seasonal round, following the migration of fish and land and sea mammals. Traditional knowledge gathered over centuries and passed from generation to generation analyzes changes in seasonal temperatures, various environmental factors, and animal migration patterns to determine when a resource will be harvested (Brown 1979; Iñupiat Community of the Arctic Slope 1979). Caribou hunting usually peaks in mid-summer but can occur almost any time of year. Fishing is prominent in summer, and individuals travel to the ocean to hunt seals and eiders. In the fall, individuals continue to harvest caribou and fish and pursue moose and bowhead whale through much of August and September. Fishing under the ice for Arctic cisco takes place mostly during October and November, while fishing for burbot (*tittaaliq*) rounds out the winter months. Wolves, wolverines, and fox are also taken during the winter months. Subsistence use areas in the region are more fully described in Appendix G of the GMT1 SEIS (BLM 2014).

Although the people of Nuiqsut live in a modern village, they rely heavily on wild fish and game. The Kuukpik Subsistence Oversight Panel and the Native Village of Nuiqsut communicate subsistence concerns to the oil industry, to government agencies, and to other entities including and the Nuiqsut Whaling Captains Association. The entire population either participates in harvesting, processing, or receiving and eating subsistence fish and game (BLM 2012, 2014; Brown 1979).

Subsistence Use Areas. The Northeastern region of the NPR-A is within the Beaufort Coastal Plain. The Beaufort Coastal Plain is a treeless, wind-swept plain that gradually ascends from the Arctic Ocean south to the foothills of the Brooks Range (McTeague et al. 2015). Its coastal shores, braided rivers, and unique geographical features provide habitats that are important for a wide variety of wildlife including fish, birds, waterfowl, and furbearing mammals, all of which are important to local Iñupiat communities. Use areas in the region include spring geese hunting areas, late fall and winter caribou hunting areas, and winter wolf and wolverine subsistence areas. There are also numerous broad whitefish (*aanaakliq),* Arctic cisco (*qaaktaq*), grayling (*sulukpaugaq*), and burbot (*tittaaliq*) fishing use areas along the Colville River and its tributaries.

User access to all of these areas and resource availability are of great concern to the Nuiqsut residents. Issues of access include not only the hunters' physical access to specific traditional locations and locations where the animals being sought may be moving to, but emotional and spiritual access to these locations as well. This access can be disrupted by visual impediments, noise, and odors that detract from the act of subsistence by affecting the experiential quality of the hunt. These disruptions may also displace the resources present in a given location. The residents of Nuiqsut are particularly vulnerable to any displacement of the caribou herd, as it is a main source of sustenance. Changes in access and changes in the movement of the animals used for subsistence have direct bearing on the costs, time, and amount of effort expended on each hunt, and harvest success rates.

Socio-cultural Systems. The socio-cultural system of the residents of Nuiqsut is based heavily on their subsistence lifestyle. The act of the harvest and sharing of the harvest are essential to the Iñupiat way of life and essential in keeping the community together and passing

cultural knowledge to the next generation. Disruption in this lifestyle, be it fragmentation of land; disruption of land and sea mammal migration routes; introduction of unequal monetary compensation; pollution from oil and gas development; or damage to resources from oil spills, results in a loss of the community involvement, physical space, and some of the resources the Iñupiat need to survive. It also devalues the physical landscape for Nuiqsut residents, who understand the landscape as an essential part of life in Nuiqsut. Levels of community involvement are important in subsistence activities because these activities promote transmission of skill, provide an extensive knowledge network of the location of food and water sources, and strengthen community cohesion. Impacts like these continue to result in diminished or lost cultural identity, which could result in health and wellness consequences for some individuals, such as increased levels of stress, including stress related to improper compensation for their time spent participating in land planning meetings (BLM 2014, meeting notes).

Subsistence and Socio-cultural Conditions and Trends

Condition and trend of certain elements, such as subsistence use, can be measured and evaluated; however, changes in other areas of socio-cultural systems are much more difficult to quantify for purposes of evaluating trends. The BLM has been working and will continue to work with local residents to understand the impacts and the trends in the community that can be addressed.

Subsistence Use

Baseline Condition. The Alaska Department of Fish and Game (ADF&G) reports harvest data from subsistence hunting and fishing. For Nuiqsut, its harvest database contains data from the years 1985 and 1993 for many subsistence resources and 2003–2006 for caribou only. In 1985 (baseline case for ADF&G), 40 households out of 76 estimated households were sampled. In 1993 (representative case for ADF&G), 62 households out of an estimated 91 households were sampled. In 2006, 78 households out of an estimated 96 households were sampled, but limited data are available regarding caribou harvests only. In all three of these surveyed years (1985, 1993, 2006), 100% of the households were using subsistence resources. The percentage of households that were successfully harvesting resources was 97.5% in 1985 and 90.3% in 1993. As shown in Table B-1, similar percentages also applied to caribou harvesting alone. In 2006, those households harvesting caribou comprised 59% of the households sampled. Resources harvested include, but are not limited to, various fish species, brown bear, caribou, moose, muskox, dall sheep, fox, squirrel, wolf, marine mammals (seal, whale, walrus, polar bear), various birds (e.g., goose, eider, duck, ptarmigan), eggs, and berries. Primary subsistence resources are caribou, bowhead whale, fish, waterfowl, and ptarmigan. Some species are taken more opportunistically when other species are being hunted, such as polar bears, walruses, and beluga whales. Subsistence harvesting occurs seasonally for the different resources and allows for year-round activity.

TABLE B-1 Caribou Harvest

Year	% Households Using Harvested Caribou	% Households Harvesting Caribou	Estimated Harvest (# of caribou)	Estimated Weight (lb)
1985	97.5	90.0	513	60,000
1993	98.4	74.2	672	82,000
2003	95.1	45.9	293	No data
2004	97.4	70.1	429	No data
2005	98.9	60.7	436	No data
2006	100.0	59.0	363	No data

Nuiqsut's annual subsistence harvest for all resources has ranged from approximately 160,000 lb in 1985 to 267,800 lb in 1993, with caribou consisting of 60,000 lb (38%) and 82,000 lb (30%) respectively.

Trends. One of the trends noticed in the ADF&G data, at least for caribou, is a reduction in the number of households that are participating in the hunt, although the percentage of users of subsistence resources remains very high (at or near 100%). It is recognized that the number of harvested resources varies based on the abundance of primary subsistence species (e.g., how many whales are harvested in any given year and its effect on the need for other species). Fewer households participating also appear to translate to reduced numbers of individual animals harvested. Resources where an increase in the percentage of households participating in the harvest was noted between 1985 and 1993, rather than a reduction, are wolf, red fox, marine mammals (especially seals), ducks, berries, and plants (ADF&G 2015).

The ADF&G study completed for years 2002–2007 (ADF&G 2011) illustrates that many of the areas repeatedly used for caribou subsistence harvest west of the Colville River could be substantially affected by development in the Greater Mooses Tooth Unit and, to a lesser extent, the Bear Tooth Unit (as shown in Figure 2-1). The hunt areas between the Colville River and Fish Creek, where the caribou harvest was estimated at 100–240 per year (ADF&G 2011), are the most likely to be affected and/or substantially disrupted. Effects could include displacement of desired resources and an inability of hunters to access the areas physically due to infrastructure barriers or mentally due to aesthetic, spiritual, acoustic, and/or experiential characteristics not in keeping with traditional values of what a hunt should be like. The BLM will continue to work with local residents and the latest and most up-to-date subsistence harvest data available.

Socio-cultural Systems

Baseline Condition. The number of residents of Nuiqsut is over 400, nearly 90% of which are Alaska Natives, as reported in the 2010 Census (U.S. Census Bureau 2016). Populations are very dynamic, but the cultural foundation of the village residents when Nuiqsut was established in 1973 was strongly rooted in the Iñupiat tradition, including a subsistence

lifestyle, a tradition that continues today. The socio-cultural changes that are currently being observed and felt by residents as oil and gas development has increased in the region are described in the trends section below.

Trends. Other aspects of the Iñupiat cultural traditions and community cohesion are important, but are harder to quantify or measure (see Appendix E for the conceptual model of subsistence and socio-cultural systems). For example, tensions related to the permitting process have been noted as increasing with increasing development. These tensions arise from both inter- and intra-community conflicts over inequalities in the beneficiaries of the development; stress with the process itself and the time and effort it takes to interpret the data and findings regarding effects on the population and its traditional subsistence practices; and consternation over the impacts identified regardless of the likelihood they will occur (e.g., accidents). Affected residents may experience a sense of distrust regarding whether their concerns are being heard and whether cumulative impacts are being appropriately addressed. This trend in increasing frustration with the process is currently qualitative, but through analysis of past public meeting transcripts (see appendix I), it is hoped that a more quantitative analysis of the trends can be generated in the future.

Another trend of concern to Nuiqsut residents is the devaluation of the Nuiqsut cultural landscape through the cumulative impacts of multiple projects whittling away at the traditional lands used for subsistence. As lands within the Nuiqsut cultural landscape are developed for oil and gas, there are fewer lands remaining to support traditional activities and the teaching of traditional knowledge to younger generations. The physical footprints of the projects are small, but the visual, acoustic, and experiential impacts resulting from the infrastructure are more far-reaching. The proximity to town and overlap with many of the most valuable subsistence use areas are factors that exacerbate the impacts of development. The impacts on the subsistence resources themselves are also difficult to quantify, as there are many reasons movement patterns or abundance of animals can change over time.

APPENDIX B REFERENCES

Alaska Department of Fish and Game (ADF&G) 2011. *Monitoring of Annual Caribou Harvests in the National Petroleum Reserve in Alaska: Atqasuk, Barrow, and Nuiqsut*, 2003-2007. Division of Subsistence Technical Paper No. 361. May.

ADF&G 2015. “Community Subsistence Information System: Nuiqsut.” Available at: http://www.adfg.alaska.gov/sb/CSIS/.

BLM (Bureau of Land Management) 2004. *Alpine Satellite Development Plan, Final Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Sept. Available at: http://www.blm.gov/eis/AK/alpine/dspfeisdoc.html.

BLM 2005. *Northeast National Petroleum Reserve – Alaska Final Amended Integrated Activity Plan/Environmental Impact Statement*. Jan. Available at: http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/ne_npra_feis.html.

BLM 2008. *Northeast National Petroleum Reserve – Alaska Final Supplemental Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. May. Available at: http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npr-a_final.html.

BLM 2012. *National Petroleum Reserve – Alaska Final Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Nov. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2014. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Oct. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

Brown, W.E. 1979. *Nuiqsut Paisaŋich – Nuiqsut Heritage: A Cultural Plan*. Prepared for the Village of Nuiqsut and the North Shore Bureau Planning Commission and Commission on History and Culture. (Note: Author is not listed in plan. Final page is an acknowledgements section written by Brown. This is cited as Brown 1979 in the NE NPR-A EIS.)

Department of Commerce, Community, and Economic Development (DCCED) 2016. Online community database at: https://www.commerce.alaska.gov/web/.

Iñupiat Community of the Arctic Slope 1979. *Natural Petroleum Reserve in Alaska 105(c) Final Study Volume 1(b): The Iñupiat View*. U.S. Department of the Interior, Anchorage, AK. March.

McTeague, M.L., et al., 2015. "Introduction," *in* Trammell, E.J., M.L. Carlson, N. Fresco, T. Gotthardt, M.L. McTeague, and D. Vadapalli (eds.), 2015. *North Slope Rapid Ecoregional Assessment*. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. July.

Pedersen, S. 1986, *Nuiqsut Subsistence Use Land Use Atlas*. 1986 Update, ADF&G, Division of Subsistence, Fairbanks, Alaska, File Report 1986-01.

Stephen R. Braund and Associates (SRB&A), 2010a, Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow MMS OCS Study Number 2009-003, United States Department of the Interior Minerals Management Service Alaska OCS Region.

SRB&A 2010b, Nuiqsut caribou subsistence monitoring project: results of 2009 hunter interviews Anchorage, Alaska, Prepared for ConocoPhillips Alaska, Inc.

SRB&A 2011, Nuiqsut caribou subsistence monitoring project: results of year two hunter interviews and household harvest surveys. SRBA. Anchorage, Alaska.

SRB&A, 2013a, Nuiqsut caribou subsistence monitoring project: results of year 3 hunter interviews and household harvest surveys. SRBA. Anchorage, Alaska.

SRB&A 2013b, Nuiqsut caribou subsistence monitoring project: results of year 4 hunter interviews and household harvest surveys. Anchorage, Alaska

U.S. Census Bureau 2016. "Nuiqsut." Available at: www.census.gov.

APPENDIX C:

SUMMARY OF THE IMPACTS EXPECTED WITH O&G DEVELOPMENT

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APPENDIX C:

SUMMARY OF THE IMPACTS EXPECTED WITH O&G DEVELOPMENT

The IAP EIS (BLM 2012) and the GMT1 SEIS (BLM 2014) identified various potential impacts from oil and gas (O&G) development in the NPR-A. These impacts are summarized below. The method used to determine which of these impacts are residual is described in Section 2.3; the method used to determine which residual impacts warrant compensatory mitigation is described in Section 2.4.

The NPR-A IAP and GMT1 EISs identified potential adverse impacts from oil and gas development, including effects on:

- The **physical environment**, including air quality, surface and groundwater resources and water quality, soils resources, and paleontological resources.
- The **biological environment**, including birds, fish, terrestrial and marine mammals, vegetation, and special status species.
- **Social systems** and related resources, including socio-cultural systems, subsistence, environmental justice, public health, cultural resources, visual resources, recreation, wild and scenic rivers, and wilderness characteristics.

This appendix provides more information about these potential adverse impacts from oil and gas development. Sections 2.3 and 2.4 describe how BLM will require mitigation for these impacts in the Northeastern NPR-A, including requiring compensatory mitigation for residual impacts that warrant compensation.

The EIS also identified positive impacts from development, most importantly positive economic impacts for the North Slope Borough, Arctic Slope Regional Corporation (ASRC) and other Alaska Native regional corporations, and benefiting communities and shareholders. However, the RMS focuses on adverse impacts because impact mitigation is not required for positive effects. The substantial positive impacts of oil and gas development are recognized and noted, though they are not the focus of this strategy.

Primary Sources of Impact Associated with Oil and Gas Development in the Arctic Region

Primary sources of impact associated with oil and gas development in the Arctic region include the construction, operation, and decommissioning of infrastructure, including roads, processing facilities, wells, well pads, pipelines, airstrips, bridges, communication towers, etc.; activities associated with the various phases of development (exploration, construction, operations, and decommissioning), including human activity, drilling, pumping and storage, operation of vehicles, aircraft, vessels, etc.; and effects from emissions (such as air pollution and

dust), waste disposal (such as produced water, lubricants, and garbage), and spills and releases of oil or other hazardous materials.

The mechanisms by which infrastructure, activities, and emissions associated with oil and gas development cause impacts on physical, biological, and social systems are varied and complex. Typically, a given impact source will have multiple effects across resources. For example, infrastructure development effects on biological systems include, but are not limited to, direct and indirect habitat destruction or alteration; changes to species distribution; disturbance; displacement; interference with movement/migration; mortality and health effects. These effects may occur directly (e.g., bird mortality by collisions with structures) or indirectly by interfering with a natural process, such as drainage patterns that affect water availability that in turn affects the health and survival of vegetation and animals. Infrastructure development and operation may also affect social systems, for example, when facility construction requires disturbance of a cultural resource site and simultaneously creates a visual impact on nearby villages.

Effects of Oil and Gas Development on Subsistence Activities

Of primary concern to RMS stakeholders are the effects of oil and gas development on subsistence activities. Subsistence systems provide food security and other economic values, but they are also important to social and cultural systems (BLM 2012). Subsistence activities encompass sharing and distribution networks, cooperative hunting and fishing, and ceremonial activities. Subsistence hunting and other features of the subsistence way of life embody cultural, social, and spiritual values that are essential to Alaska Natives. Consequently, direct impacts from oil and gas development either to subsistence resources or the ability of Alaska Natives to harvest subsistence resources typically cause a variety of important indirect socioeconomic and health impacts, which are discussed below.

- **Loss of Traditional Use Areas.** Depending on the location of oil and gas facilities and related infrastructure, the project's "footprint," (i.e., the acreage that is actually occupied by facility components) can have a direct impact on subsistence use areas, particularly those used for fishing and for hunting caribou, geese, and furbearers such as wolf and wolverine. In addition to land areas occupied by the facilities themselves, hunters are likely to avoid areas up to several miles away from the facilities, per the discussion under "avoidance of developed areas" below. As a result, development could result in an area much larger than the "footprint" area of the facility being effectively removed from the traditional harvest area of a given community. This can reduce the amount of subsistence harvesting for individuals or result in additional travel distance or time to obtain subsistence resources in other areas. Reduced subsistence harvesting may have negative health effects and negative economic and social impacts (see below). The increased travel has a variety of negative effects, including greater expenditure of time for subsistence activities, greater expenditures for vehicle fuel and repairs, and potential health impacts from additional travel-related accidents.

- **Access to Subsistence Areas.** The presence of oil and gas infrastructure and associated facilities (e.g., roads) can limit subsistence users' access to subsistence areas. Subsistence users may be forced to travel longer distances to avoid physical obstacles related to oil and gas infrastructure, experience physical problems using or crossing roads or crossing under pipelines, or find that travel through a certain area may be prohibited or restricted. As a result of reduced access to subsistence areas, subsistence users may have to travel farther to harvest subsistence resources, which increases time, travel, and other costs associated with subsistence activities.

- **Avoidance of Developed Areas.** Subsistence users may avoid areas of oil and gas activities. Reasons for avoiding development include: (1) the concern that discharging a firearm near the various facilities and infrastructure will result in liability for damage, death to a worker, or serious environmental consequences (e.g., an oil spill from a punctured pipeline); (2) previous negative experiences dealing with oil field security and personnel; (3) the belief that animals habituated to oil and gas infrastructure are contaminated and not safe for human consumption; and (4) other spiritual and aesthetic aversions to being on the land and hunting or fishing near infrastructure.

  Avoidance of developed areas may extend for several miles from the actual location of facilities, thus potentially affecting a much larger area. As noted above, avoidance of the total area of any development in the planning area and lands around it could effectively remove the area from the traditional harvest area of a given community. If concerns about food contamination lead to reduced consumption of subsistence resources, this may increase the consumption of non-subsistence foods, which can in turn lead to economic problems, food security problems, and social, cultural, and possibly mental (stress, anxiety, depression) and physical (nutrition) health issues.

- **Aircraft Disturbance.** The noise and visual disturbance associated with aircraft overflights can disturb animals and disrupt hunts when low-flying aircraft spook the animals. Reduced hunting success may mean that additional money and time are required for additional hunting expeditions, or to purchase commercial meat. Hunters cannot avoid disturbance from aircraft by avoiding permanent infrastructure; therefore, impacts from aircraft can cause more acute stress and disruption, which can sometimes turn into long-term stress and financial and food-security issues throughout the year. Lack of hunting success due to aircraft disruption can lead to reduced subsistence resource consumption, which, as noted above, can have negative economic, social, and health effects. Noise from air traffic could also create a nuisance around individuals' camps and cabins, possibly reducing their use as a base for subsistence harvests.

- **Disruption of Migrating Subsistence Species.** Noise, traffic, odors, and infrastructure associated with oil and gas exploration, facility construction and

operation, and decommissioning could affect the availability of key resources such as caribou, waterfowl, and furbearers. Migrating subsistence species such as caribou may be displaced from areas of oil and gas activity, resulting in long-term localized effects. If subsistence species move away from areas of development, they could become more difficult to locate and harvest.

- **Direct Damage to or Contamination of Subsistence Resources and Habitats.** A small number of fish could be injured or killed, potentially affecting harvests in localized areas. Waterfowl might also avoid traditional harvest locations. Oil spills that enter water could contaminate or cause concerns about contamination of marine mammals and fish, which can lead to reduced consumption of subsistence resources, with potential subsequent negative economic, social, and health effects.

- **Cumulative Effects.** Overall, future development is expected to increase the severity of existing impacts, including: continued hunter avoidance of industrial areas, continued disturbance of hunters and wildlife from increased air and road traffic, reduced access to or loss of subsistence use areas, and reduced availability of subsistence resources in developed areas. There could also be substantial cumulative effects from climate change, including the inability to travel during the short goose-hunting season.

Social and Cultural Impacts of Oil and Gas Development

Oil and gas development has a variety of positive and negative social and cultural impacts. Positive impacts include increased employment opportunities and easier commuting and other travel-related social benefits associated with road development (including seasonal connection via ice road to the Dalton Highway). As noted above, some impacts are indirect effects related to oil and gas impacts on subsistence resources and activities; however, oil and gas development also has social and cultural impacts beyond subsistence.

- **Subsistence-Related Social and Cultural Impacts.** Subsistence hunting and harvesting activities are central to the cultural identity and social cohesion of North Slope communities. Because the subsistence way of life embodies cultural, social, and spiritual values that are essential to Alaska Natives, impacts on subsistence resources and activities may lead to a variety of important social and cultural impacts.

  Impacts on subsistence resources and activities may lead to reduced consumption of subsistence resources, which in turn may lead to economic and socio-cultural impacts. However, the devaluation of the cultural landscape is also a direct, indirect, additive, and cumulative impact related to subsistence. Residents believe that the cultural, spiritual, or other personal value placed on their families' camping, hunting, and fishing sites is

substantially diminished when industrial infrastructure is developed nearby. There may be a loss of spiritual connection to the land.

If subsistence impacts lead to decreased participation in subsistence activities, this could have impacts on future generations, as harvesters may no longer be able to teach younger hunters about subsistence uses in traditional harvesting areas. Decreased subsistence harvesting and reduced participation in subsistence activities could lead to decreased sharing, decreased cooperative hunting and fishing, as well as decreased participation in subsistence-related ceremonies, all of which contribute to the social fabric of Alaska Native communities.

Finally, issues surrounding subsistence and impacts from oil and gas development on the subsistence lifestyle may be a significant source of stress within North Slope communities. This stress is compounded by concerns over the additional and synergistic effects of climate change, competition with sport hunters, and other impact sources on the subsistence lifestyle.

- **Other Social and Cultural Impacts.** Oil and gas development increases employment opportunities, and new roads may make it easier for residents to travel, including travel to work for those who work in the oil field. However, there are impediments to local employment in the oil field due to cultural issues and the lack of adequately trained local residents.

  The permitting process involves a substantial amount of scoping, testimony, interviews, surveys, and requests for comments on observations and impacts. Such questions can elicit emotions and experiences that are linked to several decades of interactions with outsiders requesting information. Anxiety and intra- and inter-community conflict over the continuous overload of bureaucratic and legal processes involved with permitting and development is a source of frustration and disenfranchisement for Alaska Natives. Keeping track of oil company activities and NEPA or similar processes is a drain on residents' time and resources, and can be overwhelming. Disagreement and conflict over differing attitudes toward development, the use of new roads, and related topics is generated within individuals, families, the community itself, and with other North Slope communities. Although the economic benefits of oil development are substantial and widespread, disparities in the economic benefits accrued by residents (e.g., village ANCSA corporation shareholders and non-shareholders) that result from development can also be a significant source of tension.

  Oil and gas development increases contacts between Alaska Natives and non-Natives, such as non-resident workers. While there are positive aspects to the cultural interactions, negative aspects include, but are not limited to, the importation of alcohol into villages or lifestyles in conflict with traditional cultural values, which have both negative social and health impacts.

- **Cumulative Effects.** Increasing development activities on the North Slope may result in more residents obtaining employment in the oil and gas industry. Climate change could affect subsistence resources and land uses, creating significant social anxiety for the Iñupiat. Expected cumulative impacts include a mixture of socio-cultural benefits and adverse impacts that are major in extent.

