Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth 2 Development Project

Draft Supplemental Environmental Impact Statement

Volume 1: Chapters 1-6

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U.S. Department of the Interior
Bureau of Land Management
Anchorage, Alaska

In cooperation with:

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U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Bureau of Ocean Energy Management
State of Alaska
North Slope Borough
Iñupiat Community of the Arctic Slope

March 2018

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Alpine Satellite Development Plan GMT2 Development Project Draft Supplemental Environmental Impact Statement

Lead Agency	U.S. Department of the Interior (USDOI), Bureau of Land Management (BLM)
Proposed Action	To provide ConocoPhillips Alaska, Inc. (ConocoPhillips) with authorizations to construct, operate, and maintain a drill site, pipelines, access road, and ancillary facilities to develop and produce petroleum resources on federally managed lands within the Greater Mooses Tooth (GMT) Unit of the National Petroleum Reserve in Alaska (NPR-A).

Abstract

ConocoPhillips is proposing to produce hydrocarbon resources from a surface location on federal oil and gas lease AA-081798 in the NPR-A. The proposed GMT2 Project includes a drill site in the GMT Unit, a pipeline, and a road corridor to ConocoPhillips facilities at Greater Mooses Tooth 1 (GMT1).

This draft supplemental environmental impact statement (EIS) is being prepared to evaluate relevant new circumstances and information that have arisen since the Alpine Satellite Development Plan Final EIS was issued in September 2004, to provide opportunities for public participation, as well as to address changes to ConocoPhillips' proposed development plan for GMT2 (referred to as Colville Delta 7 [CD7] in the Alpine Satellite Development Plan EIS).

GMT2 is part of the Alpine Satellite Development Plan, for which a final EIS was prepared by the BLM, with a record of decision approving issuance of the BLM authorizations needed for development of the Alpine Field. The currently proposed GMT2 Development Project is very similar to the CD7 development approved for permitting in the 2004 Alpine Satellite Development Plan Record of Decision, with changes to accommodate access to the hydrocarbon reservoir and access to existing infrastructure.

The BLM has lead responsibility for preparation of this draft supplemental EIS. The U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Bureau of Ocean Energy Management, State of Alaska, Native Village of Nuiqsut, Iñupiat Community of the Arctic Slope and the North Slope Borough are participating in the analysis as cooperating agencies.

The draft supplemental EIS documents the potential effects to: Physiography, Geology, Soils and Permafrost, Sand and Gravel, Paleontological Resources, Water Resources, Surface Water Quality, Climate and Meteorology, Air Quality, Noise, Terrestrial Vegetation and Wetlands, Fish, Birds, Terrestrial Mammals, Marine Mammals, Threatened and Endangered Species, Sociocultural Environment, State and Local Economy, Subsistence Harvest and Uses, Environmental Justice, Public Health, Cultural Resources, Land Use, Recreation, Visual Resources, and Transportation. The potential effects of spilled crude-oil-produced fluids, seawater, and other chemicals have also been evaluated.

Further Information Contact Stephanie Rice of the Bureau of Land Management at 907-271-3202 or visit the supplemental EIS website at http://www.blm.gov/alaska.

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Executive Summary

What is the BLM proposing to do in this supplemental EIS?

BLM Alaska prepared this supplemental EIS to analyze an application by ConocoPhillips to construct, operate, and maintain a drill site, access road, pipelines, and ancillary facilities to support development of petroleum resources at the proposed Greater Mooses Tooth 2 (GMT2) site within the National Petroleum Reserve in Alaska (NPR-A). The key issues in the supplemental EIS center on oil and gas production decisions, the protection of surface resources, access to subsistence resources, and appropriate mitigation measures.

The purpose of the supplemental EIS is to evaluate any relevant new circumstances and information that have arisen since the Alpine Satellite Development Plan Final EIS, dated September 2004. Additionally, the BLM completed the NPR-A Integrated Activity Plan/Environmental Impact Statement Record of Decision in 2013 to determine the appropriate management of BLM-administered lands (public lands) in the nearly 23-million-acre NPR-A. This supplemental EIS tiers to both of these previous National Environmental Policy Act (NEPA) analyses and incorporates them by reference.

What are the major issues and focus of controversy?

The key issues in the supplemental EIS are analysis of impacts to surface resources, particularly subsistence resources, and analysis of socioeconomic impacts. Much of the analysis focuses on issues raised in scoping, such as subsistence and wildlife protections; impacts of and contributions to global climate change, impacts to water quality and air quality; air traffic effects; economic benefits to Alaska Natives; and cumulative effects of oil and gas development on the North Slope. The supplemental EIS examines a range of alternatives for the GMT2 Project, and considers relevant and reasonable mitigation measures, consistent with BLM policy.

Of particular interest is the proximity of the GMT2 site to the Village of Nuiqsut, and potential impacts to subsistence. Potential impacts to subsistence may result from hunter avoidance of the area, changes in access to subsistence use areas, resource (particularly caribou) availability, community participation in subsistence activities, aircraft traffic, spills, and rehabilitation of infrastructure upon abandonment.

What measures are being taken to reduce impacts?

All action alternatives incorporate ConocoPhillips' existing lease stipulations for the GMT Unit, as well as best management practices contained in the 2013 NPR-A Integrated Activity Plan/Environmental Impact Statement Record of Decision. ConocoPhillips has requested that the BLM grant deviations to two stipulations/best management practices (Appendix I). The BLM will determine whether or not to grant these deviations in its record of decision.

As the GMT2 applicant and primary oil development company in the Nuiqsut area, ConocoPhillips has attempted to mitigate impacts from flights in its exiting Alpine Development Field, and financially contributes to subsistence support programs in the community. ConocoPhillips has also incorporated project designs, such as subsistence pullouts, to reduce impacts to subsistence and other resources.

The BLM is considering the adoption of new potential mitigation measures as part of its GMT2 supplemental EIS authorization, which are analyzed for applicable resources throughout Chapter 4 of this document. The BLM will determine which new mitigation measures to adopt in its record of decision.

What alternatives are being considered by the BLM?

The draft supplemental EIS contains three action alternatives and a no-action alternative (Alternative D). Alternative A, the Proponent's Proposal, consists of an 8.2-mile gravel road and pipeline connecting the GMT2 pad with existing infrastructure at GMT1. Alternative B, the Alternate Road Alignment, consists of a 9.4-mile road and pipeline connecting the GMT2 pad to existing infrastructure. The alternate road alignment follows the watershed divide between the Fish Creek and Ublutuoch drainages. Alternative C, Roadless Development, consists of an 8.6-mile pipeline connecting GMT2 with infrastructure at GMT1, and an airstrip and occupied structure pad to support operations at GMT2.

Alternative A is the BLM's preferred alternative; however, this is not a final decision. The BLM will consider input from all stakeholders submitted during the public comment period before identifying the final preferred alternative in the final supplemental EIS. The identification of a preferred alternative does not constitute a commitment or decision in principle, and there is no requirement to select the preferred alternative in the Agency's record of decision. If warranted, the BLM may select a different alternative than the preferred alternative in its record of decision.