Effects of Oil and Gas Development on Public Health

Oil and gas development may have a variety of positive and negative effects on public health. Increased income for individuals or families may improve health in affected communities through increases in the standard of living, reductions in stress, and opportunities for personal growth and social relationships. Increased income and employment opportunities may also improve diet and nutrition by providing money to fund subsistence activities. There also may be positive impacts on public health as a result of increased access to health care and facilities. Negative impacts on public health could result through changes in diet, nutrition, exercise, environmental exposures, infectious disease, safety, and acculturative stress. Similarly to social and cultural impacts, health impacts can result from impacts on subsistence resources and activities or from other causes not related to subsistence.

- **Subsistence-Related Public Health Effects.** Subsistence-related public health effects stem primarily from increased travel related to subsistence harvesting and changes in diet, nutrition, and exercise. When subsistence harvesters are forced to travel farther to harvest subsistence resources, this may increase travel times and costs for subsistence activities, and could potentially decrease harvests and increase risk of injury and travel-related accidents.

  For some individuals, decreased success in subsistence harvesting leads to various hardships that increase emotional stress, and, as noted above, concern about impacts on subsistence activities are a general source of emotional stress for North Slope communities that may lead to negative health effects, especially if it contributes to depression, anxiety, or increased substance abuse. Similarly, individual, intra-community, and inter-community conflict and associated stresses related to oil and gas development concerns may cause emotional stress that results in negative health effects.

  Decreased consumption of subsistence resources, regardless of whether it is caused by avoidance of traditional use areas, decreased success at hunting caused by aircraft overflights, inadequate resources, or other causes, may affect diet and nutrition. If residents are unable to obtain adequate supplies of subsistence foods, they may shift to consuming commercially available foods, sometimes referred to as a “Western” diet, which may result in negative health outcomes, such as increased rates of diabetes, metabolic disorders, and associated chronic diseases.

- **Other Public Health Effects.** Impacts on public health not associated with subsistence impacts include environmental exposures, increases in infectious diseases, safety, acculturative stress, economic impacts, and the capacity of local health care services.

  Oil and gas development is associated with impacts on air and water quality that can have negative health effects for at-risk populations when they are exposed to hazardous substances, for example, though poor air quality episodes or contamination of food sources or water supplies. An associated public health impact is increased stress associated with concerns about how to respond to health and safety incidents that could occur at oil and gas facilities, such as blowouts or breaches of pipelines or the additional risk posed by natural events such as floods..

  An influx of non-resident workers to local communities may increase exposures to communicable disease, alcohol and drug use for local residents, as well as increasing stress and mental health issues associated with these activities. There may also be an increased prevalence of social pathologies, including substance abuse, assault, domestic violence, and unintentional and intentional injuries associated with economic growth.

  The development of permanent and seasonal roads in the region also has the potential to induce increased travel and raises the risk of subsequent accidents and injuries.

- **Cumulative Effects.** Future oil and gas development could cause cumulative effects through impacts on subsistence that have negative health effects and from impacts on air quality, water quality, or spills. There could also be cumulative effects associated with climate change, through stress-related climate change impacts on subsistence and increased injury and trauma from longer and more difficult subsistence harvesting.

Environmental Justice Issues Associated with Oil and Gas Development

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," formally requires federal agencies to evaluate the potential for environmental justice impacts arising from their actions (Federal Register 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of oil and gas development in the Northeastern region of the NPR-A on environmental justice issues follows guidelines described in the Council on Environmental Quality's (CEQ's) Environmental Justice Guidance under the National Environmental Policy Act (CEQ 1997). The analysis method involves the description of the

geographic distribution of low-income and minority populations in the affected area, the assessment of whether the impacts of the development would produce impacts that are high and adverse; and if impacts are high and adverse, determination as to whether these impacts disproportionately affect minority and low income populations.

Oil and gas development under the RFDS is expected to have substantial environmental justice impacts on local communities, based on (1) findings that the community of Nuiqsut includes a minority population and (2) findings of major impacts on socio-cultural systems and subsistence. Negative impacts are anticipated to affect lower-income residents disproportionately, as they are more dependent on subsistence resources, but less capable of adapting to subsistence impacts. If subsistence harvests decrease as a result of oil and gas-related impacts, or subsistence-related travel costs increase, lower-income residents may be unable to spend more money on fuel and other subsistence-related expenses, and may be less able to shift to more expensive commercial food sources, thereby potentially experiencing decreased food security. The Iñupiat of the North Slope are also disproportionately impacted by climate change. Economic benefits related to oil and gas production are a countervailing positive impact. Based on all accumulated evidence and local testimony, it is reasonable to anticipate that other oil and gas projects will result in cumulative environmental justice impacts.

Oil and Gas Development Impacts on Ecological Systems: Air, Water, Vegetation, Fish, Birds, and Mammals

Oil and gas development under the RFDS will cause impacts on ecological systems, including air and water resources, plants, fish, birds, mammals, and other wildlife, and several threatened and endangered species.

- **Air Quality.** During construction, there could be short-term and transient emissions from fuel-burning equipment, drilling emissions, and fugitive dust sources. During operation, there could be ongoing and long-term emissions from heaters, vehicles, and other stationary and mobile sources; emissions from flaring; and fugitive dust. Cumulative impacts are difficult to estimate but are expected to be minimal. Impacts could result from increased air emissions, including fugitive dust, pollutants, and greenhouse gases.

- **Water Quality.** Long-term impacts on local water resources could result from the placement of new infrastructure, including changes in drainage patterns and changes in stream flow. There would be short-term, temporary impacts from ice infrastructure (e.g., roads and pads). Cumulative effects would probably be small in magnitude and most impacts would be local in nature. Impacts could result from changes in surface drainage due to construction of roads and pads, and loss of wetlands and associated functions largely from construction of roads and pads and gravel mine development.

- **Vegetation.** Expected direct impacts on vegetation include removal as a result of the construction of oil and gas infrastructure, including construction of

roads and pads and gravel mine development. There could also be indirect impacts from gravel, spray, and dust deposition near graveled surfaces. Areas of direct and indirect impacts could be within potential wetlands. Climate change and oil and gas and other development would contribute to cumulative effects. Impacts could include loss of upland and wetland vegetation communities and their associated functions, alteration of plant communities as a result of dust deposition, soil salinity change, increased snow drifting, changes to natural drainage patterns, and increased probability of colonization by non-native, invasive species.

- **Fish.** Expected impacts on fish would include injury at water-use intakes, barriers to fish movement, and impacts associated with altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, and increased turbidity and sedimentation. Collectively, these impacts could contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. Cumulative effects would likely be minor and localized.

- **Birds.** Expected impacts on birds include mortality and impacts on bird behavior, and nesting, brood-rearing, foraging, and molting habitats through habitat loss and alteration, disturbance from noise and visual activity, displacement from habitats, or attraction to habitats altered by thermokarst and early green-up adjacent to gravel infrastructure. If climate change over the next several decades were to result in substantial changes in weather patterns, then changes to vegetation types and distribution, insect abundance and timing of emergence could occur, and habitat disturbance impacts from oil and gas activities could be exacerbated. Cumulative effects, exacerbated by climate change, could include loss of bird habitat, long-term in duration, localized, and minor. Some residual adverse effects (on a small number of birds) could include direct and indirect loss of habitat, habitat fragmentation and behavioral alternation due to avoidance of developed infrastructure, vehicle traffic, and human activity; and mortality from collisions with human infrastructure or vehicles.

- **Mammals.** Expected impacts on mammals include:
  - Physical habitat changes; displacement from (or attraction to) altered habitats; disturbance from noise or activity; obstruction of movement from construction activities.
  - Collisions (mortality); disturbance and obstruction of movement from vehicles or air traffic; defense of life and property (mortality); increased hunting; premature den emergence (grizzly bear) associated with vehicle and aircraft traffic and human activity during drilling and operations phases.
  - Obstruction of movement by pipelines and spills or leaks causing exposure to toxic materials from pipelines during drilling and operations phases.

  - Possible avoidance by parturient female caribou of marginal calving habitat.
  - A variety of cumulative impacts, including impacts associated with climate change, vegetation change, and other causes.

Impacts include wildlife habitat fragmentation; loss or alteration of habitat; behavioral disturbance by anthropogenic activities resulting in short-term displacement, deflection of movement or delay of movement; mortality; or altered survival or productivity.

- **Threatened and Endangered Species.** Threatened and endangered species subject to impacts under the RFDS include polar bear, spectacled eider, and Steller's eider; however, there are no Steller's eider found within the area of impact under the RFDS, and therefore no impacts are expected.

  Expected impacts on polar bears include denning habitat loss or alteration, disturbance or displacement of denning females and cubs, incidental harassment of polar bears transiting the project study area, intentional hazing near occupied work sites, and mortality due to collisions or defense-of-life kills. There could be cumulative impacts from climate change and other development, including near-shore or offshore oil and gas development.

  Expected impacts on spectacled eiders include habitat loss and alteration, disturbance and displacement, obstruction of movement, mortality from various causes, and impacts from spills. There could be impacts on a *small number* of nesting, brood-rearing, and staging spectacled eiders. Impacts could result from habitat destruction and fragmentation, disturbance, vehicle and air traffic, spills of hazardous materials, including oil spills and mortality from collisions with human infrastructure or vehicles.

Other Effects of Oil and Gas Development

In addition to the impacts described above, oil and gas development under the RFDS, regardless of where it would occur in the region, would also have impacts on the following resources or processes:

- **Climate and Meteorology:** Negligible impacts from greenhouse gas emissions.

- **Climate Change:** Negligible impacts from greenhouse gas emissions and particulate matter.

- **Cultural Resources:** Moderate direct and indirect impacts from ground disturbance, effects on subsistence activities and traditional use areas, and visual and noise impacts. Minor cumulative impacts. Impacts through direct impacts on artifacts and traditionally used sites and visual and noise impacts.

- **Economy:** Minor positive impacts from increased oil and gas revenues. Negative cumulative impacts from climate change.

- **Geology and Mineral Resources:** Minor impacts from drilling and annular disposal and injection of fluids.

- **Land Use:** Moderate direct impacts from construction of gravel pads, roads, and airstrips; excavation of gravel from the mine site; and installation of vertical support members (VSMs). Change from less to more intensive land uses and changes arising from new roads providing access to new areas. Cumulative impacts from other oil and gas projects. Impacts from development of previously undisturbed areas.

- **Noise:** Minor impacts on communities and wildlife from construction (short-term), drilling, gravel mining (short-term), vehicles, and aircraft. Cumulative impact from multiple projects.

- **Oil, Saltwater, and Hazardous Materials Spills:** Increased risks of spills, primarily related to equipment failure, on land. Minor cumulative impacts from multiple projects.

- **Paleontological Resources:** Negligible impacts expected.

- **Petroleum Resources:** The purpose of development is to utilize petroleum resources, for which royalties are paid. Cumulative impacts from other oil and gas projects and from climate change.

- **Recreation:** Negligible impacts from the presence of permanent facilities and associated noise. Cumulative impacts from other development and climate change.

- **Sand and Gravel Resources:** Minor impacts from loss of sand and gravel resources and effects from gravel mining. Impacts from loss of sand and gravel resources.

- **Soils and Permafrost (also Physiography/Geomorphology):** Minor impacts from loss of soil productivity due to road and pad construction and gravel mine development; minor impacts on thermal regime of permafrost from placement of gravel fill on the tundra; snowdrifts caused by gravel structures and blockage of natural drainage patterns. Soil compression, displacement, altered soil moisture, and effects of spills from construction and operation of oil and gas infrastructure. Cumulative effects from climate change.

- **Transportation:** Minor impacts from construction-related traffic on ice roads; interference with some winter travel on frozen channels from construction activities; additional local transportation options from new roads; and

increased air traffic. Cumulative effects from construction of new roads in roadless areas.

- **Visual Resources:** Minor impacts from visibility of oil and gas facility construction activities and infrastructure (including lighting at night) during operations. Cumulative effects from other developments and from climate change. Impacts from infrastructure and lighting visibility.

APPENDIX C REFERENCES

BLM 2012. *National Petroleum Reserve – Alaska Final Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Nov. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2014. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Oct. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

Council on Environmental Quality (CEQ) 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Available at: http://energy.gov/nepa/downloads/environmental-justice-guidance-under-nepa-ceq-1997. Accessed July 1,2016.

Federal Register. 1994. *Federal Register*, Volume 59, page 7629, February 16.

APPENDIX D:

IMPACT ASSESSMENT SUMMARY TABLE

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APPENDIX D:

IMPACT ASSESSMENT SUMMARY TABLE

The following table summarizes the Bureau of Land Management and Argonne National Laboratory subject matter expert responses to the process steps and criteria used to identify the residual impacts that are likely to occur as a result of oil and gas development in the Alaska oil and gas Northeastern NPR-A. The process steps and criteria for identifying residual impacts are outlined in Section 2.3 of this document.

Northeastern NPR-A RMS Reasonably Foreseeable Development Scenario Summary Impacts Table

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Air Quality	**Moderate Impacts.** • During construction, short-term and transient emissions (including fuel combustion emissions from heavy equipment and small electric power generator engines, heaters, and other fuel-burning equipment); drilling emissions; and fugitive dust sources. • During operation, ongoing and long-term emissions from a heater; tailpipe emissions from vehicle travel; minor fugitive emissions of field gas from equipment and pipeline components; fuel combustion emissions from fuel-fired heaters, boilers, engines, storage tanks for flowback fluids, and other mobile sources; emissions from flaring at APF; and fugitive dust. **Cumulative Impacts.** Cumulative impacts to the atmospheric environment would be low due to the relatively low quantity of emissions and short duration through the construction phase compared to existing North Slope infrastructure.	• Development and implementation of an approved plan for limiting fugitive dust. • Stationary drill site equipment will be electrically powered or utilize natural gas. • Use of ultra-low sulfur diesel for all rolling stock, including portable heaters. • All oil and gas operations (vehicles and equipment) that burn diesel fuels must use “ultra-low sulfur” diesel • Powering all oil and gas operations (vehicles and equipment) by natural gas or electric power rather than diesel fuel to the extent practicable, or if not, gasoline rather than diesel. • The collection of air monitoring data both before and during the life of the project, the preparation of an emissions inventory and emissions reduction plan, air quality modeling, mitigation, changes to activities to reduce emissions, as determined necessary and appropriate by BLM, and public reporting of these data. • Road design, construction, maintenance, and operation requirements to minimize air quality impacts. • Site design and reclamation in accordance with an approved gravel mine plan. • A requirement that the permittee provide funding for monitoring to identify and address concerns related to air quality in the Nuiqsut area, develop monitoring reports, and provide funding for BLM technical review.	Increased air emissions, including fugitive dust, pollutants, and greenhouse gas (GHG).

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Birds	**Minor Impacts.** Potential mortality and impacts to bird behavior and nesting, brood-rearing, foraging, and molting habitats through habitat loss and alteration, disturbance from noise and visual activity, displacement from habitats, or attraction to habitats altered by thermokarst and early green-up adjacent to gravel infrastructure. **Cumulative Impacts.** The direct, indirect, and cumulative habitat loss of bird habitat generally would be of low intensity, long-term in duration, localized, and minor. If climate change over the next several decades were to result in substantial changes in weather patterns, vegetation types and distribution, and insect abundance, habitat disturbance impacts from oil and gas activities could be exacerbated additively, and perhaps synergistically, and extend beyond the life of the oil and gas fields. Changes in vegetation as a result of climate change would directly impact the amount and types of habitat available to tundra nesting birds. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the NPR-A, potentially leading to synergistic impacts to bird habitat.	• BMPs which ensure that solid, liquid, and hazardous wastes (including fuels) do not impact birds or their habitats, and to reduce the potential for garbage and shelters that attract predators. • BMPs and lease stipulations that protect bird habitats and food sources. • BMPs and stipulations that regulate the types of activities that can occur near water bodies, including rivers and streams, types of equipment that can be used in the planning area. • A Wildlife Avoidance and Interaction Plan and a Predator Management Plan, incorporating Federal, State, and local stipulations on wildlife interactions. • Development and implementation of a reporting system to monitor roadkill of birds and other wildlife on transportation routes. • Recommended design measures, including: – Implementing controls to minimize nesting opportunities for predatory/nuisance birds. – Designing facilities to minimize potential for bird strikes. – Limiting removal of water from freshwater lakes during the summer. – Monitoring water withdrawal volumes and water body recharge. – Timing restrictions on gravel placement on the tundra.	Some effects on birds from oil and gas activities would be unavoidable despite protective management measures: direct and indirect loss of habitat, habitat fragmentation and behavioral alternation due to avoidance of developed infrastructure, vehicle traffic, human activity, and vessel traffic in the vicinity of coastal ports; mortality from collisions with human infrastructure or vessels. The consequences of these effects are expected to last for the life of the oil and gas development and, depending on the level of rehabilitation, perhaps longer. **Molting Geese.** Some adverse impacts on molting geese would be unavoidable despite protective management measures. The additive effect of the direct/indirect effects from oil and gas activities and from a myriad of potential effects from the cumulative analysis imposed on molting geese will create some residual adverse impacts due to habitat destruction and fragmentation, disturbance, offshore development, vessel and air traffic, spills of hazardous materials, including oil spills, mortality from collisions with human infrastructure or vessels and salt water intrusion due to rising sea levels. These effects may be unavailable as these birds come from many different areas of the Northern Hemisphere to undergo molt in this location, and they have very strong preferences to specific areas and vegetation types, and it has been shown that they are especially sensitive to disturbance during this life stage. **Brood-Rearing Geese.** Some adverse impacts on brood-rearing geese would be unavoidable despite protective management measures. The additive effect of the direct/indirect effects from oil and gas activities and from a myriad of potential effects from the cumulative analysis imposed on

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Birds (Cont.)			geese rearing broods will create some residual adverse impacts due to habitat destruction and fragmentation, disturbance, offshore development, vessel and air traffic, spills of hazardous materials, including oil spills, mortality from collisions with human infrastructure or vessels, and salt water intrusion due to rising sea levels. These effects may be unavoidable as these birds have very strong preferences for specific habitats and vegetation types.
Climate and Meteorology	**Negligible Impacts.** Construction and operations activities would generate GHG emissions, but due to the quantity and duration of these emissions, project impacts to climate and meteorology are expected to be negligible.	See air quality RFDS BMPs and stipulations.	Negligible.
Climate Change	**Negligible Impacts.** The project would produce direct and indirect GHG emissions (carbon dioxide, methane, and other gases) that contribute to climate change. The project would also generate particulate matter that might affect climate. **Cumulative Impacts.** Cumulative effects of an individual project on climate change cannot be determined. Although the project is not anticipated to cumulatively impact climate change, the cumulative effect of climate change is likely more pronounced on the North Slope than elsewhere in Alaska and may include an increase in particulate matter to the extent shallow lakes and ponds dry up or are smaller, watersheds would experience a change to drier soils, and thermokarsting may increase as ice-rich permafrost becomes unstable with increases in ambient surface temperatures.	See air quality RFDS BMPs and stipulations.	Negligible.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Cultural Resources	**Moderate Impacts.** • Destruction or damage to the landscape through ground disturbing activity; restricted access to multi-generational camps, hunting areas, and travel routes; and destruction or degradation of cultural sites or areas through construction activities or incidents associated with project activities. • Indirect impacts from altering the way subsistence hunters access hunting and fishing areas; altering routes used to access hunting areas and to travel between villages, cabins, and camps; decreased landscape use near project components and loss of cultural association with those areas; and gradual shifting of cultural activities away from areas within the cultural landscape due to avoidance of project components. • Visual and noise impacts to the cultural landscape caused by construction, operation, and reclamation of project components; changes to the viewshed due to project components; and the introduction of new landmarks associated with industrial infrastructure in culturally sensitive areas. **Cumulative Impacts.** Because of the varying circumstances of occurrence surrounding the location and vulnerability of cultural resources, the significance of future cumulative impacts is difficult to assess. However, the cumulative impact would be expected to be minor.	• Certain design and operational features described in Chapter 2 of the FSEIS. • Requirement to conduct a cultural and paleontological resources survey prior to any ground-disturbing activity, and to notify the authorized officer and suspend all operations in the immediate area in the event of a discovery. • Information and training for personnel concerning applicable stipulations, BMPs, standards, and regional environmental, social, traditional, and cultural concerns. • Prohibition of permanent facilities in the streambed and adjacent to certain rivers. • Prohibition of permanent facilities on the lake or lakebed and within ¼ mile of the ordinary high water mark of any lake zone III deep lake. • Permit by BLM, on a case-by-case basis, to allow low ground-pressure vehicles to travel off of gravel pads and roads at certain times. • CPAI's built-in design mitigation measures.	Direct impacts to artifacts and traditionally used sites (destruction, damage, removal, change in use, loss of cultural identity) will be limited to the project footprint during construction and operation. These could be caused by excavation of gravel, construction and maintenance of gravel roads and pads, airstrips, bridges, culverts, and construction of ice roads or any ground disturbance. Visual and noise impacts could occur over a larger area. The impacts to the cultural landscape will be detectable and moderate due to pre-activity inventories and surveys.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Economy	**Minor Impacts (positive).** • Increased economic activity in the State, the North Slope Borough (NSB), and Nuiqsut. • Increased revenues to the State, the NSB, and Nuiqsut, resulting from shared royalties, taxes, NPR-A grants, and other fees. • Increased revenues to Alaska Native corporations from shared royalties. • Increased job opportunities. • Additional indirect positive impacts from spending by workers and government spending. • Increased oil production in the Alaska North Slope that will result in additional secondary economic impacts. **Cumulative Impacts.** Overall cumulative economic impacts resulting from increased development on the North Slope would have benefits at State, regional, and local levels. Climate change could negatively impact the economy for the North Slope; because villages are primarily located at or near sea level, any increase in mean sea level or violent storms may require relocation of part or all of villages and subsistence camps. This would have a major negative economic impact to the villages and the NSB, and a substantial impact to the State if it must help fund the relocation.	None.	None. Impacts are positive.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Environmental Justice	**Major Impacts; disproportionately high and adverse impacts to a minority population.** Overall, impacts are expected to be long-term and of high intensity. The improved permanent access to subsistence use areas is expected to have a long-term, moderate beneficial effect for many residents of Nuiqsut while significantly diminishing the traditional and subsistence value of the area due to loss of land, disturbance to and possible deflection of resources attributable to the stature of the road, road traffic, the presence of the pipeline, and increased local hunting pressure. **Cumulative Impacts.** Overall, the GMT1 project in addition to other current and reasonably foreseeable future activities could increase the severity of existing impacts on Nuiqsut, Atqasuk, Wainwright, Point Lay, Barrow, and Anaktuvuk Pass. As oil and gas development activities occur over a larger area, direct impacts to the Iñupiat would be significant and could have long-term impacts affecting both current and future generations.	See mitigation for subsistence activities and resources.	The overall impacts to the minority community of Nuiqsut from GMT1 are expected to be long-term and high intensity. Environmental justice impacts are based on findings of major impacts to socio-cultural systems and subsistence. Negative impacts will affect lower-income residents more intensely, who are less capable of adapting to subsistence impacts. Economic benefits are a countervailing positive impact. **Cumulative.** Potential impacts to subsistence are considered as significant environmental justice issues. Socio-cultural systems impacts due to the conflict and tensions over the permitting process and disproportionately shared economic benefits of development are expected to increase with subsequent development. Climate change impacts the Iñupiat of the North Slope disproportionately and Iñupiaq subsistence activities are particularly dependent on ice, wind, and permafrost conditions. The cumulative impacts to the communities of Nuiqsut, Point Lay, Wainwright, Atqasuk, Anaktuvuk Pass, and Barrow would likely be additive to the extent that other reasonably foreseeable developments within the cumulative impacts evaluation could deflect or divert subsistence resources further away from the communities.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Fish	**Minor Impacts.** Potential impacts include: • Injury at water-use intakes, • Altered water quality, • Physical habitat changes (water quantity, flow patterns, and geomorphology), • Point and non-point source pollution, • Increased turbidity and sedimentation, and • Barriers to fish movement. Collectively, these impacts could contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. **Cumulative Impacts.** Direct, indirect, and cumulative impacts to fish and fish habitats are expected to be localized, minor, and additive, and are not expected to be synergistic.	The following BMPs and lease stipulations: • Requirements for pumpable waste injection and temporary mud and cuttings storage. • Requirements for impermeable containment, spill prevention, and response planning. • Prohibition of equipment refueling and fuel storage exceeding 210 gallons within 500 feet of the active floodplain of any water body. • Prohibition of surface discharge of reserve-pit fluids, and winter water withdrawals from rivers and streams. • Limits, restrictions, and required procedures for water withdrawals. • Required practices for streambank protection. • Requirements for location of winter transportation bridges. • Prohibition on permanent oil and gas facilities being constructed within 500 feet from fish-bearing water bodies. • Requirements for pipeline construction and operation, and separation of roads and pipelines. • Minimization of impervious surfaces by encouraging a reduced development footprint. • Requirements for marsh and stream crossings. • Requirements for approval of the gravel mine site design and reclamation. • Requirements for hydrology and fish studies to determine the appropriate structures at stream channel crossings. • Restrictions on drilling in rivers, streams, and fish-bearing lakes. • Requirements for siting facilities and infrastructure (including pipelines) away from certain waterbodies. • Restrictions on discharge of pollutants from vehicle and equipment use, personnel camps, and produced fluids. • Setbacks from major rivers, including Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River. • Setbacks from deep water lakes.	Reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Geology and Mineral Resources	**Minor Impacts.** Bedrock geology would be locally impacted by drilling of production wells. A minor amount of bedrock would be disturbed and relocated to the surface during drilling. Annular disposal and injection of fluids could impact subsurface geology.	See soils and permafrost RFDS BMPs and stipulations.	Bedrock disturbance and subsurface geology impacts.
Land Use (land ownership, use, and management)	**Moderate Impacts.** • Direct impacts from construction of gravel pads, roads, and airstrips; excavation of gravel from the mine site; and installation of VSMs. • Land use would change from primarily undeveloped land used principally for wildlife habitat, subsistence, research, and some recreation, to further oil and gas development (industrial use). With the project construction, industrial land uses would dominate in the immediate vicinity of the project footprint. • Use of the land and access would be changed by the construction of the CD5-GMT1 road. The CD5-GMT1 road would provide vehicle (e.g., off-road vehicle [ORV]) access to new areas. **Cumulative Impacts.** Cumulative impacts to land use from oil and gas exploration, development, and production in the NPR-A and across the North Slope will result in development of previously undisturbed areas and will change the character of land use, resulting in increases in noise and disturbance, and potentially adversely affect habitats and subsistence. Most of the cumulative impacts from future development were expected to be localized to the development facilities.	The following design measures: • Consulting with land owners or managers within or adjacent to the project area. • Ensuring project activities do not encroach on Native allotment or traditional land use sites through survey and demarcation. • Avoiding any trespass or impact to any allotment. BMPs requiring the following: • Areas of operation shall be left clean of all debris. • Preparation and implementation of a hazardous materials emergency contingency plan and a comprehensive spill prevention and response contingency plan. • Restrictions on refueling of equipment and location of fuel storage stations near floodplains and water bodies. • The collection of air monitoring data both before and during the life of the project, the preparation of an emissions inventory and emissions reduction plan, air quality modeling, mitigation, changes to activities to reduce emissions, as determined necessary and appropriate by BLM, and public reporting of these data. • Restrictions on the timing, locations, procedures, and equipment used for various activities that could potentially cause erosion and other types of damage to the tundra and soils. • BMPs for the construction and maintenance of crossings of waterway courses.	Development of previously undisturbed areas within the subsistence use area for Nuiqsut will change the character of land use, resulting in increases in noise, odors, and disturbance, and potentially adversely affect habitats and subsistence uses.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Land Use (land ownership, use, and management) (Cont.)		• Road design, construction, maintenance, and operation requirements to minimize impacts and to protect subsistence use and access to subsistence areas. • Siting and facility design requirements to minimize the project footprint. • Site design and reclamation in accordance with an approved gravel mine plan. • Altitude restrictions for aircraft used for permitted activities. • Information and training for personnel concerning applicable stipulations, BMPs, standards, and regional environmental, social, traditional, and cultural concerns. • Setbacks of project facilities from portions of Fish Creek and from the Ublutuoch (Tiŋmiaqsiġvik) River.	
Mammals (Marine)	**Negligible Impacts.** Impacts on spotted seals, bearded seals, beluga whales, or other marine mammals rarely occurring off the coastline of Harrison Bay are not expected. If a large oil spill reaches open water during summer or fall, small numbers of beluga whales, bearded seals, and larger groups of spotted seals could be negatively impacted by contact or ingestion of hydrocarbons. **Cumulative Impacts.** The overall cumulative impact to marine mammals, notably beluga whales, spotted seal, and bearded seal, for the Harrison Bay and Colville River delta for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible.	None; however, possible impacts from large oil spills are mitigated by BMPs and stipulations for spills (see below).	Seismic surveying, air and boat traffic, and construction activities may disturb small numbers of seals or whales, but events of this nature would be brief and would be unlikely to impact population levels or distribution. Noise from offshore drilling activities may also disturb some species and would be more long-term in nature. Increased barge traffic will likely displace some migrating whales and possibly other marine mammals. Large spills from offshore developments could cause significant mortality events, but such spills are low-probability events, so resultant mortality events would also be unlikely.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Mammals (Terrestrial)	**Minor Impacts.** • Physical habitat changes, including hydrologic alteration long-term vegetation loss, dust impacts; displacement from (or attraction to) altered habitats; disturbance from noise or activity; obstruction of movement from construction activities. • Collisions (mortality), disturbance and obstruction of movement from vehicles or air traffic; defense of life and property (mortality); increased hunting; premature den emergence (grizzly bear) associated with vehicle and aircraft traffic and human activity during drilling and operations phases. • Obstruction of movement by pipelines and spills or leaks causing exposure to toxic materials from pipelines during drilling and operations phases. **Cumulative Impacts.** Cumulative impacts on caribou are within the range of cumulative impacts from oil and gas activities considered by BLM. If climate change results in widespread changes in vegetation composition and insect abundance, disturbance effects of oil and gas activities to terrestrial mammals could be exacerbated. If these cumulative effects reduced caribou populations, there could also be a reduction in the abundance of predators such as wolves, bears, and wolverines. Other impacts that could prove to be synergistic rather than additive are the combined effects of vegetation change (from both human activities and climate change) and climate change-induced weather patterns on the productivity of all mammalian populations; vegetation change, climate change induced	BMPs requiring the following: • Areas of operation shall be left clean of all debris. • Preparation and implementation of comprehensive waste management, hazardous materials emergency contingency, and comprehensive spill prevention and response contingency plans. • Restrictions on refueling equipment and fuel storage station location near floodplains and water bodies. • Prohibition of surface discharge of reserve-pit fluids and discharge of produced water in upland areas and marine waters. • Preparation and implementation of bear-interaction plans. • If an oil spill with potential impacts to public health occurs, consideration by BLM of the effects on subsistence food sources. • Restrictions on certain activities near grizzly and polar bear dens and seal birthing lairs, and the conduct of surveys to identify bear dens and seal birthing lairs. • Design of pipelines and roads to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. • Site design and reclamation in accordance with a gravel mine plan approved by the authorized officer. • Preparation of an ecological land classification map of the development area and geographical information system (GIS) files for all new infrastructure construction. • Altitude restrictions for aircraft used for permitted activities. • Information and training for personnel concerning applicable stipulations, BMPs, standards, and regional environmental, social, traditional, and cultural concerns. • Permitting (on a case-by-case basis) low ground-pressure vehicles to travel off of gravel pads and roads.	Wildlife habitat fragmentation; loss or alteration of habitat; behavioral disturbance by anthropogenic activities resulting in short-term displacement, deflection of movement or delay of movement; mortality (e.g., vehicle strikes); or altered survival or productivity (e.g., altered energy balance leading to increased mortality or reduced parturition rates.)

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Mammals (Terrestrial) (Cont.)	weather patterns, increased insect activity, and year-round development effects on the productivity of caribou populations; and of predation, oil development, and climate change on muskoxen.	• Prohibition against chasing wildlife with vehicles. • Surveys for the Alaska tiny shrew in certain areas. • Development of a Wildlife Avoidance and Interaction Plan and Predator Management Plan. • Seasonal ground vehicle traffic restrictions. • Provision of an annual bird and mammal roadkill report.	
Noise	**Minor Impacts.** Noise sources include construction activities, drilling, and gravel mining; stationary sources such as generators and compressors; and mobile sources including heavy earth-moving equipment, large gravel-haul trucks, tractor-trailers, oil field service trucks, pickups, and other vehicles. Noise from aircraft overflights, landings, and takeoffs will be also be generated. Noise generated by construction, drilling, and operation of the project would impact the community of Nuiqsut and subsistence resources including caribou, birds, and other wildlife. Impacts are expected to be temporary. **Cumulative Impacts.** The direct, indirect, and cumulative impact from noise associated with the proposed GMT1, conceptual GMT2, and completion of CD5 and the Nuiqsut Spur Road would be moderate and long-term. Noise from construction and gravel mining would be limited primarily to the winter months and would terminate after about two years.	• BMPs to minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. • Occupational Safety and Health Administration (OSHA) standards for worker hearing protection, if and as necessary.	See sections on fish, birds, mammals, special status species, subsistence, environmental justice (EJ), and recreation.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Oil, Saltwater, and Hazardous Material Spills	**Increased Risk of Spills.** Spill history suggests the primary type of spill would be from equipment failure. Most spills would occur to the pad area or containment and result in minor impacts. A spill that reached water (very low likelihood) could have major impacts if subsistence resources were affected. Localized impact may occur from oil or hazardous material spills. The potential impacts may be greater if oil is sprayed under high pressure into the air, creating plumes to land and/or water. Large spills that directly or indirectly enter flowing water of the rivers or creeks that discharge to Harrison Bay, the Colville River delta (including the Nigliq Channel), and Kogru River mouth could have limited impacts on some marine mammals. A pipeline spill from the CD5 to GMT1 pipeline could spill oil into the Fish Creek wetlands, which could negatively impact important bird habitat. There is potential for pipeline spills where the pipeline crosses under the road, due to corrosion of the underground portion of the pipe. Oil spilled on land could also enter lakes or ponds and could be contained by the banks of those water bodies. If a spill were to enter moving water such as rivers and streams, spreading of oil would depend on the velocity or surface currents of the moving water. **Cumulative Impacts.** The incremental cumulative impact of spills is expected to be minor for all of the action alternatives.	• Mitigation measures which require contingency planning, include setback requirements, and deal with the handling of fuel and other pollutants. • BMPs that minimize impacts from contaminants through effective hazardous materials contingency planning prior to transportation, storage, or use of fuel or hazardous substances. • BMPs that minimize the impact of fuel, crude oil, and other liquid chemical spills, including: – A comprehensive spill prevention and response contingency plan. – Setbacks for refueling of equipment and fuel storage near water bodies. – Training programs, operating procedures, monitoring, inspections, and equipment/facility specifications such as leak detection systems, oil spill response and other equipment designed for Arctic conditions. – Requirements for fuel and hazardous material storage containers. – Increased spill minimization measures at the Tiŋmiaqsiġvik (Ublutuoch) River Bridge. • Design specifications required under State-approved plans. • Measures to minimize and mitigate the occurrence of spills employed by CPAI North Slope operations.	Spills present a classic low-probability, high-risk scenario. The potential for spills increases with additional development, including the potential for spills in water. Although the risk of a large spill to water is low, the impacts to water, fish, and subsistence from a large spill in water would be high. Because most spills are small and most are on land, the incremental impact of spills is expected to be minor in the RFDS.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Paleontological Resources	**Negligible Impacts.** There are no documented paleontological resources in the project area; therefore, impacts are not expected.	Should a possible site be discovered, proper protocol for notification would be followed and setbacks established.	No impacts expected.
Petroleum Resources	**Major Impacts.** Direct impacts primarily from extraction of petroleum hydrocarbon; however, that is the purpose of the project. In context, this would constitute a loss of the committed resources, but result in beneficial economic impacts. **Cumulative Impacts:** Cumulative impacts to petroleum resources would be major due to depletion, although primarily limited to the GMT Unit. If climate change causes the permafrost to continue to warm, its ability to support structures would diminish, which could affect development on the North Slope.	None.	Loss of petroleum resources.
Physiography/ Geomorphology	**Minor Impacts.** See soils and permafrost impacts.	See soils and permafrost RFDS BMPs and stipulations.	See soils and permafrost residual adverse impacts.
Public Health	**Minor Impacts.** • Transient impacts on subsistence by diverting hunters and animals. Nuiqsut hunters could experience further limitation in their access to lands to the west of the village. Avoidance of productive land may reduce harvests and exacerbate dietary and nutritional outcomes. • Possible reduction in the use of individuals' camps and cabins as a base for subsistence harvests resulting from noise from air traffic and other sources. • Possible exacerbation of the shift away from a subsistence diet resulting from increased perception that development is causing contamination of traditional foods.	• Provision of training for employees designed to ensure strict compliance with local and corporate drug and alcohol policies. • Provision of training for employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. • Requirement for the permittee to contribute funds to create a public health monitoring program at a regional level to track health indicators that are vulnerable to impacts from oil and gas activities. • Requirement for the permittee to fund the creation of an Emergency Contingency Plan and associated Evacuation Plan for the community of Nuiqsut to identify the appropriate response by the community to a variety of health and safety events that could concur at the GMT1 development.	There would likely be low impacts to specific health issues related to water quality accidents and injuries from new roads in the area; food, nutrition, and subsistence; and non-communicable chronic diseases. Medium impacts may result from exposure to hazardous materials (for example, episodes of poor air quality); the perception of contamination of traditional foods; and social determinants of health (depression, anxiety, and resulting social ills). There may be high positive impacts to public health as a result of increased access to health care and facilities. One aspect of stress described by local residents of Nuiqsut is the uncertainty within the community of how to respond to health and safety incidents that could occur at the GMT1

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Public Health (Cont.)	• Increased travel times and costs for subsistence activities, and potentially decreased harvests and increased risk of injury and accidents resulting from avoidance by hunters of fixed production sites, particularly those near villages or in areas of heavy subsistence use. • Increased travel and risk of subsequent accidents and injuries resulting from the development of permanent and seasonal roads in the region. • Health hazards for at-risk populations from episodes of poor air quality associated with dust or emissions. • Continued funding of existing health and social programs and the preservation of the current high level of indirect employment due to revenue to the NSB and village corporations. • Increases in alcohol, drug use, and sexually transmitted infections commensurate with the level of economic growth and the degree of contact between outside workers and local populations. • Potential to improve health through increases in the standard of living, reductions in stress, and opportunities for personal growth and social relationships resulting from increased income. • Strengthened community and cultural ties and improved diet and nutrition through increased subsistence activities associated with improved income and employment. • Increased prevalence of social pathologies, including substance abuse, assault, domestic violence, and unintentional and intentional injuries associated with economic growth.	• A requirement that to the extent practicable, engines of rolling stock (such as pick-up trucks, vans, buses, other trucks and trailers, and heavy machinery) used for oil and gas operations will be powered off when not in active use. • A requirement for the permittee to contribute funding for development of an Emergency Contingency Plan and associated Evacuation Plan for the community of Nuiqsut.	development site, such as a blowout or breach of the pipeline. **Cumulative.** GMT2 and other reasonably foreseeable future projects could have an additive cumulative effect, generating potentially substantive changes in public health. The cumulative impacts of increased development to the south, west, and north of Nuiqsut may have synergistic effects with respect to disturbance of animals, and thus stress and increased travel time. The increase in development could result in a cumulative negative impact to human health resulting from impacts to air quality, water quality, or spills.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Public Health (Cont.)	**Cumulative Impacts.** Future oil and gas development could have an additive cumulative effect, generating potentially substantive changes to public health. There could be synergistic effects with respect to disturbance of animals. This may result in changes to traditional hunting grounds and may require further energy (time and travel costs) to reach these resources. Additionally, the increase in development could result in a cumulative negative impact to human health resulting from impacts to air quality, water quality, or spills. Uncertainty over the impact of climate change on subsistence resources and related traditional lifestyles and culture, combined with new conflicts in use of the Chukchi and Beaufort Seas, is a cause of concern among Iñupiaq hunters and community members. Climate change may also result in increased injury and trauma, as unusual or unpredictable weather, water, snow, and ice conditions make travel more hazardous and people may travel greater distances to find marine or land mammals or edible plants.		

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Recreation	**Negligible Impacts.** Recreation use in the project area could be negatively impacted due to the presence of permanent facilities and associated noise. **Cumulative Impacts.** Impacts from long-term or permanent facilities such as roads, pipelines, and gravel pads would accumulate and would result in the long-term loss of solitude, quietude, naturalness, or primitive/unconfined recreation, and wilderness-type values. These impacts could be locally adverse. As the climate warms in future years, the timing and location of recreation activities could change. Cumulatively there would be more activity, more human presence, increased noise, increased aircraft use, change in location of recreation activities, and correspondingly greater impacts on the setting, experiences, and desired beneficial outcome from use of public land. Also in the future as the climate gets warmer, the timing and location of recreation activities could change.	BMPs and design features that would reduce the visual impact and noise could also reduce the area of impact on recreation.	Facility visibility and noise.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Sand and Gravel Resources	**Minor Impacts.** • Loss of sand and gravel resources. • Impacts to the tundra surface from gravel extraction, including removal of surface vegetation, and overburden and extraction of the underlying gravels. • Potential thawing of permafrost around the mine site perimeter, which would create additional landform changes. • Creation of shallow or deep-water habitats by gravel mining, with potential thaw bulb formation. • Long-term impacts to soil productivity in the footprint of gravel-extraction sites. • Mixing of organic and mineral horizons with the parent material from stockpiling of overburden.	Gravel extraction design measures (assumed, under existing ASRC mine site permit): • Imposing a 500-foot buffer along the Colville River, and a 200-foot buffer around large lakes. • Requiring all temporary stockpiled material that is placed on the tundra be placed on an ice pad and removed prior to spring breakup. • Requiring that the top 12 to 18 inches of organic overburden be stockpiled separately from other overburden and used as the top layer in mine site rehabilitation at the end of each winter.	Loss of sand and gravel resources largely from construction of roads and pads and gravel mine development.
Socio-cultural Systems	**Major Impacts.** • Increased employment opportunities (positive impacts). • Potentially easier commuting to work in the oil fields (positive impact). • Disincentives to local employment in the oil field due to policies of segregation of non-resident workers and residents, especially if residents are substantially outnumbered. • Continued or increased flow of drugs and alcohol into Nuiqsut and other North Slope Borough communities via the seasonal ice road • Community conflict over use of the roads (if residents cannot access the RFDS road system due to limits imposed on the privately owned access road). • Tensions related to the permitting process.	Best management practices, including: • A requirement that areas of operation shall be left clean of all debris. • A requirement for the preparation and implementation a comprehensive waste management plan for all phases of exploration and development. • A requirement for the preparation and implementation a comprehensive spill prevention and response contingency plan for all phases of exploration and development. • The collection of air monitoring data both before and during the life of the project, the preparation of an emissions inventory and emissions reduction plan, air quality modeling, mitigation, changes to activities to reduce emissions, as determined necessary and appropriate by BLM, and public reporting of these data. • A requirement for the lessee to design and implement a monitoring study of contaminants in locally used subsistence foods.	Disincentives to local employment in the oil field due to policies of segregation of non-resident workers and residents, exacerbated by residents becoming substantially outnumbered by non-native non-residents. Continued or increased flow of drugs and alcohol into Nuiqsut and other North Slope Borough communities via the seasonal ice road. Community conflict over use of the roads if residents cannot access the RFDS road system due to limits imposed on the privately owned access road. **Information processing and other tensions related to the permitting process.** Anxiety and intra-community conflict over the continuous overload of bureaucratic and legal processes involved with permitting and development is a