The BLM's draft supplemental EIS analysis reached a preliminary conclusion that Alternative A would be the least environmentally damaging alternative that meets the purpose and need for the GMT2 Project. Development of GMT2 may significantly restrict subsistence; however, Alternatives A and B would likely have the fewest impacts to subsistence. These alternatives require less air traffic close to the community than Alternative C, and air traffic is the most frequently reported caribou hunting impact associated with development.

What is next?

The publication of this draft supplemental EIS begins a 45-day public comment period that will end on May 2018. Public meetings and subsistence hearings will be held in Nuiqsut, Utqiagvik, Atqasuk, and Anaktuvuk Pass. Public meetings will also be held in Anchorage and Fairbanks. Comments can be submitted by mail, fax, email, or in person. Mail comments to:

GMT2 SEIS Comments
Attn: Stephanie Rice
222 West 7th Avenue #13
Anchorage, AK 99513

Comments may be faxed to: 907-271-3933

Comments may be emailed to: blm_ak_gmt2_comments@blm.gov

Comments may be hand-deliver during normal business hours (9 a.m. to 4 p.m.) to:

BLM Public Information Center
Fitzgerald Federal Building
222 West 8th Avenue
Anchorage, Alaska

After the close of the public comment period, the BLM will review and respond to all comments and publish the final supplemental EIS.

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Acronyms

μg/m³	micrograms/cubic meter
°F	degrees Fahrenheit
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
Anadarko	Anadarko E&P Onshore, LLC
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
APF	Alpine Central Processing Facility
ASDP	Alpine Satellite Development Project
ASRC	Arctic Slope Regional Corporation
ATV	all-terrain vehicle
BLM	Bureau of Land Management
BMP	best management practice
BOEM	Bureau of Ocean Energy Management (USDOI)
CAH	Central Arctic Herd
CD	Colville Delta
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
ConocoPhillips	ConocoPhillips Alaska, Inc.
Corps	U.S. Army Corps of Engineers (DoD)
cy	cubic yards
DOI	Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
EO	Executive order
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FLPMA	Federal Land Policy and Management Act
FLIR	forward looking infrared
GHG	greenhouse gases (e.g., carbon dioxide [CO_2], methane, nitrous oxide)
GIS	geographic information system
GMT	Greater Mooses Tooth
GMT1	Greater Mooses Tooth 1
GMT2	Greater Mooses Tooth 2
GPS	global positioning system
ICAS	Iñupiat Community of the Arctic Slope
MG	million gallons
MPH	miles per hour
MW	megawatt
MWe	megawatt electrical
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPR-A	National Petroleum Reserve in Alaska
NPRPA	Naval Petroleum Reserves Production Act
NPS	National Park Service
NSB	North Slope Borough
NVN	Native Village of Nuiqsut
Pb	lead

PCB	polychlorinated biphenyl
PM_{10}	particulate matter <10 microns
$PM_{2.5}$	particulate matter <2.5 microns
ppb	parts per billion
ppm	parts per million
ROD	record of decision
SO_2	sulfur dioxide
SRB&A	Stephen R. Braund & Associates
TCH	Teshekpuk Caribou Herd
UM	Umiat Meridian
USC	United Sates Code
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency (for reference as author)
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compounds

Chapter 1. Introduction

In August 2015, ConocoPhillips Alaska, Inc. (ConocoPhillips), as operator and working interest owner in the Greater Mooses Tooth Unit (GMT Unit), filed an application for permit to drill to develop hydrocarbon resources of the GMT Unit from a surface location on a Federal oil and gas lease in the National Petroleum Reserve in Alaska (NPR-A).

The proposed Greater Mooses Tooth 2 Development Project (GMT2 Project) includes a drill site on federally managed land in the GMT Unit, access road and pipelines on federal and private land in the NPR-A, and a pipeline and pipe rack on private and state lands outside the NPR-A. The GMT2, formerly known as Colville Delta 7 (CD7) development production pad, is one of the five drill sites composing the Alpine Satellite Development Plan for which the U.S. Department of the Interior (USDOI) Bureau of Land Management (BLM) prepared a final environmental impact statement (EIS). The 2004 Alpine Satellite Development Plan Record of Decision approved issuance of the BLM authorizations needed for development of the satellites.

The currently proposed GMT2 Project is similar to that approved for permitting in the 2004 Alpine Satellite Development Plan Record of Decision, and evaluated in the 2012 NPR-A Integrated Activity Plan EIS and Greater Mooses Tooth 1 Supplemental EIS, with changes that reduce the overall impact. These changes include removing the drill site location from the Colville River Special Area, and reducing the road and pipeline length, thereby reducing the amount of fill and associated impacts to wetlands.

This supplemental EIS will assist the BLM and other federal, state, and North Slope Borough agencies in evaluating ConocoPhillips's permit applications for this project. It considers new information or circumstances for agencies to determine whether the impacts of the proposed GMT2 Project are still within the range of impacts analyzed in the BLM 2004 Alpine Satellite Development Plan Final EIS and the BLM 2012 NPR-A Integrated Activity Plan/EIS. The supplemental EIS re-analyzes the proposed project in accordance with the requirements of NEPA (42 United States Code [USC] 4321, et seq.) as implemented by Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1500-1508).

1.1 Project Location and Land Status

The proposed GMT2 Project is located on the "North Slope" of Alaska's Brooks Range within the NPR-A, immediately to the west of the Colville River Delta. The proposed GMT2 pad is wholly on federally managed lands within the northeastern portion of the NPR-A. The proposed road and pipeline corridors cross both federally managed lands and private lands held by the Kuukpik Corporation (Nuiqsut Village Corporation) within the NPR-A (Map 1.1-1). The northern portion of the pipeline corridor between CD1 and CD4 North (an area of intersecting pipeline segments north of CD4 known as CD4N) is on land owned by the State of Alaska, and managed by the Alaska Department of Natural Resources. Kuukpik owns land along the southern portion of the pipeline corridor between CD1 and CD4N and from CD4N to CD5. Gravel will be obtained from the Native-owned Arctic Slope Regional Corporation Mine site. None of the proposed project facilities is located on or near Native allotments. However, there is one Native allotment within the planning area outside the NPR-A (see Section 4.4.5).

The 2008 Greater Mooses Tooth Unit Agreement (BLM 2008b, No. AA-087852) was entered into by ConocoPhillips, Anadarko, and Arctic Slope Regional Corporation, and approved by the BLM. The Arctic Slope Regional Corporation has applied for subsurface estate within the GMT Unit for lands selected by Kuukpik Corporation under the Alaska Native Claims Settlement Act, 43 USC 1601 et seq., and Section

1431(o) of the Alaska National Interest Lands Conservation Act. The GMT Unit was expanded in September 2009 to include leases east of the original unit area.

The GMT Unit agreement identifies national “participating area” boundaries (Map 1.1-1). These boundaries delineate the leases or areas of leases (tracts) that are expected to contribute a portion of the production from each reservoir to the agreement. In the GMT Unit, where only exploration drilling has occurred at this point, these boundaries represent a theoretical interpretation of the reservoir locations. As geophysical data are evaluated, exploration and production wells are drilled, and the physical extents of each reservoir are discovered, enough information is collected to reasonably determine which leases should be included in a participating area. The BLM uses these boundaries to allocate production for royalties to each committed tract within the participating area. Royalties are calculated using the allocation method agreed to in the unit agreement (see 43 CFR Section 3131.81).