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Socio-cultural Systems (Cont.)	• Devaluation of the Nuiqsut cultural landscape. • Disruptions to subsistence use areas, resources, and activities. • Increased intra-community conflict over differing opinions on development. **Cumulative Impacts.** Future development is not expected to result in substantial changes to population or employment levels for the community of Nuiqsut. Increasing development activities on the North Slope, particularly those that occur in areas accessible from the community of Nuiqsut by road, may result in more residents obtaining employment in the oil and gas industry. Several effects of climate change could affect subsistence resources and land uses, and are therefore likely to create significant social anxiety for the Iñupiat. The overall extent of expected cumulative impacts is not expected to result in overall impacts that would be more substantial than those caused by technology, other aspects of modernization, and climate change, and include a mixture of socio-cultural benefits and adverse impacts that are, on the whole, of a degree and intensity that can be characterized as major.	• In the event of an oil spill, the requirement for BLM to consider the immediate health impacts and responses for affected communities and individuals and establish long-term monitoring for contamination of subsistence foods and public health. • A requirement for cultural and environmental training of personnel involved in oil field activities.	prime source of frustration and disenfranchisement. Keeping track of oil company activities and NEPA or similar processes is beyond the ability of the average resident. This institutional overload is felt more intensely by some groups of people than others: tribal governments have few paid staff, subsistence users often have full-time employment and are already pressed for time to harvest adequate amounts of resources. These individuals, who perhaps feel that they have the most at stake, are not able to participate at a consistent level and are not compensated for the time required to participate. Discussions about subsistence, change, and impacts often produce strong emotions. The permitting process involves a substantial amount of scoping, testimony, interviews, surveys, and requests for comments on observations and impacts. Such questions can elicit emotions and experiences that are linked to several decades of interactions with outsiders requesting information. Disagreement and conflict is generated within individuals, families, the community itself, and with other North Slope communities. **The devaluation of the Nuiqsut cultural landscape** is a direct, indirect, additive, and cumulative impact. Residents believe that the cultural, spiritual, or other personal value that they place on their families' camping, hunting, and fishing sites is substantially diminished when industrial infrastructure is developed nearby.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Socio-cultural Systems (Cont.)			**Disruption to subsistence use area, resources, and activities** is a direct and cumulative social impact. Subsistence hunting and harvesting activities are central to the cultural identity and social cohesion of the community of Nuiqsut. The RFDS will likely result in major socio-cultural impacts for Nuiqsut. Evidence shows that North Slope socio-cultural systems have been subjected to both positive and negative ongoing, additive, and synergistic cumulative impacts from oil and gas activities above and beyond the impacts caused by other aspects of colonialism, technology, previous development, community health and welfare, and climate change. Ongoing stresses are anticipated to be substantially more intense in Nuiqsut that in other NSB communities. Negative socio-cultural impacts associated with development will likely continue to match or outweigh the economic benefits of development in Nuiqsut.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Soils and Permafrost	**Minor Impacts.** • Impacts to the thermal regime of permafrost (including thermokarst formation, subsidence, and increased potential for soil erosion and sedimentation) from: – Placement of gravel fill for roads, pads, and airstrip on the tundra. – Snowdrifts caused by gravel structures. – Blockage of natural drainage patterns. • Localized compression of soils and vegetation from construction of ice roads and pads. (Impacts from long-term disturbance from ice pads, ice roads, and snow trails would be negligible.) • Displacement of soil and disturbance during installation of VSMs when constructing pipelines. • Soil impacts related to altered snow accumulation and shading of vegetation and the ground underneath pipelines. • Impacts caused by spills during construction (e.g., diesel fuel). **Cumulative Impacts.** If global climate change persists, the cumulative impacts to soil from oil and gas development, and non-oil and gas development, on the North Slope could be greater than predicted. If the climate warms, the permafrost will thaw to an increased depth each season, which will cause varying degrees of impacts on subsidence, soil moisture, and vegetation.	• Use of insulated conductors to minimize subsidence issues and provide near well bore protection. • Installation of thermosyphons adjacent to certain infrastructure components to protect the permafrost conditions and the infrastructure. • Additional design measures required by State and Federal permit conditions: – Placing a minimum of 5 feet of gravel fill. – Elevating heated buildings or structures on pilings. – Elevating all on- and off-pad pipelines above grade on VSMs. – Minimizing or avoiding impoundments by maintaining natural drainage. – Designing bridges and culverts to maintain existing surface drainage patterns, prevent erosion, and ensure adequate water flow to maintain soil ice features. – Installing thermosyphons around wells. Additionally, insulating well conductor piles. – Requiring workers to stay on gravel surfaces unless their job duties require them to be on the tundra. – Applying dust control measures to roads, pads, and summer mining activities, and minimizing dust settlement on vegetation or snow. – Reducing surface discharge of wastewaters through use of a disposal well, including zero discharge of produced water and drilling wastes. – Implementing operating procedures and maintenance programs to ensure the design measures remain in effect throughout the life of the project. – Implementing spill prevention and response programs. – Placing overburden for gravel mining either on previously disturbed area within the pit or on an ice pad. • Erosion control measures included in the project. SWPPP.	Loss of soil productivity from construction of roads and pads and gravel mine development.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Subsistence	**Major Impacts.** • Spills (low probability, high risk). • Projects footprints' direct impact to subsistence use areas, particularly those for caribou, geese, and furbearers such as wolf and wolverine. Some winter fishing activities may also be impacted. • Disruption to subsistence hunting activities caused by aircraft traffic. • Reduced access to and user avoidance of traditional subsistence use areas. • Reduced value of traditional subsistence use areas. • Potential disruption and deflection of subsistence resources. • Decreased community participation and transmission of knowledge. **Cumulative Impacts.** Overall, future development could increase the severity of existing impacts, including: • Continued hunter avoidance of industrial areas, • Continued disturbance of hunters and wildlife from increased air and road traffic, • Reduced access to or loss of subsistence use areas, and • Reduced availability of subsistence resources in development areas. These impacts could result in increased investments in time, money, fuel, and equipment and potentially affect hunting success. As oil and gas development activities occur over a larger area and impact a greater portion of subsistence use areas, subsistence users may alter their harvesting patterns and this could result in a loss of opportunities to harvest subsistence resources in traditional	• BMP H-1 NPR-A Subsistence Advisory Panel: tribal government representatives provide input and make recommendations to BLM on ways to minimize impacts to subsistence from oil and gas and associated activities. • Protective measures established in previous RODs for EISs in the NPR-A to minimize impacts of oil and gas activities and ensure the continued health of wildlife and subsistence resources, including measures designed to protect fish, birds, and terrestrial and marine mammals (for details, see RFDS BMPs and stipulations for these resources elsewhere in this table). • A requirement for the permittee to develop a Right of Access Agreement regarding authorized use of the roads associated with the project and hunting prohibitions, along roads and near project components. • A requirement for the permittee (in consultation with local hunters and local organizations) to facilitate, improve, and expand communication protocols to inform subsistence users of daily flight patterns and identify potential conflict areas during peak hunting times. • A requirement for the permittee to provide BLM with flight information needed to track and record aircraft flight data. • A requirement for BLM to establish a time period during peak caribou hunting when non-essential helicopter flights associated with BLM-permitted activities will be suspended near Nuiqsut. Also, the number of takeoffs and landings to support oil and gas operations with necessary materials and supplies shall be limited to the maximum extent possible. • A requirement for the permittee to begin employing unmanned aerial vehicles (UAVs) to conduct monitoring activities that otherwise require helicopters (i.e., pipeline inspections, studies, and other appropriate activities), when feasible.	**Subsistence Uses of the RFDS Area.** The Nigliq Channel, the Fish Creek area, and the branches of the Nigliq and land between the two rivers are among Nuiqsut's most productive and important fishing and caribou hunting areas and have been particularly important for residents with limited economic means and transportation options. The value of undeveloped land to the west of town increases as it becomes increasingly rare. **User Access.** Restricted access to subsistence use areas is experienced as a primary impact of oil development and is a central concern with the RFDS. Physical problems using or crossing the roads or crossing under pipelines will restrict user access. **User Avoidance.** Subsistence harvesters often avoid areas of development due to concerns about hunting near human or industrial activity, shooting near traffic, near infrastructure, and in particular near pipelines, and concerns about contaminants and the health of animals near development. Avoidance of the RFDS area will be at a greater distance than infrastructure's footprint and the loss of subsistence use areas could be larger than the direct overlap of future projects with documented use areas. The connection provided by the Kuukpik Spur Road could decrease the avoidance effect and act as a countervailing impact, but to date, conflict over the use of the privately owned road and stress associated with the impacts to access of the CD5 road have outweighed any countervailing impacts that the RFDS road system could create. **Resource Availability.** Noise, traffic, odors, and infrastructure associated with the RFDS could affect the availability of key resources such as

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Subsistence (Cont.)	use areas. This loss of opportunity could have impacts on future generations, as harvesters may no longer be able to teach younger hunters about subsistence uses in traditional harvesting areas. Climate change and anticipated warming could significantly affect subsistence harvests and uses if warming trends continue as predicted. The reduction, regulation, and/or loss of subsistence resources would have severe impacts on the subsistence way of life for residents. If permafrost loss increases as predicted, there could be synergistic cumulative impacts on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of fresh water, and availability of terrestrial mammals, marine mammals, waterfowl, and fish, all of which could necessitate relocating some North Slope Borough communities or their population, shifting the population to places with better subsistence hunting, and causing a loss or dispersal of community.	• A prohibition (except in emergencies and other special circumstances) of the permittee and its contractors using airboats on rivers on BLM-managed lands in the Nuiqsut subsistence use area. • A requirement for the permittee to monitor, through the life of the project, changes in subsistence activities in the community of Nuiqsut, by funding a study to quantify changes in subsistence use and harvest levels. • A requirement for the permittee to undertake a one-time economic study of subsistence at the beginning of the GMT1 project.	caribou, waterfowl, and furbearers. Overall project activity will be highest during construction periods. Impacts could lead to increased time, costs, effort, and risks for harvesters. Caribou are sometimes unable to pass under pipelines due to heavy snow drifts and may be unlikely to cross roads that are high and steeply sloped that the caribou cannot see over. Caribou, especially cows with calves, tend to avoid areas of human activity. The RFDS area is in the peripheral range of both the Teshekpuk Caribou Herd and Central Arctic Herd; therefore, Nuiqsut hunters are particularly vulnerable to changes in the distribution and/or behavior of caribou in these herds. Contamination or perceived contamination associated with development could result in reduced resource availability to subsistence users. **Aircraft Traffic.** Aircraft traffic is the most commonly reported impact on subsistence activities and will increase with the RFDS. Harvesters report failed hunts due to low-flying aircraft spooking the animals. Future development will result in additional flights, particularly during construction phases. For Greater Mooses Tooth 1, there will be an estimated 115 new flights per year for 30 years of operation of which 107 would occur during the June–September season (complete estimates are 3,112 per year with 1,564 during the summer/fall season). It can be estimated that each new production pad will result in similar increases in aircraft flights. Hunters cannot avoid disturbance from aircraft by avoiding permanent infrastructure; therefore, impacts from aircraft can cause more acute stress and disruption. Acute disruption during the hunting season can turn into long-term stress and financial and food-security issues throughout the year: lack of success hunting caribou means lack of meat and

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Subsistence (Cont.)			can involve loss of money and time. Additional money and time is required for additional hunting expeditions or money to purchase commercial meat. Lack of success due to aircraft can lead to economic problems, food security problems, and social, cultural, and possibly mental (stress, anxiety, depression) and physical (nutrition) health issues. The RFDS could increase the severity of impacts on Nuiqsut subsistence uses in addition to introducing impacts on subsistence uses for other North Slope communities. Impacts include hunter avoidance of industrial area, increasing disturbance from air and road traffic, reduced access to or loss of subsistence use areas, and reduced availability of resources in development areas. These impacts could cause hunters to travel farther and into the traditional hunting grounds of other communities and could result in increased investments in time, money, fuel, and equipment and potentially affect hunting success. The effects of climate change could affect subsistence harvests, travel, and access. Disturbance to, and displacement of, caribou could lead to an unavoidable reduction in the total annual caribou harvest by making the harvest more difficult, costly, and time consuming for subsistence hunters. Wolf and wolverine harvests would be reduced in areas of human activity, while bear and fox could habituate to oil and gas activities within the NPR-A. If oil and gas infrastructure were located in subsistence hunting areas, some (real or perceived) restrictions on access by subsistence hunters would be unavoidable.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Threatened and Endangered Species (Polar Bear)	**Minor Impacts for Some Individuals; Negligible at Population Level.** • Habitat loss or alteration. • Disturbance or displacement of denning females and cubs. • Incidental harassment of polar bears transiting the project study area. • Intentional hazing near occupied work sites. • Mortality due to collisions or defense of life kills. **Cumulative Impacts.** When evaluating the currently proposed project in conjunction with the conceptual GMT2, climate change, and other RFF projects, these projects could have an additive cumulative effect with respect to polar bears. Further development may encroach on polar bear denning habitats, and the placement of additional infrastructure would increase disturbances, the potential for encounters, and obstruction to movement. Offshore development and development of onshore support facilities would have cumulative additive impacts to polar bears and their habitats. This impact would be anticipated to be long-term, localized, and, depending on the species and location, would range in intensity.	• Preparation and implementation of bear-interaction plans to minimize conflicts between bears and humans. • Prohibition of heavy equipment within one mile of known or observed polar bear dens.	• Habitat loss or alteration. • Disturbance or displacement of denning females and cubs. • Incidental harassment of polar bears transiting the project study area. • Intentional hazing near occupied work sites. • Mortality due to collisions or defense of life kills.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Threatened and Endangered Species (Spectacled Eider)	**Minor Impacts.** • Habitat loss and alteration. • Disturbance and displacement. • Obstruction of movement. • Various sources of mortality (e.g., vehicle collisions, nest predation). • Spills. **Cumulative Impacts.** The overall cumulative impact to spectacled eiders for the Harrison Bay and Lower Colville River watersheds for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible.	None listed in the FSEIS. Mitigation for birds would presumably apply.	Effects from direct, indirect, and cumulative effects would be additive, and some will be unavoidable and adverse to nesting and staging spectacled eiders. Some adverse impacts on spectacled eiders would be unavoidable despite protective management measures. The additive effect of the direct/indirect effects from oil and gas activities and from a myriad of potential effects from the cumulative analysis imposed on spectacled eiders will create some residual adverse impacts due to habitat destruction and fragmentation, disturbance, offshore development, vessel and air traffic, spills of hazardous materials, including oil spills and mortality from collisions with human infrastructure or vessels, habitat changes due to salt water intrusion. There are high density areas for spectacled eiders contained within the area covered by the Regional Mitigation Strategy, and as such, adverse effects to these birds may be unavoidable.
Threatened and Endangered Species (Steller's Eider)	No impacts to Steller's eiders are expected to occur. **Cumulative Impacts.** The overall cumulative impact to Steller's eiders for the Harrison Bay and Lower Colville River watersheds for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible.	None listed in the FSEIS. Mitigation for birds would presumably apply.	No impacts expected.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Threatened and Endangered Species (Yellow-Billed Loon)	**Minor Impacts.** • Habitat loss and alteration. • Disturbance and displacement. • Obstruction of movement. • Effects of spills. • Various sources of mortality (e.g., vehicle collisions, nest predation). **Cumulative Impacts.** The proposed project, in conjunction with the conceptual GMT2 and other RFF projects, could have a small additive cumulative effect with respect to yellow-billed loons as further development may result in additional infrastructure and ice roads/pads over a wider area. In addition, the development of offshore development and associated onshore facilities may also have an additive cumulative effect with respect to yellow-billed loons, as this species is known to utilize marine waters. At any given location, the additive cumulative location would be dependent upon RFF project locations relative to loon populations and their priority habitat.	None listed in the FSEIS. Mitigation for birds would presumably apply.	• Habitat loss and alteration. • Disturbance and displacement. • Obstruction of movement. • Effects of spills. • Mortality.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Transportation (Local)	**Minor Impacts.** • Minor impacts to local transportation resulting from construction-related vehicle traffic on industry-constructed ice roads with no public access. • Interference with some winter travel on frozen channels from construction activities. • Operation of the facilities would result in lower levels of vehicle traffic than is anticipated during construction. • Increased air traffic to support transportation of work crews, materials, and equipment, and for special studies. • For 2019 and beyond, a 4% increase in total flights above baseline, including an approximate 7% increase in helicopter flights for special studies in the NPR-A which would occur from June through September. **Cumulative Impacts.** The cumulative effect of GMT1 would be focused on the construction of an industrial gravel road system in an area currently roadless. For the GMT1 project, impacts to local transportation would occur during both the construction and operation phase. In general, impacts to local transportation range from minor to moderate on an interim to long-term basis. The cumulative impacts of these new transportation facilities, as they provide opportunities for other RFF projects to occur in the Umiat area, would be intense and long-term and would have both localized and regional benefits.	• Tying transportation components of the GMT1 project into existing transportation infrastructure without additional modification. • BMPs and lease stipulations addressing design and operational features that reduce impacts and total area of disturbance. • An Aircraft Plan.	Winter cross-country travel by snow machine could be impeded by the presence of a permanent gravel road, should the road be constructed in such a way as to make crossing the road impossible. If unable to cross the road, or only able to cross the road at constructed ramps, then this would alter normal transportation by focusing routes through one particular area (i.e., to utilize ramps), or by resulting in travelers by snow machine having to travel further to go around existing road.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Vegetation and Wetlands	**Moderate Impacts.** • Direct impact to vegetation totaling 72.7 acres). • Indirect impacts from gravel spray and dust deposition extending up to 300 feet from the edge of the gravel footprint, total 587.3 acres. • All areas of direct and indirect impacts are within potential wetland. **Cumulative Impacts.** Climate change may eventually lead to shifts in the composition of Arctic tundra. Permafrost may thaw to an increased depth each season, which will cause varying degrees of impacts on subsidence, soil moisture, and vegetation. The potential for many shallow streams, ponds, and wetlands in the Arctic to dry out under a warming climate is increased by the loss of permafrost. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near NPR-A, potentially leading to synergistic impacts to vegetation. Overall, the direct, indirect, and cumulative impact to vegetation and wetlands associated with the proposed GMT1, conceptual GMT2, and completion of other RFF projects would be moderate intensity and long-term duration.	• BMPs on solid and liquid-waste disposal, fuel handling, and spill cleanup to reduce the potential impacts of intentional releases, spills, and solid waste. • BMPs to reduce air pollution-caused damage. • BMP for overland moves (and seismic work). • Lease stipulations on activities associated with oil and gas exploration. • BMPs affecting development through minimization of disturbance, such as facility design and construction of pipelines, roads, pads, airstrips, and other facilities. • Lease stipulation to facilitate the regrowth of Native vegetation following facility abandonment. • Lease stipulations for setbacks associated with development near rivers, lakes, and other specified habitats. • BMP to minimize the impacts to vegetation of summer tundra travel.	Loss of upland and wetland vegetation communities and their associated functions from construction of roads and pads and gravel mine development. Indirect effects of road and pad development are: alteration of plant communities as a result of dust deposition, soil salinity change, increased snow drifting, and changes to natural drainage patterns; increased probability of colonization by non-native, invasive species.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Visual Resources	**Minor Impacts.** Construction and operation of the project would be visible from surrounding areas. Facilities and structures (e.g., CD5-GMT1 road, airstrip) would introduce a moderate contrast with the natural landscape when viewed from the foreground-middle-ground zone. The CD5-GMT1 road structure would be visible across the tundra. C**umulative Impacts.** The overall cumulative impact to visual resources in the area from production facilities, an elevated pipeline system, gravel roads, and airports would be high. Cumulative effect to visual resources could extend over a mile on a clear day. Lights at permanent facilities would also be seen from a distance of several miles during winter. As development expands across the North Slope, primarily into areas where no infrastructure currently exists, so will the extent of impact on visual resources. Climate change could affect visual resource values by altering the current conditions of color, vegetation, land formation, adjacent scenery, and the presence of water. These would be an additive cumulative negative impact which would permanently alter the existing visual resources. Overall cumulative impact to visual resources in the immediate area of production facilities, elevated pipeline, gravel roads, and airports would be high.	• Recommended painting or other means to blend structures with existing landscape. • Recommended lighting design to reduce lighting impacts from structures more than 20 ft tall.	Visibility of operating facilities and associated structures.

Resource/Issue	RFDS Unmitigated Impacts[a]	RFDS BMPs and Stipulations[b]	RFDS Residual Adverse Impacts[c]
Water Resources	**Minor Impacts.** Long-term impacts to local water resources resulting from the placement of new infrastructure, including: • Changes in the drainage pattern. • Changes in stream flow. Short-term, temporary impacts from ice infrastructure (e.g., roads and pads). Intensity of impacts is characterized as minor and of localized extent. **Cumulative Impacts.** Because of the abundance of water resources on the North Slope, the overall cumulative impact to water resources on the North Slope and in the NPR-A would probably be small in magnitude, and most impacts would be local in nature.	• Requirement for all cuttings and drilling mud to be disposed of by injection, and allowing on-pad temporary storage of muds and cuttings. • Prohibition on permanent oil and gas facilities within 500 feet from fish-bearing water bodies. • Requirement for stream and marsh crossing design and construction. • Setbacks from major rivers (with exceptions for essential road and pipeline crossings). • 0.25-mile development setback from deep water lakes.	Changes in surface drainage due to construction of roads and pads.

[a] Direct, indirect, and cumulative impacts expected under RMS RFDS, prior to application of BMPs and stipulations.

[b] Anticipated BMPs and stipulations under RMS RFDS.

[c] Adverse residual impacts (unavoidable impacts) remaining after application of BMPs and stipulations.

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APPENDIX E:

CONCEPTUAL MODELS

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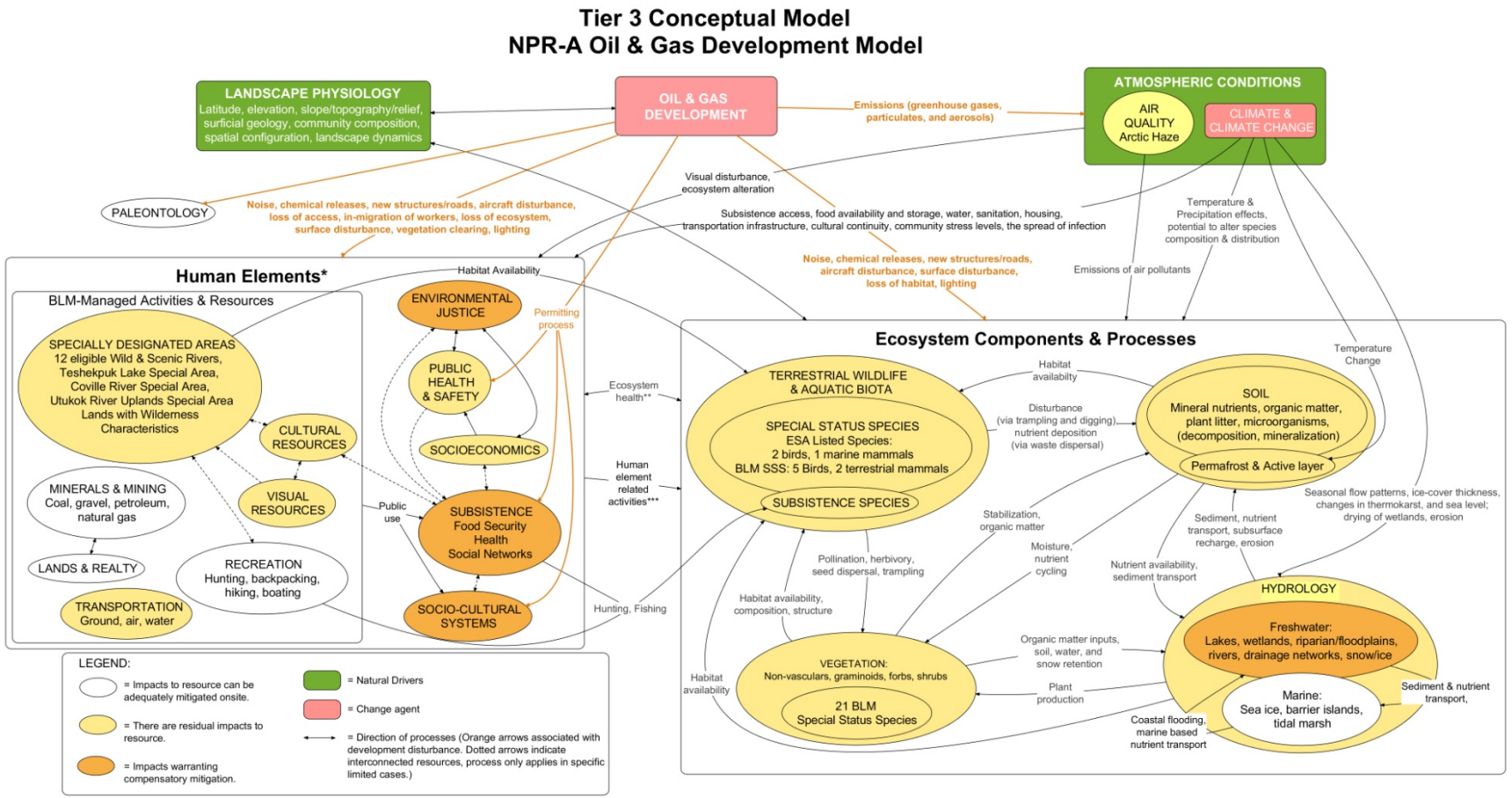
APPENDIX E:

CONCEPTUAL MODELS

Conceptual models are graphical illustrations that depict the key components of systems and how they interrelate. One might think of a conceptual model as a spider web that depicts how all the components of concern in a particular system are connected. In this case, the "system" is coupled human and natural systems that are present in the Northeastern NPR-A. The "components" are the components the stakeholders and subject matter specialists identified as being concerned about as oil and gas development in the region expands into the NPR-A. These include the population and movement of caribou (and other subsistence species); the quality of the air and water; and the impact and influence of non-natives on the Iñupiat culture and lifestyle. It is useful to chart the interconnections in a conceptual model because, just as is the case with a spider web, pulling on one thread affects every strand with different levels of intensity and sometimes in different directions. In the case of the NPR-A, oil and gas development can be thought of as a "pull on a thread," as can a compensatory mitigation action. A conceptual model, while not quantitative, can give users the big picture of the interconnections, can convey a sense of how tugs on the threads might impact other key components, and can help recognize the potential for unintended consequences.

The conceptual models provided here depict the coupled human and natural systems found in the Northeastern NPR-A. They helped the project team account for and better understand the scope of the potential impacts of oil and gas development and in identifying and evaluating the potential compensatory mitigation actions. Using existing conceptual models, including those found in the North Slope REA (McTeague et al. 2015); the IAP FEIS (BLM 2012); ASDP EIS (BLM 2004); and, the GMT1 SEIS (BLM 2014a) as a starting point, two models specific to oil and gas development in the Northeastern NPR-A were developed. The *Tier 3 Conceptual Model* (Figure E-1) depicts how the key components of the natural and human (socioeconomic and cultural) systems interrelate, and how they might be impacted by oil and gas development. Resources that may have residual impacts from oil and gas development are shown in tan and brown, and those that may warrant compensatory mitigation are shown in brown. The *Tier 3A Conceptual Model for Subsistence* (Figure E-2) describes in greater detail the predominant residual impacts to the Iñupiat subsistence system from oil and gas development and other drivers, as well as the relationships among subsistence, certain human elements (including BLM-managed activities and resources), and certain elements of the North Slope ecosystem.