The Arctic Slope Regional Corporation has assumed administration of some leases on Kuukpik land in the NPR-A pursuant to 43 CFR 3135.1-8(b). In accordance with 43 CFR 3135.1-8(c), the lease terms and conditions continue to apply to the lessee. However, only Arctic Slope Regional Corporation (as the new lessor) may enforce the lease stipulations on the conveyed lands—the BLM no longer has jurisdiction to do so. The BLM remains the land manager and lessor on lands that have been selected but not conveyed, and thus the BLM continues to enforce the lease stipulations and best management practices on such lands. While the BLM best management practices only apply on BLM-managed lands (including selected lands), the new landowner of conveyed lands (Arctic Slope Regional Corporation or Kuukpik Corporation) may adopt best management practices similar to or the same as those required by the BLM on lands that the BLM manages.

1.2 History of Operations in the Area

In 1923, Executive Order 3797 created the 23-million-acre Naval Petroleum Reserve Number 4 to protect a future oil supply for the Navy. In 1976, the Naval Petroleum Reserves Production Act transferred management of the area to the Secretary of the Interior and renamed Pet-4 as the NPR-A. In 1980, Congress authorized petroleum production in the NPR-A, and directed the Department of the Interior to undertake “an expeditious program of competitive leasing of oil and gas” in the Reserve (P.L. 96-514). Several lease sales were held in the early 1980s, and one exploration well was drilled.

Interest in leasing within the NPR-A lagged until the mid-1990s, when development on adjacent state lands made exploration in the NPR-A an economically feasible option. To pursue this renewed interest, the BLM developed an integrated activity plan and associated environmental impact statement, assessing potential use of the Northeast NPR-A for oil development. The integrated activity plan/ environmental impact statement was completed in August 1998, with a record of decision signed in October 1998, making approximately 87 percent (4 million acres) of the Northeast planning area available for oil and gas leasing. Lease AA-081798 was issued under the 1998 record of decision and included numerous stipulations to protect habitat, subsistence use areas, and other resources in the planning area.

ConocoPhillips’s first exploration program under leases obtained from the 1998 lease sale included the Lookout Prospect. The BLM authorized exploration based on a program-specific environmental assessment (EA) (BLM 2000) tiered to the 1998 integrated activity plan/EIS. Results of exploration indicated that developable reserves exist at Lookout. Lookout was subsequently planned for development as a satellite of ConocoPhillips’s Alpine Development Project (Alpine Development Plan) in the Colville River Unit and the associated drill site was named CD6. The Alpine Development Plan began with construction of the Alpine CD1 and CD2 drilling sites and associated facilities. Oil production from CD1 commenced in November 2000 and from CD2 in November 2001.

In total, the Alpine Satellite Development Plan included five satellite developments (CD3 through CD7) as potential extensions of the Alpine Development Plan. These satellites were planned to bring 3-phase (oil, water, and gas) hydrocarbon production to the Alpine Central Processing Facility at CD1 for processing and transport via the existing Alpine Central Processing Facility and Kuparuk common carrier oil pipelines to the Trans-Alaska Pipeline System.

In January 2003, the BLM and cooperating agencies (U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency [EPA], the U.S. Coast Guard, the State of Alaska, and the North Slope Borough) initiated the Alpine Satellite Development Plan EIS for the five proposed drill sites. The final EIS was issued in September 2004. In November 2004, the Secretary of the Interior issued a record of decision that approved the two satellites on federally managed lands (CD6 and CD7). The CD3 site was subsequently constructed on State of Alaska lands and CD4 was constructed on Kuukpik Corporation land. Production began at those sites in 2006. After a lengthy permit review, including relocation of the Nigliq Channel Bridge and adjustment of the road and pad to conform to the new bridge location, the U.S. Army Corps of Engineers issued a permit for CD5 development on Kuukpik Corporation land, which began operation in 2015. The record of decision for the GMT1 Project was issued in February 2015, and first gravel for the construction of GMT1 was laid in February 2017. The GMT2 Project is contingent on the construction of GMT1.

While the CD5 approval was in process, it was established that the two satellites on federally managed land (CD6 and CD7) were not located in the same reservoir as CD1, CD2, CD3, CD4, and CD5. As a result, ConocoPhillips asked the BLM to designate and approve the proposed unit area so ConocoPhillips could perform exploration and development operations in an efficient and logical manner under a unit plan of development. The CD6 satellite was renamed "GMT1" and CD7 was renamed "GMT2" after it was determined that these sites would not be part of the Colville River Unit and would be in the newly established GMT Unit.

1.3 Purpose and Need for the Project

The purpose of the proposed GMT2 Project is to construct a drill site, access road, pipelines, and ancillary facilities to support development and transportation of petroleum reserves from the GMT2 production pad, while protecting important surface resources. The project will produce 3-phase hydrocarbons (oil, gas, and water) that will be carried by pipeline to the Alpine Central Processing Facility at CD1(Alpine Central Processing Facility/CD1). Sales quality crude oil produced at Alpine Central Processing Facility/CD1 will be transported from CD1 via the existing Alpine Sales Oil Pipeline and Kuparuk Pipeline to the Trans-Alaska Pipeline for shipment to market.

Under the Naval Petroleum Reserves Production Act, the Secretary is required to conduct oil and gas leasing and development in the NPR-A (42 USC Section 6506a). The Department of the Interior and Related Agencies' Fiscal Year 1981 Appropriations Act specifically directs the Secretary to undertake "an expeditious program of competitive leasing of oil and gas" in the Petroleum Reserve. The GMT2 Project helps satisfy the purpose to develop oil and gas resources in the NPR-A. Specifically, the Naval Petroleum Reserves Production Act, as amended, encourages oil and gas leasing in the NPR-A while requiring protection of important surface resources and uses. EO 13212 (May 2001) directs federal agencies to give priority to energy-related projects:

> For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections.

The Naval Petroleum Reserves Production Act provides that the Secretary "shall assume all responsibilities" for "any activities related to the protection of environmental, fish and wildlife, and historical or scenic values" [42 USC Section 6503(b)] and authorizes the Secretary to "promulgate such rules and regulations as he deems necessary and appropriate for the protection of such values within the reserve."

Development and production of hydrocarbons from GMT2 will help offset declines in production from the Alaska's North Slope. Development will also provide benefits to local, state, and national economies through local hire for jobs created during construction and operations, tax revenues, revenue sharing, royalties, and new resources to help meet U.S. domestic energy demand.

1.4 Purpose and Need for Federal Action

The Council on Environmental Quality regulations direct that an EIS "shall briefly specify the underlying purpose and need to which the agency is responding …" (40 CFR 1502.13). The agency purpose and need for action triggers the NEPA analysis, and dictates the range of alternatives. It further provides the rationale for eventual selection of an alternative and a decision (BLM 2008c). This document brings together the evaluation needs of the BLM, U.S. Army Corps of Engineers, and other federal agencies.

The need for the action is established by the federal agencies' responsibilities under various federal statutes including the Mineral Leasing Act, Naval Petroleum Reserves Production Act , and the Clean Water Act to respond to ConocoPhillips's requests for drilling permits, fill material discharge permit, and other related authorizations to develop and produce petroleum in the GMT Unit.