These models were particularly useful in identifying which impacts warrant compensatory mitigation, by helping to identify which of the potentially impacted resource are considered to be "important, scarce, or sensitive."



* These are activities and resources with (or requiring) human engagement in one of the following ways: 1) requires active participation in management of a resource or activity (e.g., lands and realty, specially designated areas, transportation, mineral development, recreation); 2) addresses the perspective or perception of a resource (e.g., visual resources, acoustics, lands with wilderness characteristics, cultural); and/or 3) addresses human- specific values (e.g., cultural resources, socioeconomics, environmental justice).
**Ecosystem health is referred to as the degree to which the integrity of the soil and the ecological processes of the ecosystem are sustained (BLM Handbook H-4180-1). Ecosystem health can influence sociocultural systems, subsistence resources, cultural resources, visual resources, specially designated areas, recreation, harvest supply, and fuel availability. Human elements can also influence ecosystem components (e.g., recreation can compact soils, hunting can impact species, etc.).
***Many human-related activities affect ecosystem health. For example activities associated with mineral and natural resource extraction (including new infrastructure and increased vehicle, air, and water traffic) as well as recreational activities can contribute to changes in air and water quality; habitat fragmentation and destruction; and changes to species migration and distribution patterns.

FIGURE E-1 Tier 3 Conceptual Model for Oil and Gas Development in the Northeastern NPR-A

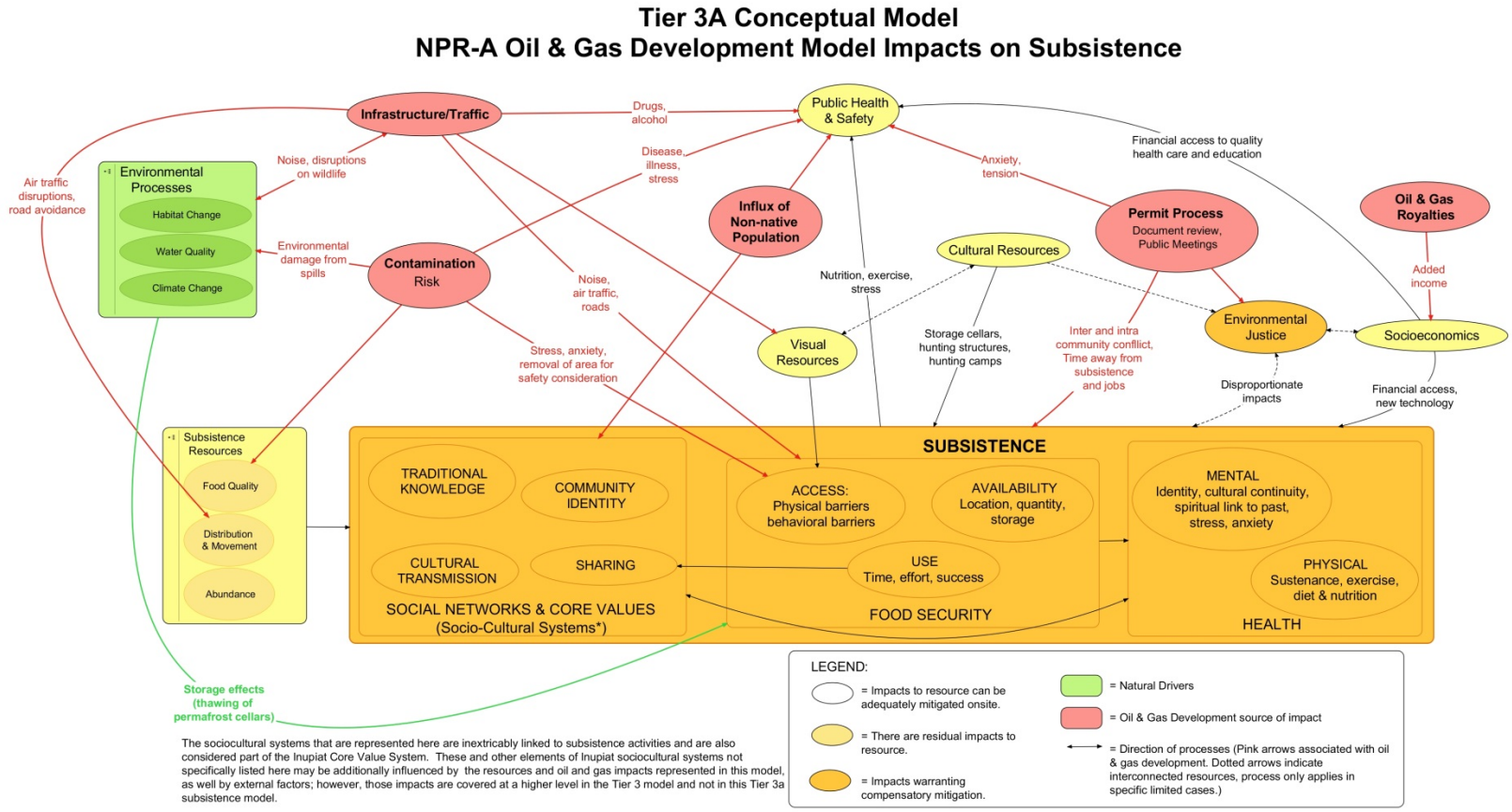


FIGURE E-2 Tier 3A Conceptual Model for Oil and Gas Development on Subsistence in the Northeastern NPR-A

Considerations in the Development and Application of the Conceptual Models

Natural systems and features (e.g., rivers, bluffs, vegetation, and fish and wildlife) provide the setting in which cultural activities take place in the NPR-A and heavily influence the characteristics of the region's cultural landscape. Subsistence use of the surrounding environment is the foundation of the region's culture, and provides a mainstay of the diet for many families (BLM 2008, 2014b). Table A-3 summarizes important subsistence fish and wildlife species in the RMS region. Subsistence is not only a source of food for North Slope residents, but the activities associated with subsistence strengthen community and social ties and reinforce community and individual cultural identity. Both Federal and State regulations define subsistence uses to include the customary and traditional uses of wild renewable resources for food, shelter, fuel, clothing, and other uses (ANILCA, Title VII, Section 803, and AS 1605.940[33]). The Alaska Federation of Natives views subsistence to not only encompass the practices of hunting, fishing, and gathering, but as a way of life that has sustained Alaska Natives for thousands of years and a set of values associated with those practices (Alaska Federation of Natives 2010). Subsistence use areas in the region are shown in Figure A-3.

The Iñupiat have identified 12 core values to maintain healthy Iñupiaq communities (North Slope Borough 2016). Subsistence activities reflect the relationship between these core values and the Iñupiat community, their natural resources, and the surrounding environment. These core values (in no particular order) are as follows:

Avoidance of conflict
Compassion
Cooperation
Family and kinship
Sharing
Respect for nature
Humility
Humor
Hunting traditions
Knowledge of our language
Spirituality
Love and respect for our elders and one another

Over the course of several meetings and workshops, residents had the opportunity to communicate how oil and gas development had impacted their community and express concerns regarding future development (BLM 1998, 2015a, 2015b, 2016a, 2016b, 2016c). Many local residents have expressed how the physical and social act of the harvest, as well as sharing of the harvest, is essential for community cohesion and the transfer of traditional knowledge to the next generation (BLM 2014). During the practice of subsistence hunting and fishing, important historic and contemporary use sites and subsistence resource areas serve as the settings for oral histories and traditional storytelling that carry on important messages about social elements of the Iñupiat way of life. These culturally important historic and contemporary use areas have been continually used for generations and provide a spiritual link to the past. Continuation of these

practices in contemporary life helps to maintain the individual and community Iñupiaq cultural identities as well as ties to the landscape (Brown 1979).

At the heart of Iñupiat concerns are impacts to subsistence from oil and gas development. Impacts on subsistence are impacts on Iñupiat economic and socio-cultural systems. Impacts on the subsistence lifestyle, be they directly on the Iñupiat or on the resources they pursue, result in diminishment or loss of the community involvement, physical space, and natural resources the Iñupiat need for their well-being. Development also may cause physical and mental health consequences for some individuals, through dietary changes and increased levels of stress (BLM 2014b, 2015a, 2015b, 2016a, 2016b).

Subsistence activities are predominantly represented in the core values of hunting tradition and sharing; however, many of the core values relate back to subsistence in some way including: cooperation, compassion, family and kinship, respect for nature, knowledge of language, and spirituality.

Social and cultural traditions of the Iñupiat are heavily dependent on the act of subsistence hunting. For example, during the practice of subsistence hunting and fishing, traditional knowledge is passed from person to person and from generation to generation, through the telling of oral histories, storytelling, and the physical act of subsistence activities (Brown 1979; Iñupiat Community of the Arctic Slope 1979). Traditional knowledge includes locations of subsistence use areas, migration patterns of animals, hunting and fishing techniques, language use, and information about kinship ties. Subsistence harvests are often shared. Sharing (a core value) is what allows individual hunters to sometimes fail within the system. An unsuccessful hunt teaches humility (another core value), but sharing, when food supplies are low or non-existent, teaches love and respect for elders and one another and compassion, two additional core values. These acts (i.e., sharing of both traditional knowledge and of harvest) are essential for community cohesion, individual and group identity, and physical and mental health.

In this model, subsistence refers to the subsistence system and includes three interrelated parts: *Food Security, Health,* and *Social Networks*. The model of the subsistence system represents important aspects that are at the core of Iñupiat values and concerns that have been voiced to the BLM (BLM 2015a, 2015b, 2016a, 2016b). Subsistence resources, although part of the subsistence system, are shown separately as they can be influenced by outside factors such as environmental processes and activities unrelated to oil and gas development.

Food Security reflects the change in subsistence resources as a result of various direct and indirect impacts of oil and gas development and can be further divided into three elements: access, availability, and use of resources. Access to resources by subsistence users can be affected by (1) physical barriers, such as new infrastructure that limits or alters access to use areas or alternatively opens new areas for harvesting; and (2) behavioral barriers. For example, hunters have expressed the desire to hunt away from infrastructure and development-related activities and noise. Availability of resources can be affected by the changing distribution and movement patterns of subsistence resources such as the Central Arctic Caribou Herd or bowhead whales, which can be influenced by the presence of oil and gas infrastructure or related air traffic. Availability of resources also includes food storage. Food storage options can be affected

when frequent and fluctuating temperature changes cause permafrost to melt, reducing the efficacy of ice cellars. Residents have suggested the installation of community freezers could mitigate this impact. Changes in use of subsistence areas are influenced by access to and availability of resources. Individuals have noted the increased time and expense (additional gas and supplies) when having to travel around new infrastructure or activity areas to reach a traditional subsistence use area (BLM 2015a, 2015b, 2016a, 2016b).

Health represents impacts to the physical and mental health of an individual and/or the community as a result of change to the subsistence system. Impacts on physical health include changes in sustenance and nutrients from a reduction or change in types of foods consumed. Impacts on mental health include increased stress levels, social conflict, and lack of opportunities for social interaction. Sources of stress that have been noted by Nuiqsut residents include changes in the participation level of youth in subsistence activities; the obligation to attend meetings regarding oil and gas development and the permitting process; and conflict between individuals in the community regarding the costs and benefits of oil and gas development to the community. Another contributor to both physical and mental health is the lack of places for social interaction. The Nuiqsut residents have frequently mentioned the lack of teen centers, playgrounds, community centers, and other places of social interaction that are essential for physical, mental, and social development of their youth (BLM 2015a, 2015b, 2016a, 2016b).

Social Networks represent the various aspects of the Iñupiat socio-cultural system that influence the well-being of residents as a result of social activities surrounding subsistence. Social Networks surrounding subsistence can further be divided into the following interrelated categories: traditional knowledge network of resources, community identity, cultural transmission, and sharing. Subsistence activities include hunting, sharing the hunt, and day-to-day support for food preparation, and all are part of the Iñupiat core values. These activities provide opportunities for the transmission of traditional knowledge while building an individual's and group's knowledge of the network of subsistence resources, kinship ties, and sense of community (Brown 1979; BLM 2014b). Negative changes to community identity and mental and physical health can occur when there is a breakdown in the social network.

There are five prominent sources of impact that result from oil and gas development that affect subsistence either directly or indirectly. These are:

- Increase in the non-native population;
- Oil and gas royalties;
- The permit process;
- Development of infrastructure and increased traffic (vehicular and air) due to oil and gas activities; and
- Risk of contamination.

Additional drivers aside from oil and gas development that affect subsistence resources are mainly environmental processes such as animal and plant habitat change, weather patterns, climate change, and water quality. These environmental processes can be influenced by all of the drivers of oil and gas development (listed above), except oil and gas royalties, as well as outside influences such as world climate change and development unrelated to oil and gas.

Four of these drivers — increase in the non-native population, infrastructure and increased traffic, contamination risk, and the permit process — directly affect subsistence or subsistence resources. Infrastructure development and increased traffic and contamination can also influence environmental processes which in turn can cause changes in subsistence resources and the subsistence system. In addition, some of these drivers impact other resources (visual, cultural) or social issues (socioeconomics, environmental justice) which in turn affect subsistence. For example, oil and gas infrastructure can block or restrict access to drying racks or contemporary and historic camp sites which are locations for food processing and often serve as the setting for the telling of oral histories and communicating important information. When access to these places is lost, these activities may not take place and cultural knowledge regarding resources and kinship ties are lost. While most of the impacts of oil and gas development are considered to have negative impacts on subsistence, some can be considered positive, such as earning royalties or increased access to subsistence use areas from newly constructed roads.

To further understand the model, an example of how a specific driver, namely infrastructure development and increased traffic, can impact subsistence is provided below.

One of the largest impacts of oil and gas development is the construction of new infrastructure in areas where none previously existed. Infrastructure includes pipelines, facilities, access roads, etc. Increased infrastructure leads to increased vehicle and air traffic in the vicinity of the infrastructure.

Infrastructure, specifically new roads, can create physical barriers by preventing or restricting hunter access to subsistence use areas. Roads are often built-up with large berms on either side, making it difficult and dangerous, if not impossible, to cross with snow machines. Because of this, hunting may require more effort and time, as areas that were once open would be closed, so a new hunting area would need to be found. If this occurs, additional time and effort will be needed as hunters will have to go around facilities to access new areas, requiring more gas and more supplies. The hunt may be less successful because hunters are less familiar with the new areas, and there may be less time for hunting. Infrastructure can also cause hunters to alter their behavior, as they may find areas near infrastructure unfit for hunting for safety, aesthetic, or personal reasons.

Infrastructure development and increased traffic can also affect the movement and distribution of subsistence resources, potentially causing reductions in game populations. Although there is no firm scientific evidence that oil and gas activities have caused a decline in herd populations on a broad scale, there is evidence (Wilson et al. 2016) and Nuiqsut residents have stated that movement patterns have been altered for the Central Arctic Caribou Herd and the bowhead whale (BLM 2015a, 2015b, 2016a, 2016b). If there are fewer resources, or

resources are more difficult to find because they are scattered or in a different place than they were prior to development, this affects the time, effort, and success of the hunt. This in turn affects whether or not there are enough resources to share, sharing being an Iñupiat core value and component of Iñupiat social life. When resources are not shared, the physical and mental health of the Iñupiat community can be adversely affected.

Infrastructure development and increased traffic can also affect environmental factors, causing change in habitat, climate, water quality, and weather patterns, all of which effect the abundance, distribution, and quality of subsistence resources. When subsistence resources are reduced, food security is compromised and there is less food to share. This in turn affects the physical and mental health of the Iñupiat community.

Another driver that directly impacts subsistence is the oil and gas permitting process. The Nuiqsut residents have indicated the permitting process is a cause of much anxiety and stress. Time burdens and schedule conflicts involved with the permit process impact all parts of the subsistence system. Participating in public meetings and workshops and reading environmental impact statements and meeting notes leaves little time for subsistence activities and also contributes to the psychological stress of individuals. Psychological stress associated with decreased hunting success; the personal sacrifice of being away from home, not being able to hunt and fish or take care of the family; and the confusion from trying to live in both the western and traditional worlds, has potential to contribute to an increase in substance abuse. Nuiqsut residents have also voiced concern with increased rifts in the community regarding opinions on development. There is a concern that this stress is passed on to children as well. Stress and anxiety among community members affect the general public health and safety of the community.

The third driver that directly impacts subsistence is the increase in the non-native population. In recent years, the North Slope has experienced an increase in the number of non-native oil workers, research parties conducting research activities in support of oil and gas development, and general Western culture. This influx of outsiders and Western culture has influenced daily life in two specific ways. First, it impacts the socio-cultural systems (cultural transmission, traditional knowledge, community identity, sharing) within the subsistence system. For example, the Iñupiat have noted a loss of the Iñupiaq language among the younger generation, as a result of Western-influenced education systems which mostly teach the English language. The Iñupiat have also noted a shift in focus among members of the Iñupiat community from subsistence activities (hunting, fishing, sharing) to topics surrounding oil and gas development like money, business, and land (BLM 2015b, 2015c, 2016a, 2016b, 2016c). A breakdown in this socio-cultural system can cause negative changes in mental and physical health of individuals within the community. Secondly, the influx of oil workers and researchers impacts the distribution and movement of subsistence resources. The Iñupiat have indicated that air, water, and vehicle traffic have disrupted caribou migration patterns and that subsistence hunters have trouble finding caribou herds in their usual places (BLM 2015a, 2016a). This is discussed above in reference to infrastructure development and increased traffic; however, it is magnified by research efforts in support of oil and gas development, including an influx of researchers and equipment (including helicopters and cars). Any effect on subsistence resources in turn affects the larger subsistence and socio-cultural system.

The final driver that directly impacts subsistence is the risk of contamination. Contamination from an oil spill or natural gas blowout has long been a concern of local residents. Residents of Nuiqsut have expressed concerns regarding potential oil spills that could impact wildlife habitat, specifically water resources like streams and rivers, rendering subsistence resources unfit for consumption. Contamination and risk of contamination also contribute to physical illness and psychological stress, impacting public health and safety. Residents of the North Slope have expressed concern about industrial pollutants potentially causing respiratory disease and cancer and have also cited the Repsol gas well blowout as contamination from oil and gas exploration of the 1940s and 1950s as a source of this concern (BLM 2015b).

APPENDIX E REFERENCES

Alaska Federation of Natives 2010. The Right to Subsist: Federal Protection of Subsistence in Alaska.

BLM (Bureau of Land Management) 1998. Appendix F: *Northeast NPR-A Integrated Activity Plan EIS Subsistence Analysis Workshop Proceedings, Nuiqsut, Alaska. August 19-21. In: Northeast National Petroleum Reserve-Alaska Final IAP/EIS*. U.S. Department of the Interior, Bureau of Land Management.

BLM 2004. *Alpine Satellite Development Plan, Final Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Sept. Available at: http://www.blm.gov/eis/AK/alpine/dspfeisdoc.html.

BLM 2008. *Northeast National Petroleum Reserve – Alaska Final Supplemental Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. May. Available at: http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npr-a_final.html.

BLM 2012. *National Petroleum Reserve – Alaska Final Integrated Activity Plan/Environmental Impact Statement*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Nov. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702.

BLM 2014a. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska. Oct. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912

BLM 2014b. *Greater Mooses Tooth Unit 1 Supplemental Environmental Impact Statement Public Participation/ANCILA 810 Hearing*. Nuiqsut [Meeting Transcript], Alaska. March 13.

BLM 2015a. *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project, Record of Decision*. U.S. Department of the Interior, Bureau of Land Management. Feb. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912.

BLM 2015b. *GMT1 Regional Mitigation Strategy Meeting in Nuiqsut* [Meeting Transcript]. May 30.

BLM 2016a. *Draft Meeting Proceedings, Nuiqsut Trilateral Committee: GMT1 Compensatory Mitigation Funds* [Meeting Transcript], Nuiqsut, Alaska. Friday, April 22, 2016.

BLM 2016b. *Draft Meeting Proceedings, Nuiqsut Public Meeting: GMT1 Compensatory Mitigation Funds* [Meeting Transcript], Nuiqsut, Alaska, Friday, April 22, 2016.

BLM 2016c. BLM-Alaska: NPR-A Regional Mitigation Strategy [Website and Meeting Notes]. Available at: http://www.blm.gov/ak/st/en/prog/NPR-A/RMS.html.

Brown, W.E. 1979. *Nuiqsut Paisaŋich – Nuiqsut Heritage: A Cultural Plan*. Prepared for the Village of Nuiqsut and the North Shore Bureau Planning Commission and Commission on History and Culture.

Iñupiat Community of the Arctic Slope 1979. *Natural Petroleum Reserve in Alaska 105(c) Final Study Volume 1(b): The Iñupiat View*. U.S. Department of the Interior, Anchorage, AK. March).

McTeague, Monica L., E. Jamie Trammell, Tracey Gotthardt, Matthew L. Carlson, Justin R. Fulkerson, and Timm Nawrocki (eds.) 2015. Introduction to the Final Report in: *North Slope Rapid Ecological Assessment.* Prepared for the Bureau of Land Management, U.S. Department of the Interior. Anchorage, Alaska.

North Slope Borough, 2016. *Our Iñupiat Values*. [Official Website of the North Slope Borough-Healthy Communities Initiative]. Available at: http://www.north-slope.org/assets/images/uploads/Inupiat_Values_VB_program.jpg.

Wilson, R., L. Parrett, K. Joly, and J. Dau 2016. "Effects of roads on individual caribou movements during migration," *Biological Conservation* 195:2-8.

APPENDIX F:

TOOLS AVAILABLE FOR MITIGATION ACTIONS ON BLM MANAGED LANDS IN ALASKA, INCLUDING THE NPR-A

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APPENDIX F:

TOOLS AVAILABLE FOR MITIGATION ACTIONS ON BLM-MANAGED LANDS IN ALASKA, INCLUDING THE NPR-A

Tool	Authority	Considerations (Durability, Procedural, NPR-A RMS, etc.)	Overall Utility for NPR-A RMS
LUP/IAP Allocations (e.g., No Surface Occupancy [NSO], unavailable for leasing, Areas of Critical Environmental Concern, etc.)	Federal Land Policy and Management Act (FLPMA) and Naval Petroleum Reserves Production Act (NPRPA)	Procedural considerations: • Determined through Land Use Plan (LUP) decision process Durability considerations: • For up to the life of the LUP/Integrated Activity Plan (IAP), unless amended • Can exclude incompatible uses	**4 - HIGH**
Leasing Deferrals (subset of LUP/IAP allocations)	NPRPA	Procedural considerations: • IAP/plan-level decision • Equates to unavailable for leasing during the deferral period Durability considerations: • Lease deferral areas are identified for a set term but can be revoked through plan amendment	**4 - HIGH** if surface is closed to non-subsistence uses/temporary uses through plan decisions
Areas Unavailable for Leasing (sub-set of LUP/IAP allocations)	FLPMA and NPRPA	Procedural considerations: • Determined through LUP/IAP process Durability considerations: • For up to the life of the LUP/IAP, unless amended	**4 - HIGH** if surface is closed to non-subsistence uses/temporary uses through plan decisions

Tool	Authority	Considerations (Durability, Procedural, NPR-A RMS, etc.)	Overall Utility for NPR-A RMS
Terms, Conditions, and Stipulations	FLPMA NPRPA Mineral Leasing Act (MLA) (lease terms and conditions)	Procedural considerations: • Authorization-specific (or determined LUP/IAP process) • Variance requests may be considered • Determined and evaluated through NEPA process • Additional protections (e.g., NSO) could be added to existing lease agreements through an amendment or rider to the lease (if leaseholder is willing) • Optimal approach for the "minimize" tier of the mitigation hierarchy Durability considerations: • Can be amended or terminated with a new decision (e.g., renewal decision)	**4 - HIGH**, may incentivize minimizing surface impacts
Converting Leases to NSO		Procedural considerations: • Additional protections (e.g., NSO) could be added to existing lease agreements through an amendment or rider to the lease (if leaseholder is willing; voluntary) • Evaluated through NEPA process • Optimal approach for the "minimization" tier of the mitigation hierarchy • Could be applied to an entire lease; however, identification of specific NSO parcels is most likely (i.e., parcels within a lease tract that correspond to high value resources, setbacks, etc.) Durability considerations: • Can be amended or terminated with a new decision or lease agreement • NSO be tied to the life of the impact (vs. life of the right-of-way)	**4 - HIGH to VERY HIGH**, may incentivize minimizing surface impacts

Tool	Authority	Considerations (Durability, Procedural, NPR-A RMS, etc.)	Overall Utility for NPR-A RMS
Oil and Gas Lease Relinquishments	For non-NPR-A Leases/MLA Leases: 43 CFR § 3108.1 NPR-A Leases: 43 CFR § 3136.1	Procedural considerations: • Voluntary on behalf of leaseholder Durability considerations: • Area may/may not be available for new leasing, depends on LUP/IAP decisions; durability is the same as IAP decisions	**4 - HIGH** only if relinquished lease(s) is in an area that is now unavailable for future leasing (very few opportunities exist) Otherwise, **LOW to MODERATE** if relinquished lease(s) is in an area that is open to future leasing
Right of Way (NPRPA) **NOTE:** This tool is specific to the NPR-A	NPRPA, Section 102	Procedural considerations: • Right-of-way would need to be consistent with IAP • Use must be consistent with NPRPA • Unclear who the right-of-way would be issued to and for what use • Processing fee and annual rental to BLM; unclear if compensatory mitigation funds can be spent this way Durability considerations: • Allowable uses in IAP ROD would not be able to be excluded • No term limit; term established by Authorized Officer (AO) • Not revocable at will	**4 - HIGH**
Easement (2920)	FLPMA, 2920 Regulations	Procedural considerations: • Easements are used to assure that uses of public lands are compatible with non-Federal uses occurring on adjacent or nearby land • May only be issued for purposes not authorized under FLPMA Title V • Does not convey a possessory interest Durability considerations: • Excludes incompatible uses • Could be layered with other options to increase durability • Indefinite term limit allowable on easements	**3 - MODERATE** However, could be a suitable option for layering with other mitigation tools.

Tool	Authority	Considerations (Durability, Procedural, NPR-A RMS, etc.)	Overall Utility for NPR-A RMS
Setbacks (a sub-set of Terms, Conditions, and Stipulations)	FLPMA and NPRPA (determined through applicable LUP or NPR-A IAP and authorization-specific decisions)	Procedural considerations: • Determined through LUP/IAP/authorization-specific decision process • Must be consistent with Resource Management Plan/IAP/decision Durability considerations: • Can exclude incompatible uses • Generally modified or revoked only via planning process • Lengthy process • Variance requests can be considered	**3 - MODERATE**
Cooperative Agreement	FLPMA 307(b) – "in cooperation with others" Sikes Act, as amended (1974)	Procedural considerations: • Relatively easy to establish • Can be approved independent of other decisions (e.g., LUP, authorizations) Durability considerations: • Revocable at will • May not exclude incompatible uses • Not tied to planning, environmental, or public processes	**2 - LOW** but suitable for layering with other mitigation options
Right-of-Way (ROW) (2800)	FLPMA, Title V; 2800 Regulations	Procedural considerations: • Title V ROWs are development-oriented for facilities that are often linear in nature (i.e., canals, pipelines, transmission lines, roads) Durability considerations: • Excludes incompatible uses	**2 - LOW** However, could be a suitable option for layering mitigation tools and may be used for project-specific mitigation actions (e.g., subsistence access road, boat ramp)

Tool	Authority	Considerations (Durability, Procedural, NPR-A RMS, etc.)	Overall Utility for NPR-A RMS
Conservation "Pools"	FLPMA and NPRPA, (determined through applicable LUP or NPR-A IAP)	Procedural considerations: • Equates to leasing/no leasing and/or NSO decision, as such, it is an LUP/IAP-level decision; similar to "zoning" in an LUP/IAP • No specific mechanism or process for "establishing" pools; assumed to be identification of an area suitable for other mitigation/protection mechanisms (e.g., area suitable for a conservation easement) • Durability considerations: • Identification of a conservation pool would not offer durability in and of itself; layering with other mitigation/protection mechanisms would offer durability specific to the instrument used	**2 - LOW** Could be layered with other mitigation tools
Special Areas (established by Secretary or determined by plan) **NOTE:** This tool is specific to the NPR-A	NPRPA, Section 104 (determined through IAP process)	Procedural considerations: • Determined through IAP process • Must be consistent with NPRPA • Lengthy process • Recommendation for additional Special Areas can be submitted to AO at any time • AO must seek comments from interested public agencies, groups, and persons • AO makes recommendation to Secretary • Secretary makes final determination • Must be consistent with NPRPA Durability considerations: • Can exclude incompatible uses • Generally modified or revoked only via planning process	

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APPENDIX G:

BLM RANKING OF CANDIDATE REGIONAL MITIGATION SITES

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APPENDIX G:

BLM RANKING OF CANDIDATE REGIONAL MITIGATION SITES

The BLM is currently considering many potential mitigation actions as listed in Section 2.8. These actions were nominated by stakeholders and the BLM. All of the actions listed were evaluated by the BLM in the matrix that follows.

TABLE G-1 BLM Matrix for Ranking Candidate Regional Mitigation Actions

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
1	Facilitate access to subsistence use areas	(5) High – in draft resolution from tri-lateral committee	(4) Precise effect on adverse impacts to subsistence baseline unknown, but local hunters rank it highly. Will help achieve subsistence and cultural goals.	(3) Will require maintenance.	(2) Some permitting work has been completed. High risk of becoming impassable if not maintained.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	20
2	Reimburse hunters for additional costs	(5) High – in draft resolution from tri-lateral committee	(5) Could fully reverse adverse impacts. Will help achieve subsistence and cultural goals.	(3) Will require ongoing funding during period of impacts. Could be managed as an endowment if funds allow. Impacts should cease after restoration of the sites.	(2) Increasing demand could exhaust funding before impacts cease. Climate change could adversely impacts subsistence wildlife populations.	(2) Technically, and politically feasible. Will require development and oversight of rules.	(3) Immediate benefits	20
3 & 4	Develop and implement programs to share and store food	(1) Low – not a priority of the tri-lateral committee	(3) Could partially compensate for adverse impacts to subsistence. Would help achieve subsistence and cultural goals.	(3) Will require ongoing funding during period of impacts. Could be managed as an endowment if funds allow. Impacts should cease after restoration of the sites.	(3) Climate change could adversely impacts subsistence wildlife populations.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	16

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
5	Manage/control sport hunting	(1) Moderate – not a priority of the tri-lateral committee	(2) Could partially compensate for adverse impacts to subsistence. Would indirectly help achieve subsistence and cultural goals.	(3) Will require ongoing funding to enforce. Could be managed as an endowment if funds allow. Impacts should cease after restoration of the sites.	(1) Could be a challenge to enact and enforce.	(1) Potential technical, administrative, and political challenges.	(2) Short delay in delivering full benefits (until compliance is achieved)	10
6	Develop and implement programs to enhance local food production	(5) High – resolution from tri-lateral committee	(3) Could partially compensate for subsistence impacts. Will help achieve subsistence and health and safety goals.	(2) Will require ongoing funding during period of impacts, and after impacts cease. Could be managed as an endowment if funds allow.	(3) Successfully done in similar situations	(3) Technically, administratively & politically feasible.	(2) Short delay in achieving full benefits (until sustainable harvest is achieved)	18
7	Construct cultural centers in impacted communities	(5) High – resolution from tri-lateral committee	(4) Could partially compensate for adverse impacts to Iñupiaq culture and for environmental justice (EJ) impacts.	(2) Will require ongoing funding during period of impacts, and after impacts cease. Could be managed as an endowment if funds allow.	(2) Total construction cost and operations and maintenance costs could present a risk.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	19

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
8	Fund cultural camps for youth, preferably through an endowment	(3) Moderate – public support in local community	(4) Could partially compensate for adverse impacts to Iñupiaq culture and for EJ impacts.	(2) Will require ongoing funding during period of impacts, and after impacts cease. Could be managed as an endowment if funds allow.	(3) Low risk of failure	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	18
9	Support a whaling captain apprentice program	(3) Moderate – public support in local community	(4) Could partially compensate for adverse impacts to Iñupiaq culture and for EJ impacts.	(2) Will require ongoing funding during period of impacts, and after impacts cease. Could be managed as an endowment if funds allow.	(3) Low risk of failure	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	18
10	Support projects that document, teach, and protect culture, history, and language	(3) Moderate – public support in local community	(4) Could partially compensate for adverse impacts to Iñupiaq culture and for EJ impacts.	(2) Will require ongoing funding during period of impacts, and after impacts cease. Could be managed as an endowment if funds allow.	(3) Low risk of failure	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	18

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
11	Protect, restore or reclaim areas with important environmental, subsistence, or cultural resource values through a no-surface occupancy agreement, conservation easement or other tools	(5) High – particularly for areas that support subsistence wildlife	(3) Could partially compensate for adverse impacts to subsistence. Would indirectly help achieve subsistence, ecological, and cultural goals, but impacts to habitat not major.	(5) Will not require ongoing funding during period of impacts. Leases could last beyond impacts without additional funding.	(2) Documented evidence that these mechanisms have worked. Change agents (climate change, invasive species, wildfire) could adversely impact protected areas.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until point in time when resources would have been affected)	20
12	Continue monitoring of annual survival of the spectacled eider on the North Slope	(2) Identified by BLM resource specialists, not identified as a priority by stakeholders	(2) Could indirectly compensate for any impacts to the species (and the ecosystem), but impacts to the species are not identified as being major.	(3) Would require ongoing funding for enforcement during period of impacts, and to continue after impacts cease.	(2) Change agents (climate change, invasive species, wildfire) could adversely impact survival.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in realizing benefits (until studies are completed, actionable findings are identified, and implemented)	13

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
13	Identify and protect high-value wetlands	(5) High – particularly for areas that support subsistence wildlife	(3) Could partially compensate for adverse impacts to the ecosystem, but impacts to ecosystem are not expected to be significant.	(5) Could require a modest amount of ongoing funding for enforcement during period of impacts. Restrictions could last beyond impacts without additional funding.	(3) Documented evidence that these mechanisms have worked.	(2) Technically and administratively feasible. Could be political challenges if stakeholders disagree on "high-value."	(2) Short delay in delivering full benefits (until point in time when wetlands would have been altered)	20
14	Fund programs to protect against the introduction and proliferation of invasive species	(2) Moderate	(1) Could partially compensate for adverse impacts to the ecosystem, but impacts to ecosystem are not expected to be significant.	(3) Could require ongoing funding during period of impacts, and additional funding to continue after impacts cease.	(2) Documented evidence that these mechanisms have worked, but change agents (climate change, invasive species, wildfire) could adversely impact protected areas.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until point in time when invasive species would have become problematic)	13
15	Develop conservation or management plans for the NPR-A, vicinity	(3) Moderate – particularly among conservation groups	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the ecosystem, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed, and maintenance.	(3) Low risk that a plan could be developed.	(2) Technically and administratively feasible. Could be political challenges if stakeholders disagree on goals.	(1) Longer delay in realizing benefits (until studies are completed, actionable findings are identified and implemented)	12

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
16	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on subsistence species	(3) Moderate – particularly among conservation groups	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the ecosystem, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed, and maintenance.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in realizing benefits (until studies are completed, actionable findings are identified and implemented)	13
17	Create/expand /enforce special management areas/buffers	(4) Moderate – particularly for areas that support subsistence wildlife	(3) Could partially compensate for adverse impacts to subsistence. Would indirectly help achieve subsistence, ecological, and cultural goals, but impacts to habitat not major.	(5) Will not require ongoing funding during period of impacts. Restrictions could last beyond impacts without additional funding.	(2) Documented evidence that these mechanisms have worked. Change agents (climate change, invasive species, wildfire) could adversely impact protected areas.	(2) Technically and administratively feasible. Could be political challenges if stakeholders disagree on what should be protected.	(3) Immediate benefits	19

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
18	Restore/maintain water flow volume, protect surface water quality	(4) Moderate – particularly for areas that support subsistence wildlife	(3) Could partially compensate for adverse impacts to subsistence. Would indirectly help achieve subsistence, ecological, and cultural goals, but impacts to habitat not major.	(5) Could require ongoing funding during period of impacts.	(2) Precise actions are not known at this point. Restoration of flow could be a technical challenge. Climate change could alter flow.	(2) Potential technical challenges. Administratively and politically feasible.	(2) Short delay in delivering full benefits (until restoration is complete for the entire watershed)	18
19	Fund projects to control erosion	(3) Moderate - particularly for areas that support subsistence fisheries	(3) Precise actions/locations are not known at this point. Could mitigate adverse impacts to subsistence. Would indirectly help achieve subsistence, ecological, and cultural goals, but impacts to habitat not major.	(5) Could require ongoing funding during period of impacts.	(2) Precise actions are not known at this point. Climate change could alter flow.	(1) Restoration of flow could be a technical challenge. Administratively and politically feasible.	(2) Short delay in delivering full benefits (until waterways return to normal)	16

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
20	Collect baseline data and provide ongoing monitoring of ecosystem health and function	(3) Moderate – particularly among conservation groups	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the ecosystem, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed, and maintenance.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Short delay in delivering full benefits	13
21	Evaluate and predict effects of environmental change in breeding areas on spectacled eiders	(2) Identified by BLM resource specialists, not identified as a priority by stakeholders	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the species, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in delivering full benefits (until results become actionable and actions are taken)	12
22	Improve education efforts to eliminate take and the use of lead shot across the range of the spectacled eiders	(2) Identified by BLM resource specialists, not identified as a priority by stakeholders	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the species, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until hunters abandon lead shot)	13

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
23	Continue monitoring spectacled eider blood lead levels in areas where information is lacking	(2) Identified by BLM resource specialists, not identified as a priority by stakeholders	(1) Would not directly mitigate any impacts. Could indirectly lead to mitigation of adverse impacts to the species, but such impacts are not expected to be major.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in delivering full benefits (until monitoring indicates need for corrective action, actions are identified and implemented)	12
24	Improve air quality monitoring	(4) Moderate – nominated at several workshops by local residents	(2) Could indirectly mitigate adverse impacts to human health and safety and to the ecosystem.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until air quality is assessed, need for action is identified, and corrective actions are taken)	16
25	Support health programs in impacted communities	(3) Moderate – nominated at several workshops by local residents	(1) Could indirectly mitigate adverse impacts to human health.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	15

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
26	Develop and implement research and monitoring projects focused on improving the understanding of the effects of development infrastructure and activities on human health	(3) Moderate – nominated at several workshops by local residents	(1) Could indirectly mitigate adverse impacts to human health.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in delivering full benefits (until knowledge becomes operational and produces positive results)	13
27	Build recreation centers, teen centers, playgrounds, and/or picnic areas in and around impacted communities	(3) Moderate – nominated at several workshops by local residents	(1) Could partially mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	15
28	Provide parking in Deadhorse	(3) Moderate – nominated at several workshops by local residents	(1) Could partially mitigate impacts to quality of life and health and safety in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(3) Immediate benefits	15

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
29	Assist communities in communicating with levels of government and/or to obtain grants to help the communities deal with impacts	(3) Moderate – nominated at several workshops by local residents	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until grants are awarded and implemented)	14
30	Support the implementation/ expansion of STEM programs	(2) Moderate	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until program produces desired results)	13
31	Support the development and implementation of job training programs in North Slope communities	(2) Moderate	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until program meets demand)	13
32	Develop and implement programs that support local entrepreneurial and economic development in impacted communities	(2) Moderate – Programs, such as NS Marketplace, already exist.	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until program stimulates sustainable economy)	13

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
33	Fund increased local oversight/ monitoring of development activities, e.g., staff, training, funding to contract for technical and scientific expertise	(2) Moderate	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until training is complete and oversight produces results)	13
34	Pay for engineering/ architectural plans to secure sources of construction funding for facilities and infrastructure improvements in impacted communities	(2) Moderate	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(2) Short delay in delivering full benefits (until funds are secured and projects implemented)	13
35	Fund the development of long-term community development plans for impacted communities.	(2) Moderate	(1) Could partially and indirectly mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(3) Technically, administratively, and politically feasible.	(1) Longer delay in delivering full benefits (until plans are developed and implemented)	12

TABLE G-1 (Cont.)

ID	Proposed Mitigation Project	Importance	Effectiveness	Durability	Risk	Feasibility	Timeliness	Score
36	Build new housing to meet growing demand in impacted communities	(2) Moderate	(1) Could partially mitigate impacts to quality of life in impacted communities.	(2) Will require ongoing funding while being developed and after the impacts cease.	(3) Low risk of failure.	(1) Could be challenges administratively and politically.	(2) Short delay in delivering full benefits (until demand is met)	11

APPENDIX H:

RELATIONSHIP OF IMPACTS, MITIGATION GOALS, AND MITIGATION ACTIONS

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APPENDIX H:

RELATIONSHIP OF IMPACTS, MITIGATION GOALS, AND MITIGATION ACTIONS

NOTE: The underlined word is used to reference the respective goal in the Mitigation Goals column (column 3):

- Sustain and enhance access to and use of traditional subsistence use areas.
- Sustain and enhance opportunities and rights for Native peoples to live, practice, and pass-on Iñupiaq culture and lifestyle.
- Sustain and enhance the functionality of the ecological system, including land, water, and landscapes that allow for sustainable populations of fish and wildlife and their natural movement and distribution.
- Sustain and enhance the health and safety of the residents.
- Sustain and enhance opportunities for economic and community development, such as job training and local contracting.

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Air Quality	Increase in emissions of air pollutants. The projected direct and indirect emissions would be less than emissions that have occurred due to North Slope oil and gas activities in the past when production rates were much higher. However, the adverse impacts of increased emissions in close proximity to a community, particularly on children, the elderly, or residents with pre-existing respiratory illnesses, and particularly during periodic inversions, is anticipated to constitute a long-term negative health impact.	Health & safety Ecosystem	Improved air quality monitoring in communities
Birds	Direct and indirect loss of habitat, habitat fragmentation and behavioral alternation due to avoidance of developed infrastructure, vehicle traffic, human activity, and vessel traffic in the vicinity of coastal ports; mortality from collisions with human infrastructure or vessels. The consequences of these effects are expected to last for the life of the oil and gas development and, depending on the level of rehabilitation, perhaps longer.	Subsistence Culture & lifestyle Ecosystem	Preservation easements/leases Restrictions on infrastructure Construct new access routes to subsistence use areas Compensation for additional hunting costs

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Cultural Resources	Because the exact locations of unknown cultural resources sites are somewhat unpredictable, their disturbance cannot be entirely avoided. Excavation to recover remaining site data from an inadvertently disturbed site could result in the total destruction of the site, although if artifacts are recovered and housed in a cultural center or museum then the loss is partially mitigated.	Culture & lifestyle	Preservation easements/leases Restrictions on infrastructure Cultural centers Cultural education programs
Economy	Development of oil and gas resources may impair other economic activities, such as recreation. Oil and gas development near communities and other areas will increase the cost of subsistence activities and affect local food security, especially if not accompanied by increased employment and personal income in local communities. A lack of access to subsistence resources without increased personal income will increase transfer payments from one or more levels of government as residents seek financial assistance in place or as part of relocating to seek training and employment in Fairbanks, Anchorage, or elsewhere. A loss of a subsistence lifestyle may also result in social dysfunction and increased social ills and require increased government expenditures for health care or law enforcement intervention.	Community Culture & lifestyle	Construct new access routes to subsistence use areas Compensation for additional hunting costs Food storage and sharing programs Jobs and job training programs Entrepreneurial programs Education programs Community development and assistance programs
Environmental Justice	Noise and disturbance from development activities would be unavoidable. Exploration and development activities could reduce populations or production of terrestrial mammals, water birds, and fish or subsistence users' access to these resources and would primarily affect subsistence resources and would disproportionately affect Alaska Native minority populations. Most other subsistence effects would be short-term, local, and relatively minor. Wolf and wolverine harvests would be reduced in areas of human activity, while bear and fox could habituate to oil and gas activities within the NPR-A. Effects on the harvest of other species from noise and traffic disturbance and construction activities should be avoidable, if mitigated. If oil and gas infrastructure were located in subsistence hunting areas, some (real and/or perceived) restrictions on access by subsistence hunters would be unavoidable.	Subsistence Culture & lifestyle Community Health & safety	All proposed actions

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Fish	Some effects on fish from oil and gas activities would be unavoidable despite protective management measures: increased energy expenditure from avoidance behavior due to water use activities, construction within waterways, and seismic exploration; impeded migrations along the coast from causeways, unless a structural alternative is engineered to provide effective passage; sublethal effects from point and non-point source pollution; increased sedimentation and turbidity, changes in geomorphology, and altered hydrology due to roads, stream crossings, and floodplain gravel mining; and injury or mortality related to a small number of water use intakes.	Subsistence Culture & lifestyle Ecosystem	Preservation easements/leases. Restrictions on infrastructure Construct new access routes to subsistence use areas Compensation for additional hunting costs Food storage and sharing programs
Mammals (Marine)	Proposed RMS Boundary: Seismic surveying, air and boat traffic, and construction activities may disturb small numbers of seals or whales, but events of this nature would be brief and would be unlikely to impact population levels or distribution. Noise from offshore drilling activities may also disturb some species and would be more long-term in nature. Increased barge traffic will likely displace some migrating whales and possibly other marine mammals. Large spills from offshore developments could cause significant mortality events, but such spills are low-probability events, so resultant mortality events would also be unlikely.	Subsistence Culture & lifestyle Ecosystem	Preservation easements/leases Restrictions on infrastructure Construct new access routes to subsistence use areas Compensation for additional hunting costs Food storage and sharing programs
Mammals (Terrestrial)	Some disturbance and disruption of caribou and some habitat alterations from oil development are unavoidable. Displacement or reduced habitat use by the Teshekpuk Caribou Herd, Western Arctic Herd, and Central Arctic Herd caribou are likely to be local and long-term, and could persist over the life of the oil fields. For the Teshekpuk Caribou Herd this could result in a shift of the concentrated calving area, if development occurred within that area. Some noise and disturbance of other terrestrial mammals would be unavoidable, but would be short-term and localized and would not substantially affect mammal populations. Any impacts to individual mammals due to direct contact by spilled oil would be unavoidable, direct, adverse effects. Any such impacts to mammal habitat due to spills would be unavoidable, indirect, adverse effects.	Subsistence Culture & lifestyle Ecosystem	Preservation easements/leases. Restrictions on infrastructure Construct new access routes to subsistence use areas Compensation for additional hunting costs Food storage and sharing programs
Paleontological Resources	Because the exact locations of unknown paleontological resources sites are generally unpredictable, their disturbance cannot be entirely avoided.		