The No Action alternative (Alternative D in Chapter 2, Proposed Project and Alternatives), was analyzed in the GMT2 document, but due to the BLM's requirements under the above federal statutes, would not be selected; the BLM would need to issue a permit. However, the no action alternative does provide a baseline for the affected environment and for action alternative analysis. CEQ regulations also direct that the BLM must include a description of the No Action alternative (40 CFR 1502.14(d)). Thus, while the No Action would not be selected under the above federal statutes, CFR regulations state that it must still be described in the narrative of the EIS.

Under the No-Action Alternative, the current conditions and expected future condition in the absence of the project are evaluated. ConocoPhillips's application for permit to drill, application for discharge into waters of the U.S., and related authorizations would not be approved. The No-Action Alternative does assume continuing exploration work as required under the GMT Unit Agreement; the alternative also assumes permitted studies in the NPR-A would continue, with continued use of aircraft in the project vicinity. The No-Action alternative further assumes that the GMT1 Project would be constructed, since that authorization is independent of the proposed project.

Further information on the No-Action Alternative is provided in Chapter 2 under Section 2.8.

1.4.1 Support for Federal Decisions

In proposing to undertake an action (e.g., issue a permit), federal agencies are required under NEPA to analyze the reasonably foreseeable probable environmental impacts from a proposed project and a reasonable range of alternatives, including a decision to take no action. If more than one federal agency is involved in a related action, a single NEPA document may be developed to meet the requirements of all federal agencies. Typically, as with this project, one agency is designated as the lead agency with other agencies serving as cooperating agencies.

1.4.2 Laws, Regulations, and Permits

Requirements of federal, state, and local laws and regulations associated with development activities in the NPR-A were discussed in detail in the Alpine Satellite Development Plan Final EIS (2004, Section

1.1.3–1.1.4) and the NPR-A Integrated Activity Plan/EIS (2012, Section 1.8–1.9), which are incorporated by reference. A summary is provided below.

Comprehensive planning and management of oil and gas leasing, exploration, and future development in the NPR-A have been addressed in a series of documents. They include the: NPR-A Final Environmental Assessment Federal Oil and Gas Lease Sale (BLM 1981); Final EIS for Oil and Gas Leasing and Development in the NPR-A (BLM 1983); Northeast National Petroleum Reserve Alaska Integrated Activity Plan/EIS (BLM 1998b); Northeast NPR-A Final Amended Integrated Activity Plan/EIS (BLM 2005); Northeast National Petroleum Reserve-Alaska Final Supplemental Integrated Activity Plan/EIS (BLM 2008); and NPR-A Final Integrated Activity Plan/EIS (BLM 2012).

1.4.2.1 Lead and Cooperating Agency Authorities

The BLM. As the federal land manager of the NPR-A, the BLM is responsible for land-use authorizations in the NPR-A. Upon completion of the supplemental EIS process, the BLM will make decisions regarding ConocoPhillips's proposal. The authority for management of the land and resource development options in the supplemental EIS comes from several statutes including NEPA; the Federal Land Policy and Management Act; the Federal Oil and Gas Royalty Management Act of 1982; the Minerals Leasing Act; the Naval Petroleum Reserves Production Act of 1976, as amended; Department of the Interior Appropriations Act Fiscal Year 1981 (P.L. 96-514), amending the Naval Petroleum Reserves Production Act; and Title VIII of the Alaska National Interest Lands Conservation Act. These BLM authorities are further described below.

- NEPA sets out policy and provides the means by which the federal government, including the BLM and the federal cooperating agencies, examines major federal actions that may have significant impacts on the environment, such as the authorization of oil and gas development contemplated in this supplemental EIS (42 USC Section 4231 et seq.).
- Under the Federal Land Policy and Management Act, the Secretary of the Interior has broad authority to regulate the use, occupancy, and development of public lands and to take whatever action is required to prevent unnecessary or undue degradation of public lands (43 USC Section 1732). In accordance with the Federal Land Policy and Management Act, the BLM manages its lands and their uses to ensure healthy and productive ecosystems.
- The proposed action helps satisfy the purpose of the Naval Petroleum Reserves Production Act to explore and develop oil and gas resources in the NPR-A. Specifically, the Naval Petroleum Reserves Production Act, as amended, requires oil and gas leasing in the NPR-A while also requiring protection of important surface resources and uses.
- The Naval Petroleum Reserves Production Act provides the Secretary of the Interior with the authority to: protect "environmental, fish and wildlife, and historical or scenic values" in the Reserve [42 USC Section 6503(b)]; and provide "conditions, restrictions, and prohibitions as the Secretary deems necessary or appropriate to mitigate reasonably foreseeable and significantly adverse effects on the surface resources of the National Petroleum Reserve in Alaska" [42 USC Section 6506a(b)].
- Title VIII of Alaska National Interest Lands Conservation Act establishes procedures for federal land management agencies to evaluate impacts on subsistence uses and needs and means to reduce or eliminate such impacts on federally managed lands (16 USC Section 3120).
- The Mineral Leasing Act (30 USC Section 185, 43 CFR Part 2880), provides the BLM with the authority to issue right-of-way grants for oil and natural gas pipelines and related facilities (not authorized by appropriate leases). Pursuant to this right-of-way grant, the BLM will attach appropriate requirements for the construction, operation, maintenance and reclamation of the proposed pipeline between CD5 and GMT2.

Department of the Interior Secretarial Orders

The Secretary of the Interior issued four separate Secretarial Orders during the development of GMT2 that impacted several different parts of the Environmental Effects section in Chapter 4. These Secretarial Orders were issued from March to December 2017 and required revisiting analysis in regards to climate change, mitigation, and greenhouse gases. The Secretarial Orders, in chronological order of issuance, are presented below. Not every Secretarial Order had to be factored into GMT2, but had to be given consideration on both the analysis and the project's timeline.

Secretarial Order 3349

Secretarial Order 3349, issued on March 29, 2017, directed the DOI to, under Executive Order "Promoting Energy Independence and Economic Growth," (March 28, 2017) to "review all existing regulations, orders, guidance documents, policies, and any other similar actions that potentially burden the development or utilization of domestically produced energy resources." The Sec. Order revoked Sec. Order 3330, "Improving Mitigation Policies and Practices of the Department of the Interior," and instructed that any action under Sec. Order 3330 must be reviewed for reconsideration, modification, or rescission. Among the other authorities that Sec. Order 3349 revoked include:

- Executive Order 13653, "Preparing the United States for the Impacts of Climate Change";
- Presidential Memorandum of June 25, 2013, "Power Sector Carbon Pollution Standards,";
- Presidential Memorandum of November 3, 2015, "Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment,"
- And others (Secretarial Order in its entirety can be viewed at 'Secretarial Order 3349, in the DOI online Library').
- New language on climate change and greenhouse gases are being developed by the Office of the Solicitor.

Secretarial Order 3352

Secretarial Order 3352, issued on May 31, 2017, directed the Assistant Secretary of Land and Minerals Management to "initiate a review and development of a revised IAP for the NPR-A, promoting an appropriate statutory balance of promoting development while protecting surface resources, and to issue an evaluation under the existing IAP to efficiently and effectively maximize tracts offered for sale during the next NPR-A lease sale." The Secretarial Order also instructed the Assistant Secretaries of Lands and Minerals Management, and Water and Science, to "develop a joint plan for assessing undiscovered, technically recoverable oil and natural gas resources…including the NPR-A and Section 1002 Area." Current anticipated direction is that BLM Alaska will issue a DNA based on an alternative analyzed but not implemented in the 2012 Final IAP/EIS.

The Secretarial Order in its entirety can be viewed at 'Secretarial Order 3352, in the DOI online Library'.

Secretarial Order 3355

Secretarial Order 3355 was issued in response to the March 27, 2017 Secretarial Order on Improving the BLM's Planning and NEPA Processes. Secretarial Order 3355 set new page length restrictions of no more than 150 pages and no more than 12 months for non-RMP EIS projects. After review by the Washington Office, it was determined that, due to already having an NOI published before Sec. Order 3355 was issued, GMT2 is not subject to the Sec. Order 3355 restrictions on page and time lengths.

The Secretarial Order in its entirety can be viewed at 'Secretarial Order 3355, in the DOI online Library'.

Secretarial Order 3360

Secretarial Order 3360, issued on December 22, 2017, rescinded authorities that were found to be inconsistent with Secretarial Order 3349, "American Energy Independence." Sec. Order 3360 additionally rescinded:

- Departmental Manual Part 523, Chapter 1: Climate Change Policy, dated, December 20, 2012;
- Departmental Manual Part 600, Chapter 6: Landscape-Scale Mitigation Policy, dated, October 23, 2015;
- Bureau of Land Management, Manual Section 1794 - Mitigation, dated, December 22, 2016; and
- Bureau of Land Management, Mitigation Handbook H-1794-1, dated, December 22, 2016.

The Secretarial Order further directed the BLM Draft Regional Mitigation Strategy for the NPR-A to be revised and to include public comment where necessary; and it directed the BLM to henceforth revise the IM No. 2008-204, which outlines policy for the use of offsite mitigation for authorizations issued by the BLM. The 2008 is to be used as guidance on mitigation for the foreseeable future.

The Secretarial Order in its entirety can be viewed at 'Secretarial Order 3360, in the DOI online Library'.

The U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers has the authority to issue or deny permits for placement of dredge or fill material in the waters of the U.S., including wetlands (which incorporate the vast majority of the project study area) and for work and/or structures in, on, over, or under navigable waters of the U.S.. Consequently, U.S. Army Corps of Engineers authority extends, and its decisions following completion of the supplemental EIS will extend, to ConocoPhillips's entire proposal, regardless of who owns the land. These U.S. Army Corps of Engineers authorities are set forth as follows.

- Under Section 404 of the Clean Water Act (33 USC Section 1251 et seq.), the U.S. Army Corps of Engineers regulates placement of dredge and fill material in waters of the U.S., including wetlands. The proposed project is located in an area that is entirely composed of wetlands that are within the U.S. Army Corps of Engineers' jurisdiction.
- In accordance with 33 CFR 332.1(c)(3), "compensatory mitigation for unavoidable impacts may be required to ensure that an activity requiring a section 404 permit complies with the Section 404(b)(1) Guidelines." Pursuant to this authority, the U.S. Army Corps of Engineers can require compensatory mitigation calculated on the entire functional value of each acre of the direct project footprint, plus an additional multiple of lost functional value associated with impacts to the aquatic ecosystem surrounding the project footprint.
- Under Section 10 of the Rivers and Harbors Act (33 USC Section 401), the U.S. Army Corps of Engineers has regulatory authority for work and structures performed in, on, over, or under navigable waters of the U.S..

The EPA. The EPA authority to regulate oil and gas development is contained in the Clean Water Act (33 USC Section 1251 et seq.), Clean Air Act (42 USC Section 7401 et seq.), and the Safe Drinking Water Act (42 USC Section 300f et seq.). Similar to the authority of the U.S. Army Corps of Engineers, the EPA's authority extends, and its decisions following completion of the supplemental EIS will extend, to ConocoPhillips's entire proposal, regardless of who owns the land. These authorities follow.

- Under Section 402 of the Clean Water Act (33 USC Section 1251 et seq.), the EPA has delegated authority to the State of Alaska to issue permits for facilities operating within state jurisdiction of permits issued for the discharge of pollutants from a point source into waters of the U.S. for facilities, including oil and gas. Point-source discharges that require an Alaska Pollutant Discharge Elimination System permit include, but are not limited to, sanitary and domestic wastewater, gravel pit and construction dewatering, and hydrostatic test water, storm water discharges, etc. (40 CFR 122).

- In accordance with Section 404 of the Clean Water Act (33 USC Section 1251 et seq.), the EPA reviews and comments on U.S. Army Corps of Engineers Section 404 permit applications for compliance with the Section 404(b)(1) guidelines and other statutes and authorities within its jurisdiction (40 CFR 230).
- Under the Safe Drinking Water Act (42 USC Section 300f et seq.), the EPA's responsibilities include the management of the Underground Injection Control program and the direct implementation of Class I and Class V injection wells in Alaska. These wells cover injection of non-hazardous and hazardous waste through a permitting process for fluids that are recovered from down hole, as well as municipal waste, stormwater, and other fluids that did not come up from down hole (40 CFR 124A, 40 CFR 144, 40 CFR 146). The EPA oversees the Class II program delegated to the State of Alaska that is managed by the Alaska Oil and Gas Conservation Commission, which includes Class II enhanced oil recovery, storage, and disposal wells that may receive non-hazardous produced fluids originating from down hole, including muds and cuttings (40 CFR 147).
- Under Sections 165 and 502 of the Clean Air Act (42 USC Section 7401 et seq.), the State of Alaska is delegated authority to issue air quality permits for facilities operating within state jurisdiction for the Title V operating permit (40 CFR 70) and the "prevention of significant deterioration" permit (40 CFR 52.21) to address air pollution emissions. The EPA maintains oversight authority of the State's program.
- Under Section 311 of the Federal Water Pollution Control Act of 1972, as amended (Clean Water Act, 33 USC Section 1321, 40 CFR Part 112), the EPA requires a "spill prevention containment and countermeasure plan" for storage of over 660 gallons of fuel in a single container or over 1,320 gallons in aggregate aboveground tanks.
- Under the Clean Water Act as amended (Oil Pollution Act; 33 USC Chapter 40; FRP Rule; 40 CFR Part 112, Subpart D, Section 112.20–112.21) the EPA requires a "facility response plan" to identify and ensure the availability of sufficient response resources for the worst case discharge of oil to the maximum extent practicable, "…generally for facilities that transfer over water to or from vessels, and maintaining a capacity greater than 42,000 gallons, or any facility with a capacity of over one million gallons."
- 40 CFR parts 1500–1508 and Section 309 of the CAA (42 USC Section 7609): requires a review and evaluation of the draft and final EIS for compliance with Council on Environmental Quality guidelines.