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Public Health	Ongoing exploration and development activities will further the trend toward higher consumption of store-bought food and decreased reliance on and availability of traditional food. As a result, the rates of diabetes, metabolic disorders, and associated chronic diseases will continue to increase. Because some displacement of subsistence resources and hunters is anticipated, injuries will increase as hunters' travel times and distances lengthen. The predicted influx of workers to villages along with disruption of subsistence harvests and ongoing acculturation will lead to increases in social pathologies, alcohol and drug abuse, and sexually transmitted infections.	Health & safety	Fund community health programs Food storage and sharing programs
Recreation	Some adverse effects to recreation from oil exploration and development are unavoidable — exploration and development activities and facilities such as the winter activities of seismic, ice roads/snow trails, ice pads, ice airstrips, and non-seasonal activities such as drill pads, pipelines, and gravel roads. The winter activities effects would be short-term, while the non-seasonal activities effects would be long-term. Activities could displace recreationists or introduce noise and signs of man's presence (e.g., aircraft overflights), thus adversely affecting their experiences on the public lands. However, the degree of the effect would depend on the actual location of the activities and their relationship to recreation opportunities.	Culture & lifestyle Community	Community development programs Construct recreational facilities
Socio-cultural Systems	The inability to harvest sufficient quantities of bowhead whales as a result of disturbance could cause residual effects on Iñupiaq traditional harvesting and sharing practices. The loss of the resources that Iñupiaq people use to define themselves would further distance younger generations from their Iñupiaq heritage and could cause profound changes in the community. Federal, North Slope Borough, and community-supported social programs with adequate funding would mitigate many of the socio-cultural consequences of oil and gas development. However, unavoidable repercussions to the communal practice of sharing of subsistence resources could occur.	Culture & lifestyle	All proposed actions

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Soils Resources	Impacts to soils from exploratory drilling would occur over a small area but would be unavoidable and permanent. Development activities could cause damage or loss of soil over the area affected. Construction of pipelines or use of gravel mine sites would also permanently disturb or destroy soil in the immediate vicinity. Crude or refined oil spill could impact soils beyond the immediate work area. Removal of gravel pads and roads may damage soils and leave remaining areas vulnerable to thermokarst. Due to the harsh Arctic climate, it could take several hundred years for soil productivity to reach pre-disturbance levels on abandoned pads and roads.	Ecosystem	Preservation easements/leases. Restrictions on infrastructure
Subsistence	Noise and disturbance from seismic surveys, exploration, development, and production could affect the harvest of subsistence resources for the communities of Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, Wainwright, and Point Lay. Additionally, disturbance could cause potential short-term impacts to long-tailed ducks and some eider populations. No harvest areas would become unavailable for use, but many subsistence users would avoid areas of oil development because of regulatory exclusion (real or perceived) and the potential for contamination of species. Disturbance to, and displacement of, caribou could lead to an unavoidable reduction in the total annual caribou harvest by making the harvest more difficult, costly, and time consuming for subsistence hunters. Wolf and wolverine harvests would be reduced in areas of human activity. If oil and gas infrastructure were located in subsistence hunting areas, some (real or perceived) restrictions on access by subsistence hunters would be unavoidable.	Subsistence Culture & lifestyle Health & safety	Construct new access routes to subsistence use areas Compensation for additional hunting costs Cultural centers Cultural education programs Food production programs Food storage and sharing programs Whale captain apprentice program

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Special Status Species	Many of the direct impacts to vegetation would be avoidable for sensitive species, because their growth sites could be avoided during development. Some effects on special status species from oil and gas activities would be unavoidable despite protective management measures. This would include indirect loss of habitat and behavioral alteration due to avoidance of human activity and vessel traffic in the vicinity of coastal ports or offshore drill sites. Other effects would come from spills of hazardous materials, including oil spills and mortality from collisions with vessels. Impacts to special status whales, walrus, and seals would be similar to impacts to marine mammals. For "pioneering" special status species such as humpback whales, impacts to individuals could have a larger detrimental effect on very local feeding populations. Impacts to polar bears would be of the same nature as those described above for terrestrial mammals except that polar bears tend to be relatively immune to disruption of their movements by human activities.	Ecosystem	Preservation easements/leases. Restrictions on infrastructure
Surface and Groundwater Resources and Water Quality	Residual adverse effects could occur from spills into freshwater or estuarine water bodies. Impacts to lakes and ponds could persist for decades.	Ecosystem	Preservation easements/leases. Restrictions on infrastructure
Vegetation	Direct impacts to vegetation would be unavoidable. Impacts from exploration could last from 1 year to decades. Impacts caused by oil or gas field development would be residual, direct, adverse effects. Placement of gravel drilling pads, roads, airstrips, staging areas, and docks, as well as construction of oil and gas pipelines and the use of gravel mine sites, would permanently disturb or destroy soil and vegetation. Additionally, vegetation and soils may be altered by formation of impoundments where gravel structures alter drainage patterns, or by snowdrift or dust accumulation along gravel pads and roads. Impacts from moisture regime changes would adversely affect original plant communities and associated fauna, but could positively affect plant communities that colonize those areas.	Ecosystem	Preservation easements/leases. Restrictions on infrastructure

Resource/Issue	Potential Residual Adverse Impacts	Mitigation Goals*	Potential Mitigation Actions
Visual Resources	Unavoidable adverse effects would occur from exploration and development activities through the introduction of vertical lines, regular spacing, reflectivity, and a greater spectrum of colors.	Culture & lifestyle	Preservation easements/leases. Restrictions on infrastructure
Wetlands and Floodplains	Direct impacts to wetlands and floodplains would be unavoidable. Impacts from exploration could last from one year to decades. Impacts caused by oil or gas field development would be residual, direct, adverse effects. Placement of gravel drilling pads, roads, airstrips, staging areas, and docks, as well as construction of oil and gas pipelines and the use of gravel mine sites, would permanently disturb or destroy wetlands, alter natural drainage systems, and create impoundments. Changes in plant community composition could last long after the life of the development. Restoration of natural drainage could take years after decommissioning. Gravel mine sites within floodplains would create permanent water bodies, which could provide fish habitat, if connected to streams.	Ecosystem	Preservation easements/leases. Restrictions on infrastructure
Wild and Scenic Rivers	Some effects on wild and scenic river values from oil and gas activities would be unavoidable. Increased aircraft overflights of eligible rivers would impact recreation and subsistence. Recreation experiences would be less primitive, and subsistence hunts could be disrupted by such overflights.	Culture & lifestyle	Preservation easements/leases. Restrictions on infrastructure
Wilderness Characteristics	Some adverse effects to scenic quality, solitude, naturalness, and primitive/unconfined recreation from direct effects of exploration and development are unavoidable. These effects would be limited to the viewshed and/or noiseshed of the activities. If these activities impair wilderness characteristics, the areas would be excluded from the Lands with Wilderness Characteristics Inventory.	Culture & lifestyle Community	Preservation easements/leases. Restrictions on infrastructure

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APPENDIX I:

SOCIOCULTURAL IMPACTS: ANALYZING NUIQSUT RESIDENTS' COMMENTS ON OIL DEVELOPMENT

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APPENDIX I:

SOCIOCULTURAL IMPACTS: ANALYZING NUIQSUT RESIDENTS' COMMENTS ON OIL DEVELOPMENT

Introduction

In an effort to (1) better estimate the degree of various subsistence and social impacts; (2) specifically illuminate tensions related to the permitting process; (3) make clearer how some social impacts might be mitigated; and (4) conduct an analysis without creating an undue amount of additional tension, a computer-assisted qualitative analysis of the comments (public testimony) made at BLM public meetings in Nuiqsut was undertaken.

The methods described in Appendix E show that impacts to subsistence are difficult to estimate, but that numbers can be derived from replacement values for meat or, through extensive surveys, displacement (additional travel) costs or contingent valuation. The number of acres impacted can also be analyzed and assigned a reasonable value. These methods can be problematic, but they are accepted and useful.

Both determining what constitutes other sociocultural impacts and estimating their levels present greater challenges – how can the social impacts of development on a culture or a group of people such as the Inupiaq residents of Nuiqsut be isolated from general impacts of modernization, particularly when there are substantial economic benefits that must be weighed and when entities and individuals are impacted differently? Inupiaq participants in the RMS pointed out in several workshops and in written comments that subsistence, culture, and environmental justice cannot be separated for the purpose of valuation, and that cultural "intactness" is priceless. Any effort to estimate social impacts is thus a fraught practice to begin with, and assigning monetary amounts to them is practically taboo. Nevertheless, residents are insistent that social impacts are real and have been underestimated; NEPA requires a thorough sociocultural analysis; guidance for implementing Executive Order 12898 on Environmental Justice raises the bar higher for sociocultural analyses of Inupiaq (minority) residents; and, if compensatory mitigation is to be successful in offsetting the residual impacts of development to some acceptable level, some way to estimate the value of the impacted resources is necessary.

In the past, factors related to oil development in Nuiqsut that have been understood as likely to affect sociocultural systems have included:

- Employment opportunities
- Increased or variable income
- Devaluation of the Nuiqsut cultural landscape
- Disruption to subsistence activities and uses
- Tensions related to the permitting process

Employment and income statistics can be obtained, although they should not be analyzed without adequate context. The number of cultural sites or acres of traditional land impacted can be calculated. Some of the social aspects of subsistence impacts can be informed by surveys (i.e., ADF&G comprehensive harvest surveys) that collect information on the amount of subsistence foods given and received, or by research into broader sharing networks. The analysis of sociocultural impacts for GMT1 was based on this information and on what the BLM learned from previous research done on Nuiqsut, issues discussed during many hours of government-to-government consultation with the Native Village of Nuiqsut tribal council, NPR-A Subsistence Advisory Panel meetings, interviews with Nuiqsut residents, and testimony provided during public meetings on the SEIS.

The GMT1 SEIS evaluation determined that there were several factors which contributed to a finding of major impacts to sociocultural systems, and that tensions related to the permitting process, including anxiety over the continuous bureaucratic and legal processes involved with permitting, are a key source of frustration and disenfranchisement. This is an impact that has sometimes been described as "being over-met" (in reference to the number of permitting/development-related meetings residents are invited to participate in). Importantly, this is unique among social impacts because it is something that can be isolated from the general effects of colonialism and modernization: It is truly a specific impact created by nearby industrial development. It is an issue that has been present throughout the creation of this RMS: In an effort to determine how best to mitigate impacts, the process of stakeholder outreach through workshops and meetings exacerbates one of the primary impacts that has been identified. At the same time, both residents and the law require continual stakeholder outreach. Given the current and reasonably foreseeable future development scenario, it is clear that this impact will continue and that the cumulative effects of these tensions could overwhelm an increasing number of individuals and could make the government's legally required efforts to conduct analysis and outreach less effective.

Research Objectives

The objectives of this project are to analyze public testimony to better assess various social impacts of nearby oil development on the small indigenous community of Nuiqsut and to create a tool that will both facilitate analysis and lessen the inevitable impacts of future requirements to analyze social impacts in the region. An early working title of this project was *What Did You Guys Do with Our Comments? – The Human Impacts of Perpetual Impact Analysis*. Although the first part of this title sounds trite, it is the main question that has driven this research and it is a contentious one currently at the heart of much research in the Arctic and with indigenous peoples around the world.

The oft-repeated question at public meetings, "What did you guys do with our comments?" can be understood as meaning, "Are you including and giving extra weight not just to my testimony today but to all the valuable indigenous and traditional ecological knowledge that our elders, in good faith, patiently shared with you over and over again throughout several decades of meetings just like this one, and how can we be assured that you are, and why should

we continue spending so much of our time and sharing without much evidence that you are using it in your decision-making?"

The second part of the working title refers to the findings of the project and indicates the objectives to validate residents' complaints and to lessen impacts in the future. It can be understood as a continuation of the run-on interpretation above, "…because all this is really taking a toll on me mentally and on my community as a whole and I'm giving up on it." Residents regularly complain about the social impacts of development, and several articulate aspects of those impacts in ways that greatly helped develop the codebook for this project.

Methodology

The analysis of public comments used standard social science qualitative data analysis software (Atlas.ti). The purpose of this software is to help researchers uncover and systematically analyze complex phenomena hidden in unstructured data. The program provides tools that let the user locate, code, and annotate findings in primary data material, to weigh and evaluate their importance, and to visualize the often complex relations between them.

Through a lengthy and deliberate collaboration between the BLM sociocultural expert and an outside qualitative analysis specialist, a master codebook to guide analysis of the transcripts of 10 Nuiqsut public meetings on oil development[2] was designed. Initial creation of the codebook used categories and aspects of subsistence and sociocultural impacts already identified in NEPA documents as prospective groups and codes, but it was mainly developed through intensive and iterative "open coding" (also known as substantive or intuitive coding). In reviewing the data (in this case, public testimony of Inupiat), repeated ideas, concepts, or elements became apparent and were tagged with codes. As more data was collected and reviewed, codes were grouped into concepts and categories. This methodology allowed aggregation of the data on the basis of the data itself, rather than trying to fit data into predetermined, limited categories of what were already suspected to be social impacts.

Determining the unit of analysis (amount of text) to code was challenging given the nature of the transcripts, but we decided to use what would generally be considered a paragraph as the unit. Transcriptions varied as to whether they were broken into blocks or paragraphs by subject or simply divided by speakers, regardless of the length of time one person spoke. In some cases we broke long sections of text into paragraphs. Capturing repetitions by a given speaker is important, as is capturing different ways the same code might come up.

The codebook and overall project was presented to and supported by the Native Village of Nuiqsut Tribal Council in August 2016.

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[2] Testimony is from public meetings in Nuiqsut on the Alpine Satellite Development Project, the NPR-A Integrated Activity Plan, the GMT1 Supplemental EIS, scoping for the Nanushuk EIS, and the GMT1 Compensatory Mitigation Funds. A list of meetings is included at the end of this section.

The Codebook

The codebook consists of 47 intuitive codes grouped into seven categories:

1. Public Health
2. Subsistence
3. Social Impacts of the Permitting Process
4. Physical Environment and Infrastructure
5. Miscellaneous and Important
6. Inupiat Culture and Way of Life
7. Economy

Two additional categories are not based on open or intuitive coding: One (*Names/Affiliations*) is for the personal names and, when known and appropriate, the affiliations of the speakers. Codes in these categories are not included in the analyses depicted below.

The second nonsubjective category is *Places*. How testimony is coded into the *Physical Environment and Infrastructure* and the *Subsistence* groups is usually very straightforward, *Economy* is rarely subjective, and *Public Health* is only slightly more so.

A one-page version of the codebook on the following page serves as an overview and as a table of contents for the actual codebook[3], which includes descriptions of categories, rules for the use of each code, and, for each code, examples of testimony that were given that code. Much of the testimony refers to more than one subject and is co-coded appropriately, allowing the important analysis of frequencies of code co-occurrences.

[3] The full-length codebook is available on a case-by-case basis.

TABLE I-1 Analysis Codes for Nuiqsut Residents' Testimony on Oil Development

Public Health • Air quality • Noise • Food (Niqipiaq & store-bought) • Water Health • Other human health issues	Subsistence • Access/Land Loss/Avoidance • Abundance of Fish & Wildlife • Migration changes/localized displacement • Air Traffic • Roads • Hunting (competition, regulations, enforcement) • Native Allotments
NEPA Process/Social Impacts of Permitting • Meetings • Comments • Pace • Capacity • Bureaucracy/Difficulty/Confusion • Rules • Lack of Sociocultural Analysis • Lack of Environmental Analysis • Distrust • Disenfranchisement • Conflict • Compensatory Mitigation	Physical Environment & Infrastructure • Drill Pads and Wells • Pipelines • Water Resources • Climate Change • Legacy Wells • Vegetation • Oil Spill • Blowout • Bridges • Flooding • Seismic • Proximity of Development • Offshore • Environment
Places • Fish Creek • Nigliq Channel • Colville River • Judy Creek • Tingmiaqsigvik/Ublutuoch/The Y • Umiat • Teshekpuk Lake • Oliktok	Miscellaneous & Important • Cumulative Impacts • Environmental Justice • Positive Impacts • Cultural Sites • Notable Quotations
Inupiaq Culture & Way of Life • Inupiaq or Native Way of life • Future Generations • Traditional or Indigenous Knowledge	Economy/Jobs/Poverty • Economy • Overcrowding
Names/Affiliations • 53 Inupiaq residents of Nuiqsut Identified by Full Names[4] • Native Village of Nuiqsut • Kuukpik Corporation • City of Nuiqsut • Arctic Slope Regional Corporation • North Slope Borough	

4 There are also five unidentified speakers, many of whom are likely included in the 53 named speakers.

The *Social Impacts of the Permitting Process* category is the main focus of this project and is the most difficult to code. It contains numerous codes that are more nuanced than the subjects typically analyzed in NEPA sociocultural systems sections. The codes are meant to provide insights into impacts that are often difficult to articulate and that pertain to a perpetual permitting process on a small minority population for nearby, large-scale development.

There are 12 codes within this group and several of the codes cover subjects that are closely related, thus the codebook includes extensive documentation of how to distinguish similar concepts. One such code in this group is *Bureaucracy* and it is designed to capture all comments that refer to:

- Difficulty or confusion with any aspects of the NEPA process or land management, including the documents themselves, acronyms and jargon, what stage of the process the agency is at, and the significance of "alternatives" presented in draft NEPA documents.

- Confusion about the various land owners or managers, including which entities own or manage which land, how land conveyance occurs, and what the various authorities of the entities are.

- Confusion over the numerous advisory groups that exist on the North Slope.

- Complaints about information overload and frustration with red tape.

A closely related code within the group is called *Community Capacity*. This code is used whenever people discuss how they are not adequately prepared to participate effectively in the process. This can be due to lack of trained and paid personnel, lack of time to deal with the process, lack of technology or equipment, or lack of ability to solicit legal advice.

Lack of Power/Disrespect/Disenfranchisement[5] is designed to capture other commonly expressed complaints about some aspect of the permitting process that is unfair or unjust and that occurs because the Inupiat have less power and agency. It is used for any complaints of racism, of inadequate consultation, that people's input is always solicited but seems to be ignored, that they have no real power to influence the ultimate decision (limited access to actual decision makers), and any complaints that they are exploited by industry or government agencies.

Distrust is the code used for a reference to distrust of the government, of industry, or of the science and monitoring done on impacts (including the belief that there are too many and redundant studies, which is usually connected to aircraft traffic); and when conflicts of interest are cited as reasons for distrust or when people are concerned the science is being spun or edited to reduce the evidence of impacts.

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5 *Disenfranchisement* is the most accurate word for this code. However, use of the term alone disenfranchises many residents who are not familiar with it. It was felt that "marginalize" was an even worse term and that "lack of agency" would be quite confusing as well.

Any testimony that refers to social and political conflict, including intracommunity conflict that is exacerbated by the permitting process and intercommunity conflict due to appropriation of impact funds and levels of impacts experienced, is coded as *Conflict*.

Codes within this group that are much simpler to attribute include *Pace*, which is used for any comment that refers to the speed at which various projects are permitted and constructed. *Meetings* is the code for any reference to the mechanics of the meetings (e.g., length, structure, scheduling, number of, demands for, needs for food and door prizes at). Any testimony that is explicitly about testimony and public comments (how they are used, what has been done with all of them, please use previous ones, etc.) is coded with *Comments.* Any testimony that refers to inadequacy of the physical/environmental data used in the analyses is coded *Lack of Environmental Analysis,* and any reference to an EIS or agencies or researchers failing to study or include information about impacts to humans (including failure to weigh social impacts adequately) is coded as *Lack of Social/Cultural Analysis*. Most reference to funds that are directed to a community to be used to offset impacts (including the State of Alaska NPR-A Impact Mitigation funds, GMT1 funds, or the Northeast NPR-A Regional Mitigation Strategy) are coded as *Compensatory Mitigation.* All references to permit stipulations and requirements, laws and regulations, and monitoring and enforcement are coded as *Regulations and Enforcement*[6] (code shorthand: Rules).

Findings

At this initial stage of the project, the codebook is finalized and preliminary analyses can be done on the data. There is likely too little data (too few meetings) to analyze trends, but the existing data does provide evidence that social impacts of the perpetual permitting process are deeper and more complex than previous analyses have indicated.

The coding software allows numerous types of analyses to be extracted from the data sets of coded transcripts. The most simple is a spreadsheet that lists every code, depicts in columns how many times each code occurred in each meeting, and gives a total. This allows one to see whether an especially high code is high due to only one or two meetings where it may have been the subject of a lengthy discussion or whether it is high because it is something that reoccurs at most meetings in high frequency. In the transcripts coded to date, for example, *Compensatory Mitigation* (code shorthand: Mitigate) has the highest count (170) and it is clear that it is an important subject at all meetings, but the very high count is due to the fact that three of the 10 meetings analyzed focused on the uses of GMT1 mitigation funds.

The second most frequent code (85 occurrences) is *Regulations and Enforcement* (code shorthand: Rules). Nearly every occurrence of this code is due to residents requesting stricter regulations and enforcement of them to protect subsistence resources and air and water quality. The top code with which *Regulations and Enforcement* co-occurs is *Migration changes/localized displacement*.

6 The *Rules* code is used for any discussion of what the BLM refers to as avoidance and minimization mitigation.

The third highest code (81 occurrences) is *Access/Land Loss/Avoidance* (code shorthand: Access), which is used whenever people speak of their ability to use traditional land, the loss of land, the avoidance of land due to infrastructure and activities, the need to travel farther to hunt or fish, and land claims and title to land.

Both the *Regulations and Enforcement* and *Access/Land Loss/Avoidance* codes are spread more evenly over all meetings. When more meetings are included in the analysis and outliers are accounted for, it is hoped that basic code counts will allow for a robust analysis of trends.