The U.S. Fish and Wildlife Service (USFWS). The decisions ascribed to the USFWS on its responsibilities to enforce the Endangered Species Act (including marine mammal and bird species subject to the Act). Specifically, the USFWS provides consultation (recommendation) as required under Section 7 of the Act. The USFWS also provides consultation regarding impacts to fish and wildlife resources under the Fish and Wildlife Coordination Act.

The Bureau of Ocean Energy Management. The Bureau of Ocean Energy Management's Office of Environmental Programs conducts NEPA analyses and gathers compliance documents for each major stage of energy development planning related to offshore oil and gas development. Bureau of Ocean Energy Management will not issue permits associated with this project; however, the Bureau provided subject matter expertise in the drafting and review of this NEPA document. The Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska, established under EO 13580, adopted the concept of "integrated arctic management" to ensure that decisions on development and conservation made in the Arctic are driven by science, stakeholder engagement, and government coordination. Bureau of Ocean Energy Management's participation as a cooperating agency furthers these goals by enabling coordinated government efforts on natural resource development planning in the Artic.

In addition to the statutory authorities described above, a number of Executive orders apply to all federal agencies. These include EOs 11988 (Floodplain Management), 11990 (Protection of Wetlands), 12898 (Environmental Justice), 13075 (Tribal Consultation), and 13112 (Invasive Species Control).

The State and the North Slope Borough require permits for certain activities within the NPR-A. The North Slope Borough, as a Home Rule Borough, issues development permits and other authorizations for oil and gas activities under the terms of its ordinances (North Slope Borough Municipal Code Title 19).

The State has responsibility for issuance of several permits. Alaska's Department of Natural Resources issues temporary water use and water rights permits, permits for cultural resource surveys, cultural resource concurrences, and other authorizations for activities associated with oil and gas development. The Alaska Department of Fish and Game issues fish habitat permits. Under the state implementation plan, the Alaska Department of Environmental Conservation issues prevention of significant deterioration and other air quality permits. The Alaska Department of Environmental Conservation is responsible for issuing several permits and plan approvals for oil and gas exploration and development activities, including the storage and transport of oil and cleanup of oil spills. The Alaska Oil and Gas Conservation Commission is responsible for issuing drilling permits and for production, injection, and disposal plan approvals for exploration and development activities in the State of Alaska (BLM 2012, page 13). Additional state authorities are presented below.

Alaska Department of Natural Resources

- Issues rights-of-way and land use permits for use of state land, ice road construction on state land, and state freshwater bodies under AS 38.05.850.
- Issues a "temporary water use and water rights" permit under AS 46.15 for water use necessary for construction and operations.
- Issues "Alaska cultural resource permits" for cultural resource surveys under the Alaska Historic Preservation Act (AS 41.35.080).
- Issues "cultural resources concurrences" for development on state land (but not federally managed land) that may affect historic or archaeological sites under the National Historic Preservation Act of 1966, as amended (16 USC Section 470 et seq.), and the Alaska Historic Preservation Act (AS 41.35.010 through .240).

Alaska Department of Environmental Conservation

- Issues an Alaska Pollutant Discharge Elimination System "wastewater discharge permit" and "mixing zone approval" for wastewater disposal into all state waters under a transfer of authority from the EPA National Pollutant Discharge Elimination System Program under Section 402, Federal Water Pollution Control Act of 1972, as amended (Clean Water Act, 33 USC Section 1342); AS 46.03.020, .100, .110, .120, and .710; 18 AAC chapters 15, and 70, and; Section 72.500.
- Issues a certificate of reasonable assurance/National Pollutant Discharge Elimination System Program and mixing zone approval for wastewater disposal into all state waters under Section 402, Federal Water Pollution Control Act of 1972, as amended (Clean Water Act; 33 USC Section 1342); AS 46.03.020, .100, .110, .120, and .710; 18 AAC chapters, 10, 15, and 70, and; Section 72.500.
- Issues a Class I well wastewater disposal permit for underground injection of non-domestic wastewater under AS 46.03.020, .050, and .100.

- Reviews and approves all public water systems including plan review, monitoring program, and operator certification under AS 46.03.020, .050, .070, and .720, 18 AAC Section 80.005.
- Approves domestic wastewater collection, treatment, and disposal plans for domestic wastewaters (18 AAC Chapter 72).
- Approves financial responsibility for cleanup of oil spills (18 AAC Chapter 75).
- Reviews and approves the “oil discharge prevention and contingency plan” under the Oil Pollution Act of 1990 (OPA 90) and the “certificate of financial responsibility” for storage or transport of oil under AS 46.04.030 and 18 AAC Chapter 75. The State review applies to oil exploration and production facilities, crude oil pipelines, oil terminals, tank vessels and barges, and certain non-tank vessels.
- Issues a Title V operating permit and a prevention of significant deterioration permit under Clean Air Act Amendments (Title V) for air pollutant emissions from construction and operation activities (18 AAC Chapter 50).
- Issues solid waste disposal permit for state lands under AS 46.03.010, 020, 100, and 110; AS 46.06.080; 18 AAC Section 60.005; and 200.
- Reviews and approves solid waste processing and temporary storage facilities plan for handling and temporary storage of solid waste on federal and state lands under AS 46.03.005, 010, and 020; and 18 AAC Section 60.430.
- Approves the siting of hazardous waste management facilities.

Alaska Department of Fish and Game

- Issues “fish habitat permits” under AS 16.05.871 and AS 16.05.841 for activities within streams used by fish that the agency determines could represent impediments to fish passage, or for travel in, excavation of, or culverting of anadromous fish streams.
- AS16.05.841–Fishway Act deals exclusively with fish passage; applies to streams with documented resident fish use and without documented use by anadromous fish.
- AS16.05.871–Anadromous Fish Act applies to streams specified in the Anadromous Waters Catalog as important for the spawning, rearing or migration of anadromous fishes; much broader authority and extends to anadromous fish habitat.
- Evaluates potential impacts to fish, wildlife and fish and wildlife users, and presenting any related recommendations to state land managers (Alaska Department of Natural Resource) or, via the Fish and Wildlife Coordination Act, to federal permitting agencies.

Alaska Oil and Gas Conservation Commission

- Issues a “permit to drill” under 20 AAC Section 25.05.
- Issues approval for annular disposal of drilling waste (20 AAC Section 25.080).
- Authorizes “plugging, abandonment, and location clearance” (20 AAC Section 25.105 through 25.172).
- Authorizes “production practices” (20 AAC Section 25.200–25.245).
- Authorizes “Class II waste disposal and storage” (20 AAC Section 25.252).
- Approves “workover operations” (20 AAC Section 25.280).

- Reports (20 AAC Section 25.300–25.320).
- Authorizes “enhanced recovery operations” under 20 AAC Section 25.402–460.

1.4.2.2 GMT2 Permit Requirements

Table 1.4-1 summarizes key permits, approvals, and requirements associated with GMT2 Project.

Table 1.4-1. Key permits, approval, and other requirements for GMT2

Agency	Juris-diction	Permit, Approval or Other Requirement
All Cooperating Agencies	Variable	▪ NEPA Review
Bureau of Land Management	Federal	▪ Application for permit to drill ▪ Temporary use permit ▪ Material sale ▪ Threatened and endangered species formal consultation biological assessment; Endangered Species Act determination for National Marine Fisheries Service-managed species ▪ Essential fish habitat assessment ▪ Alaska National Interest Lands Conservation Act 810 evaluation and findings ▪ Compliance with Section 106 of the National Historic Preservation Act ▪ Off-lease disposal of produced water ▪ Production commingling and allocation approval ▪ EO 13075 Tribal consultation
U.S. Army Corps of Engineers	Federal	▪ Clean Water Act Section 404 permit
Environmental Protection Agency	Federal	▪ Facility response plan ▪ Spill prevention, control and countermeasures plan
U.S. Fish and Wildlife Service	Federal	▪ Letter of authorization for incidental take of polar bears ▪ Consultation under Section 7 of the Endangered Species Act/biological opinion for listed species
National Marine Fisheries Service	Federal	▪ Consultation under Section 7 of the Endangered Species Act/biological opinion for listed species
Alaska Department of Natural Resources	State	▪ Land use (ice roads and pads on state land) ▪ Temporary water use permit ▪ Cultural resources coordination/consultation with State Historic Preservation Office
Alaska Department of Fish and Game	State	▪ Title 16 fish habitat permits for all activities occurring below ordinary high water of anadromous waters and often-resident fish streams, including vehicle crossings (summer and winter), bridges, culverts, water withdrawals, pipeline vertical support member installation, etc. ▪ Public safety permit for non-lethal hazing of wild animals that are creating a nuisance or a threat to public safety
Alaska Department of Environmental Conservation	State	▪ Air quality permit ▪ Alaska Pollutant Discharge Elimination System permit (wastewater/stormwater/hydrotest discharge) ▪ Oil discharge prevention and contingency plan ▪ Section 401 water quality certification ▪ Certificate of financial responsibility
Alaska Oil and Gas Conservation Commission	State	▪ Permit to drill ▪ Approval for annular disposal of drilling wastes ▪ Area injection order
Office of Public Safety	State	▪ Fire marshal approval
North Slope Borough	Local	▪ Rezoning to resource development district–master plan ▪ Title 19 development permit/administrative approval ▪ Iñupiat History, Language, and Culture Division–traditional land use inventory clearance
Kuukpik Corporation	Local	▪ Land use authorization for facilities constructed on Kuukpik land
Native Village of Nuiqsut	Local	▪ EO 13075 Tribal consultation

1.4.3 Related NEPA Analyses

The Council on Environmental Quality regulations for the implementation of NEPA direct agencies to reduce excessive paperwork and eliminate repetitive discussion of issues by tiering to existing NEPA documents to focus on actual issues ripe for decision (40 CFR 1502.20 and 40 CFR 1502.21). This supplemental EIS adheres to the Council on Environmental Quality recommendation by summarizing the issues discussed in broader/existing NEPA documents and adopting these discussions by reference. This supplemental EIS tiers to the following NEPA documents:

- 2004 Alpine Satellite Development Plan Final EIS
- 2004 Alpine Satellite Development Plan Record of Decision
- 2008 Northeast NPR-A Final Supplemental Integrated Activity Plan/EIS
- 2012 NPR-A Final Integrated Activity Plan/EIS
- 2013 NPR-A Integrated Activity Plan Record of Decision
- 2014 GMT1 Final Supplemental EIS
- 2015 GMT1 Record of Decision

The BLM issued the 2004 Alpine Satellite Development Plan Final EIS (BLM 2004) to evaluate a proposal by ConocoPhillips for the phased development of five satellite oil discoveries—two in the Colville River Delta (CD3 and CD4) and three in the NPR-A (CD5, GMT1 [formerly CD6], and GMT2 [formerly CD7]). CD5 is on land conveyed to Kuukpik within the NPR-A boundary while the GMT2 pad is on federally managed lands administered by the BLM in the NPR-A. Both the potential impacts of proposed development activities and a range of alternatives were evaluated. No additional NEPA analysis was envisioned as necessary to support the proposed development.

The 2004 Alpine Satellite Development Plan Record of Decision (BLM 2004a) states:

> This Record of Decision documents the Department of the Interior's decision to approve rights-of-way and permits to drill on public lands in response to an application by ConocoPhillips Alaska, Inc. (ConocoPhillips). BLM (2004) fulfills the obligation of BLM and its federal cooperating agencies under the National Environmental Policy Act (NEPA), 42 USC Section 4321, to analyze the environmental impacts of federal authorizations necessary for ConocoPhillips to undertake its proposed development.

The 2008 Northeast NPR-A Final Supplemental Integrated Activity Plan/EIS (BLM 2008) addressed the Nation's need for production of more oil and gas through leasing lands in the northeast NPR-A. The BLM (2008) provides local environmental resource information and includes GMT2 Project as a basic assumption in the analyses. In addition, BLM (2008) alternatives evaluated both prescriptive and performance-based lease stipulations and other protective measures intended to mitigate impacts.

The BLM completed the 2012 NPR-A Final Integrated Activity Plan/EIS (BLM 2012) to fulfill the NEPA requirements for oil and gas lease sales (authorized by the 2013 record of decision) and for potential renegotiations of the stipulations of previously leased tracts in the entire NPR-A. Several alternative development scenarios were evaluated, with the assessment of related environmental consequences based on a number of assumptions, including potential development of the GMT Unit (BLM 2012, Section 4.1–4.2). The proposed GMT2 Project is consistent with development scenarios considered in all action alternatives (BLM 2012, Section 4.2.1.2, volume 2, page 51).

The 2012 Point Thomson Project Final EIS, which analyzed development of natural gas resources east of Prudhoe Bay in an undeveloped region of the North Slope, is also referenced in this supplemental EIS. This supplemental EIS references its recent cumulative impacts analysis and many of its impact criteria.

Additional NEPA analysis is required prior to BLM approval of proposed construction of infrastructure for development of a petroleum discovery based on specific and detailed information about where and what kind of activity is proposed (BLM 2012, page 9). The GMT2 Project was subject to a detailed NEPA analysis in BLM (2004), and was reconsidered in BLM (2012). This supplemental EIS focuses on changes and additional information that could affect federal decisions on the permit applications currently under review.

1.4.3.1 Previous ANILCA 810 Findings

2004 Alpine Satellite Development Plan

The ANILCA Section 810 evaluation of the 2004 Alpine Satellite Development Plan Final EIS found that the effects of the Preferred Alternative would fall above the level of significantly restricting subsistence use for the community of Nuiqsut. The finding of potential impacts to subsistence resources by displacement and impacts to current subsistence patterns of use was based on the following:

1) Displacement of caribou, wolf and wolverine from the Fish Creek traditional hunting area during the winter construction phase lasting for two years; two years is considered greater than "occasional redistribution,"; and,

2) The presence of oil and gas infrastructure in the Fish Creek traditional hunting area was considered more than a "slight inconvenience" to the subsistence users in Nuiqsut, who have historically altered their traditional hunting patterns to avoid oil and gas development. The Fish Creek area is proportionately the area with the highest use for Nuiqsut's winter harvest of caribou, and 25 percent of Nuiqsut's caribou harvest for 1993, 1994–1995, 2001, and 2002. Fish Creek is also an important Nuiqsut harvest area for geese (more than 45 percent) and more than half of wolves harvested by Nuiqsut hunters come from the Fish and Judy Creek areas.