TABLE I-2 Code Counts for Nuiqsut Residents' Testimony on Oil Development

	P 1: 2004_2_10 Draft Alpine Satellite Development Plan	P 2: 2004_8_9 Northeast NPR-A Amendment Draft EIS	P 3: 2010_9_16 NPR-A IAP Scoping	P 4: 2012_5_16 NPR-A Draft IAP	P 5: 2014_3_12 GMT1 EIS Scoping	P 6: 2015_5_30 GMT1 Compensatory Mitigation Funds	P 7: 2015_9_22 GMT1 Compensatory Mitigation Funds	P 8: 2016_3_21 Nanushuk EIS scoping meeting	P 9: 2016_4_22 Nuiqsut trilateral on GMT1 Compensatory Mitigation Funds	P10: 2016_4_22 GMT1 Compensatory Mitigation Funds	TOTALS
Abundance of Fish & Wildlife	8	4	3	3	6	3	3	6	3	2	41
Access/Land Loss/Avoidance	16	5	7	18	8	4	7	8	5	3	81
Air Quality	5	0	1	8	3	5	0	8	0	1	31
Air Traffic	6	2	3	0	10	0	0	8	0	1	30
Allotment	1	3	1	2	0	0	0	1	0	0	8
Blowout	0	0	0	2	1	2	1	8	0	2	16
Bridges	10	0	2	0	1	1	0	0	0	0	14
Bureaucracy	4	3	11	4	2	4	21	4	9	1	63
Community Capacity	6	0	0	1	1	0	2	0	7	0	17
Climate Change	1	0	1	1	2	0	0	0	0	0	5
Colville River	6	1	4	3	2	2	4	11	13	4	50
Comments	5	3	1	9	0	2	1	2	0	1	24
Conflict	0	0	3	1	4	11	36	6	7	0	68
Cultural Sites	5	2	0	1	0	0	0	0	0	0	8
Cumulative Impacts	12	4	2	6	6	3	7	6	1	2	49
Lack of Power/Disrespect/ Disenfranchisement	10	1	1	3	1	2	17	4	1	0	40
Distrust	9	1	4	9	4	2	14	11	1	2	57
Economy/Jobs/ Poverty/Royalties	14	6	1	9	5	14	2	7	3	1	62
Environmental Justice	1	0	0	0	0	2	1	0	0	1	5
Fish Creek	5	1	2	2	4	2	4	0	3	6	29
Flooding	5	0	0	0	0	1	0	4	0	0	10

	P 1: 2004_2_10 Draft Alpine Satellite Development Plan	P 2: 2004_8_9 Northeast NPR-A Amendment Draft EIS	P 3: 2010_9_16 NPR-A IAP Scoping	P 4: 2012_5_16 NPR-A Draft IAP	P 5: 2014_3_12 GMT1 EIS Scoping	P 6: 2015_5_30 GMT1 Compensatory Mitigation Funds	P 7: 2015_9_22 GMT1 Compensatory Mitigation Funds	P 8: 2016_3_21 Nanushuk EIS scoping meeting	P 9: 2016_4_22 Nuiqsut trilateral on GMT1 Compensatory Mitigation Funds	P10: 2016_4_22 GMT1 Compensatory Mitigation Funds	TOTALS
Food (Native & store-bought)	2	1	1	8	2	0	0	5	1	1	21
Future Generations	7	6	0	9	10	5	6	8	2	0	53
Additional Human Health Issues	5	3	2	1	1	5	1	4	0	0	22
Hunting (competition, regulations, enforcement)	1	0	3	0	0	1	4	3	18	0	30
Inupiaq Culture	16	6	2	18	7	2	9	4	3	4	71
Judy Creek	0	0	0	0	1	0	0	0	0	0	1
Lack of Environmental Analysis	21	0	4	3	12	1	1	3	4	2	51
Lack of Social Analysis	7	1	1	4	3	2	8	2	3	2	33
Legacy Wells	0	0	0	1	0	1	0	3	0	0	5
Meetings	0	2	1	5	2	2	0	1	0	1	14
Migration Changes	22	9	3	9	6	3	3	10	1	0	66
Compensatory Mitigation	5	7	4	6	6	28	38	6	58	12	170
Nigliq Channel	9	0	1	2	1	2	0	4	1	2	22
Noise	1	0	0	0	0	1	0	1	0	0	3
Offshore Oil Development	0	0	0	1	1	0	1	0	0	0	3
Oliktok	0	0	0	0	0	0	0	0	0	0	0
Overcrowding	0	0	0	4	0	1	0	0	1	0	6
Pace	2	2	2	3	0	1	3	4	4	2	23
Drill Pads & Wells	4	0	0	0	2	1	1	5	0	0	13
Pipelines	19	4	6	5	1	0	0	3	0	0	38
Positive Impacts	3	4	2	0	3	0	0	1	23	1	37
Proximity of Development	11	1	1	3	4	1	2	7	0	0	30
Roads	14	0	3	2	6	1	1	3	27	1	58
Regulations and Enforcement	14	15	5	7	6	8	7	16	6	1	85
Seismic Exploration	0	0	0	1	0	0	0	0	0	0	1
Oil Spills	3	0	2	0	1	2	0	6	0	2	16
Teshekpuk Lake	1	3	1	2	1	0	3	0	0	0	11
Tingmiaqsigvuk	0	0	0	0	0	0	0	0	0	0	0
Traditional Knowledge	9	1	0	3	4	1	0	0	0	0	18
Umiat	1	0	1	1	1	0	0	1	2	0	7
Vegetation	1	0	0	0	0	0	0	0	0	0	1
Water Resources	2	0	3	0	1	0	0	0	0	0	6

	P 1: 2004_2_10 Draft Alpine Satellite Development Plan	P 2: 2004_8_9 Northeast NPR-A Amendment Draft EIS	P 3: 2010_9_16 NPR-A IAP Scoping	P 4: 2012_5_16 NPR-A Draft IAP	P 5: 2014_3_12 GMT1 EIS Scoping	P 6: 2015_5_30 GMT1 Compensatory Mitigation Funds	P 7: 2015_9_22 GMT1 Compensatory Mitigation Funds	P 8: 2016_3_21 Nanushuk EIS scoping meeting	P 9: 2016_4_22 Nuiqsut trilateral on GMT1 Compensatory Mitigation Funds	P10: 2016_4_22 GMT1 Compensatory Mitigation Funds	TOTALS
Water Quality	0	0	0	2	1	1	0	0	3	1	8
TOTALS	309	101	95	182	143	130	208	194	210	59	1631

Top code counts can also be depicted with bar graphs that differentiate meetings by color, making it clear that two recent meetings on GMT1 compensatory mitigation funds account for the high count for the Compensatory Mitigation code and that this subject has become increasingly discussed over the past 12 years.

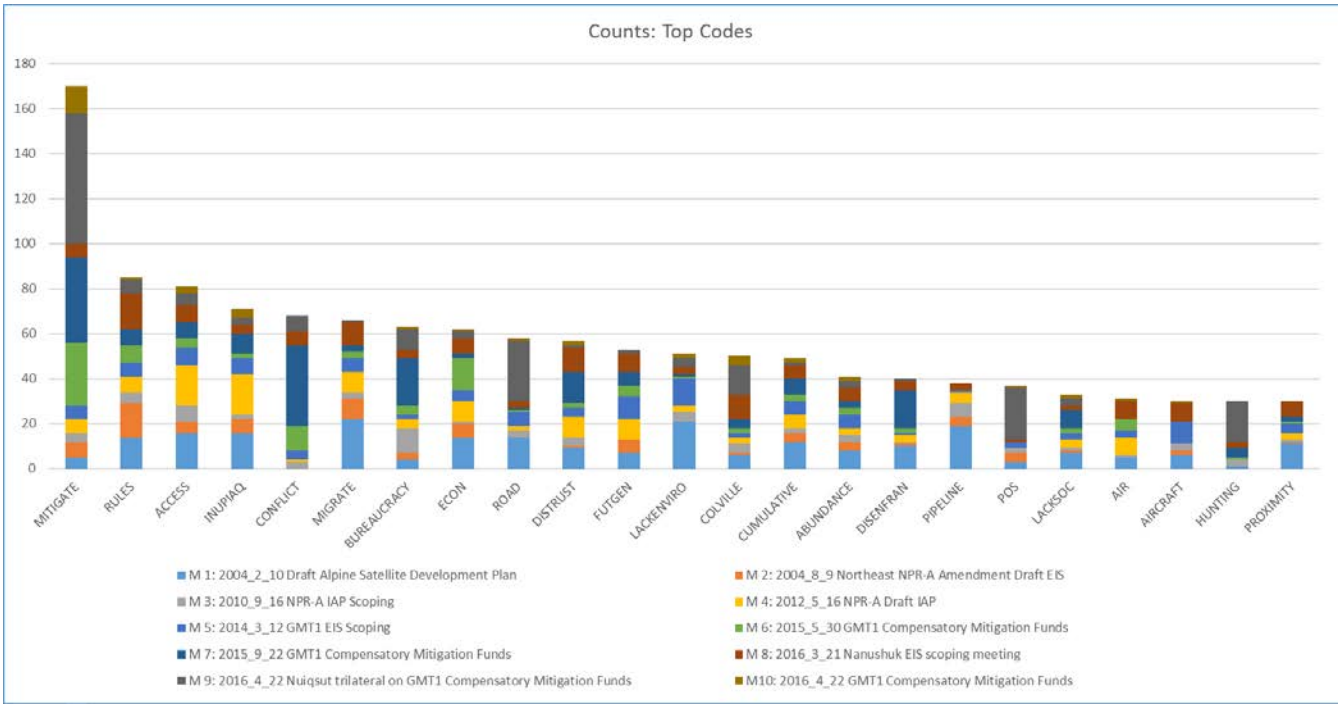

FIGURE I-1 Top Code Counts by Meeting

Depicting total code counts by meeting allow for a greater understanding of which meetings may be outliers and again indicates that discussions on compensatory mitigation include high counts for *Bureaucracy* and *Conflict*, whereas comments about *Future Generations* occur at a fairly steady frequency at most meetings.

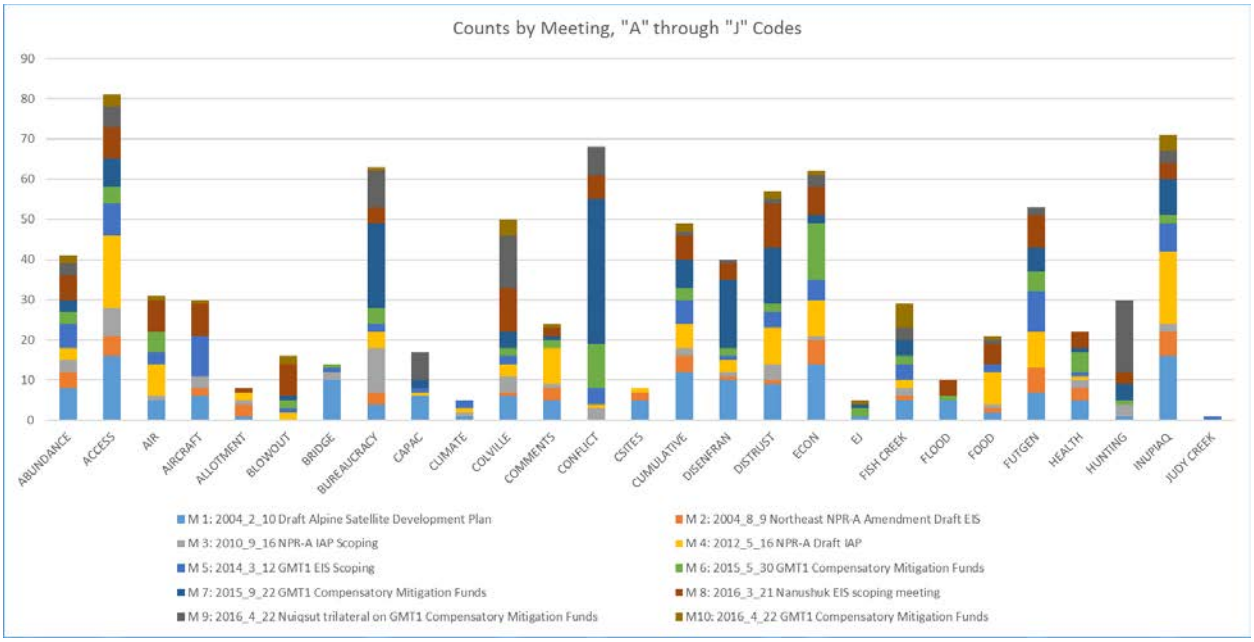

FIGURE I-2 Code Counts by Meetings for Codes "A" through "J"

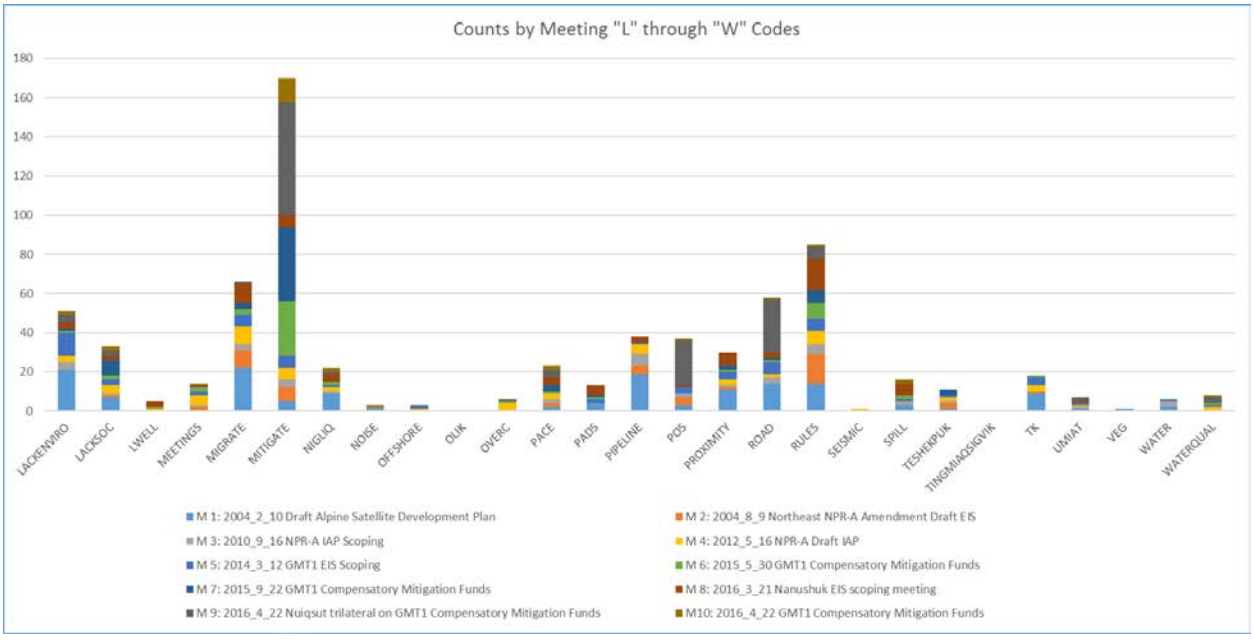

FIGURE I-3 Code Counts by Meetings for Codes "L" through "W"

Depicting the code counts by code category indicates that despite the extra attention the *Permitting Process* received at recent meetings on the RMS, codes in that category tend to occur at a high frequency at most meetings. These preliminary findings strongly support the theory that the permitting process is in itself responsible for substantial social impacts associated with oil development in Nuiqsut.

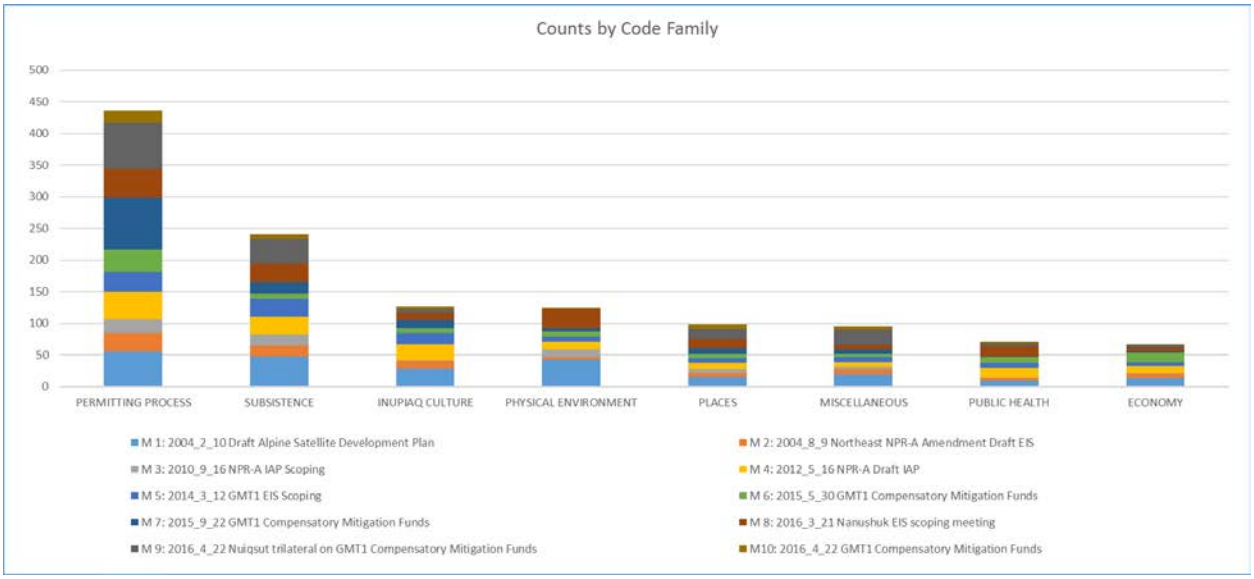

FIGURE I-4 Code Counts by Category

As mentioned above, one of the most useful analyses that can be run with the software is exploring which codes co-occur. One can look at the top co-occurrences of all codes, or one can analyze co-occurrences of specific codes. Looking at the frequency of co-occurrences with *Distrust*, for example, the data shows that its highest co-occurrences are with *Regulations and Enforcement* and *Lack of Power/Disenfranchisement* (14 times with each). The second highest co-occurrence frequency for *Distrust* is with *Cumulative Impacts*, *Social Conflict*, and *Access/Land Loss*: each co-occurs with *Distrust* 9 times.

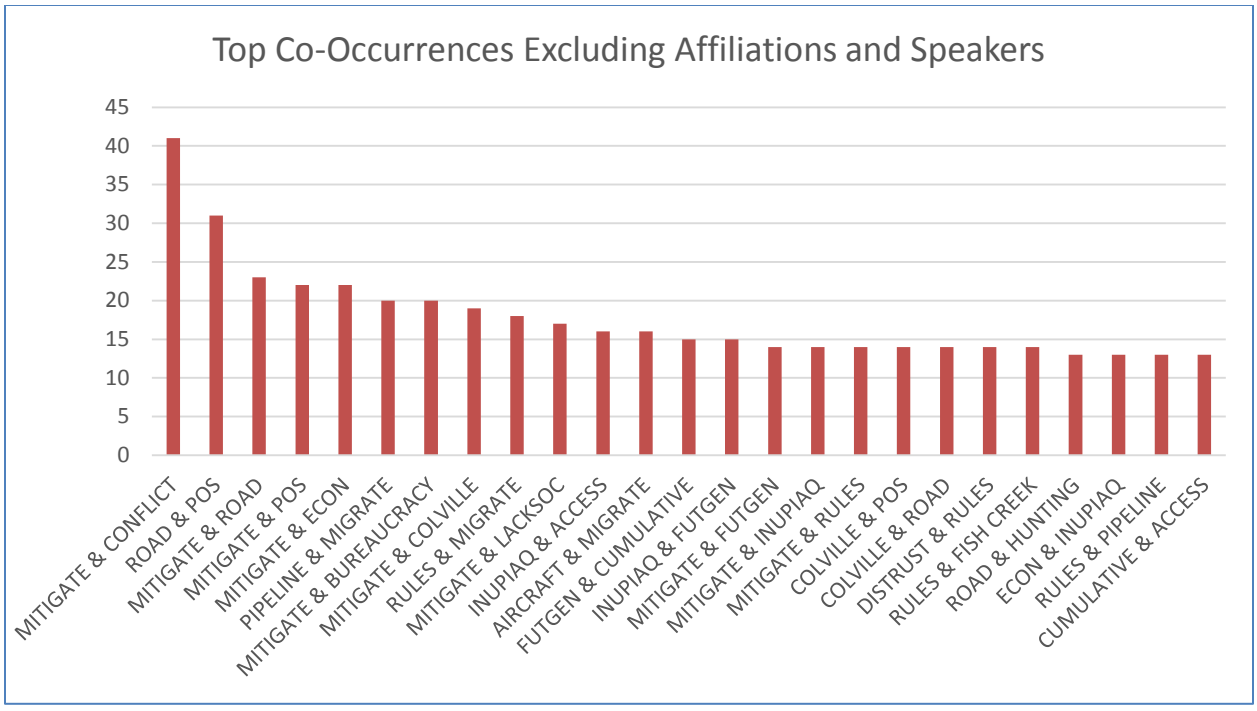

FIGURE I-5 Top Code Co-occurrences

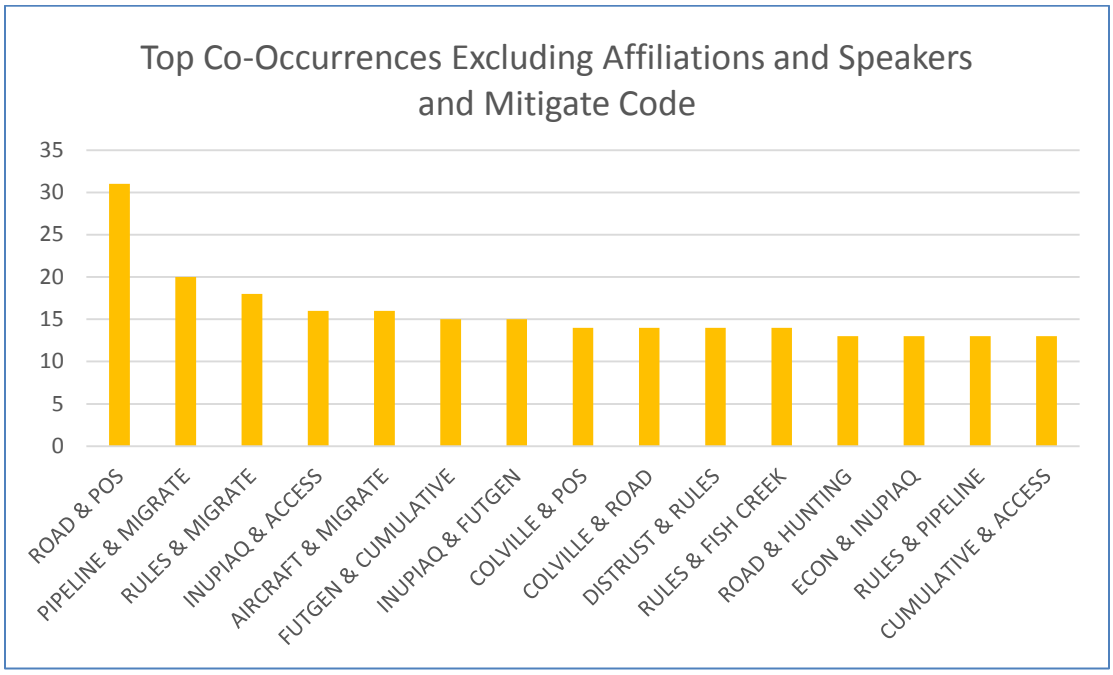

FIGURE I-6 Top Code Co-occurrences Excluding the *Compensatory Mitigation* Code

Another simple output that the software provides is a query report, which extracts all the actual testimony for the code or codes selected. A query can search for quotes from the testimony that are co-coded with a particularly high number of the top codes, such as this comment that was co-coded for *Access/Land Loss*, *Bureaucracy*, *Community Capacity*, *Cumulative Impacts*, *Future Generations*, and *Inupiaq Culture*:

> *And I didn't have a written comment, but I just want to say that I represent the elders who has no education on reading the EIS draft. They have taught us to live a good life, subsistence life, the way Inupiaqs are and that's who we are, and that's who we will continue to be when you leave. And I want to say that where were the agencies 30 years ago when Prudhoe Bay was being developed? Where were the agencies for our elders who I know have lost their rights, hunting rights over at Kuparuk, some on along the Sagavanirktok River? Where were the agencies to protect our elders who had once lived in Prudhoe Bay? Where were the agencies when Sarah Kunaknana, who I know has a sod house in Prudhoe Bay that she hasn't gone to see 30 years and was told by industry that she's – she can't go over there? She would for one time would love to go see her sod house, which is in Prudhoe Bay. Where were the agencies when my mom and other people from Oliktok were taken – driven out of there because of industry?*

Next Steps

The core transcripts for this first stage are public meetings[7] in Nuiqsut on onshore oil development. Subsequent stages of the project will expand the scope of meetings to allow users to compare and contrast data from those with the core transcripts. The other types of transcripts will include Nuiqsut public meetings on offshore oil development, public meetings in other North Slope Borough communities on oil development, NPR-A Subsistence Advisory Panel meetings, all-stakeholder Regional Mitigation Strategy workshops, NPR-A Working Group meetings, and other sets of transcripts that are available.

[7] One of the meetings included in the first 10 (2016_4_22 Nuiqsut Trilateral on GMT1 Compensatory Mitigation Funds) was technically not public; it was between BLM and numerous representatives of the three entities (Tribe, City, and Corporation). This transcript is included for now, but perhaps should be analyzed separately for comparative purposes in the future. The "Code Count by Meeting" chart shows that this meeting, as would be expected, focused heavily on mitigation.

Nuiqsut Public Meetings Analyzed in First Stage of Project

1. 2004_2_10 Draft Alpine Satellite Development Plan
2. 2004_8_9 Northeast NPR-A Amendment Draft EIS
3. 2010_9_16 NPR-A IAP Scoping
4. 2012_5_16 NPR-A Draft IAP
5. 2014_3_12 GMT1 EIS Scoping
6. 2015_5_30 GMT1 Compensatory Mitigation Funds
7. 2015_9_22 GMT1 Compensatory Mitigation Funds
8. 2016_3_21 Nanushuk EIS Scoping
9. 2016_4_22 Nuiqsut Trilateral on GMT1 Compensatory Mitigation Funds
10. 2016_4_22 GMT1 Compensatory Mitigation Funds

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Front Cover Photo Captions:
Hunter boating on the Kuuk River during caribou season (BLM); insets: Caribou in the Northeast National Petroleum Reserve in Alaska, (Bob Wick, BLM); Male polar bear walks on pack ice near the open water (Eric Regehr, USFWS); Spectacled Eider (USFWS).

Back Cover Photo Caption: Northeast National Petroleum Reserve in Alaska, (Bob Wick, BLM)