Infrastructure, traffic, and industrial effects such as noise and emissions in this area have the potential to reduce the abundance of harvestable resources, alter the distribution of these resources, and result in the non-use of traditional harvest areas. Depending on the resulting migration patterns for the Teshekpuk Lake Herd, and the areas of relocation for other subsistence species, the communities of Barrow, Atqasuk, and Anaktuvuk Pass may also be affected. However, existing data summarized in the FEIS does not warrant a positive finding under ANILCA § 810 for these three communities.

2014 GMT1

The ANILCA Section 810 evaluation for GMT1 (2014) (supplemental EIS tiered from the 2004 ASDP ANILCA §810 analysis) found that the effects of Alternative A would fall above the level of significantly restricting subsistence use for the community of Nuiqsut. It found that access to subsistence areas near Fish Creek may be facilitated for hunters and fishers who chose to use the GMT1 road, but the potential impacts to subsistence resources, user access, and patterns of use may exceed the non-significant level. Noise, traffic, and infrastructure, particularly during the construction phase but continuing throughout the life of the project, could affect the availability of key resources (caribou, wolves, and wolverine). The construction impacts would last for two years; two years is considered greater than "occasional redistribution".

A high number of overlapping caribou use areas were documented throughout the GMT1 project study area and recent documentation showed the highest number of overlapped areas along the Nigliq Channel, Fish Creek, and in overland areas west of the community toward the Tiŋmiaqsiġvik (Ublutuoch) River. During the 30-year production phase, the road itself and traffic on the road were anticipated to cause local diversion of caribou during peak caribou hunting season (July and August). Alternative A would result in increases in helicopter and fixed-wing aircraft traffic from existing conditions. Impacts were anticipated to result in increased risk, increased investments in time, money, fuel, and equipment, and potentially changed hunting success. Such effects would have a greater negative impact on poor residents who are less able to afford the means to travel further away from town and residents for whom the project area overlaps or is near their family’s traditional hunting and fishing areas.

NPR-A Integrated Activity Plan/Environmental Impact Statement

The ANILCA 810 evaluation for the 2012 NPR-A IAP followed previous findings in the 2005 and 2008 Supplements to the Northeast NPR-A IAP and found that the leasing plan would not significantly restrict subsistence use by communities in or near the NPR-A (Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, Point Lay, and Wainwright). The finding stated that adequate stipulations and best management practices had been incorporated—including specific procedures for subsistence consultation with directly affected subsistence communities, requirements for extensive studies of caribou movement, and increased setbacks or other protective measures specific to birds—to ensure that significant restrictions to subsistence uses and needs would not occur. The 2012 IAP ANILCA 810 evaluation found that the cumulative case may significantly restrict subsistence uses.

The ANILCA Section 810 evaluation for the 2013 NPR-A IAP/EIS leasing plan did not analyze the direct and indirect impacts of the GMT1 and GMT2 projects; those projects had already been analyzed by the 2004 ASDP and were expected to be analyzed in subsequent supplemental EISs.

1.4.4 Scope of Supplemental EIS

This supplemental EIS supplements BLM (2004), specifically addressing changes in the project, the affected environment, and regulations that might affect the determinations and decisions associated with BLM (2004) and BLM (2004a). This effort is greatly facilitated by tiering from and incorporating by reference BLM (2004) and BLM (2004a), as well as sections of BLM (2012), BLM (2013) and BLM (2014) where applicable.

The scope of this supplemental EIS includes analysis of potential impacts of the proposed GMT2 Project, based on the analyses performed in existing NEPA documents, with a focus on updated or more site-specific information. Resources that have been addressed thoroughly in existing NEPA documents and for which there are no changes in regulation or resource status are briefly summarized in Chapters 3 and 4 (Affected Environment and Environmental Consequences, respectively). Information for those resources where additional data, particularly site-specific and updated information has been identified, or where there has been a change in status, is presented in Chapter 3 and incorporated into the analysis of Chapter 4. See Section 4.1.3 for a discussion on how expected levels of impact are determined.

1.4.5 Changes and New Information

The primary objective of this supplemental EIS is to identify changes to the project design since it was described in BLM (2004), and to determine whether the impacts of the proposed project are still within the range of impacts analyzed in BLM (2004). A secondary objective is to review the description of the affected environment and to consider whether new information or circumstances exist, and if so, to evaluate the potential environmental impacts of the project against the updated description of the affected environment. Chapter 2, Table 2.1-1 summarizes the changes in GMT2 Project design.

A review of new data and information contained in BLM (2012) and BLM (2014) shows there are no appreciable changes in the physical, biological, or social resources associated with the project study area since BLM (2004). New data includes multi-year studies on hydrology, birds, and caribou. Recent climate data may change some projected outcomes. Many advances have been made in the study of climate change on the North Slope since 2004. In addition, ConocoPhillips's proposed project was modified to reduce impacts, and more information on the material site (potential gravel source) has been collected. The regulatory framework remains essentially the same, except for several new Endangered Species Act listings and air quality regulations. Additionally, the project will be subject to various lease stipulations and the new best management practices adopted in BLM (2013). Table 1.4-2 summarizes changes and additional information by resource.

Table 1.4-2. Environmental changes and new information in project study area since 2004

Resource	Changes in Nature of Resource	New Project Information or Regulatory Controls
Physical Terrestrial Environment	No appreciable change since BLM (2004)	Site-specific information on some paleontological resources in the area based on archaeological surveys.
Physical Aquatic Environment	No appreciable change since BLM (2004)	Site-specific information on water bodies, hydrology, and interactions during high-water events (e.g., breakup) based on field surveys.
Physical Atmospheric Environment	No appreciable change since BLM (2004)	Detailed information on air pollutant concentrations in Nuiqsut based on ambient air quality monitoring. New air quality regulations and agency guidelines.
Climate Change	Continuing trend of effects	Current reports addressing climate change in Alaska.
Vegetation and Wetlands	No appreciable change since BLM (2004)	Site-specific information on vegetation, wetlands, and habitat types for the realigned project, based on surveys initially performed for the 2004 EIS.
Fish	No appreciable change since BLM (2004)	Site-specific information regarding fish-bearing lakes from lake studies and anadromous waterways from the Alaska Department of Fish and Game **Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes.**
Birds	No appreciable change since BLM (2004)	Site-specific information regarding observances of selected bird species based on multi-year surveys performed for ConocoPhillips.
Terrestrial Mammals	No appreciable change since BLM (2004)	Site-specific information regarding caribou migration patterns and use of the project study area based on multi-year surveys performed for ConocoPhillips. Additional information on migration patterns since 2004 has been collected by North Slope Borough, Alaska Department of Fish and Game and the BLM.
Threatened and Endangered Species	Changing habitat of marine mammals (USFWS 2009a; National Marine Fisheries Service 2012) Concern about the vulnerability of yellow-billed loon population due to low starting population, low reproductive rate, and specific breeding habitat requirements (USFWS 2009b)	The polar bear and two species of ice seal were listed, and the yellow-billed loon was designated as a candidate species under the Endangered Species Act. On October 1, 2014, the USFWS determined that listing the yellow-billed loon under the Endangered Species Act was not warranted. The loon no longer has status under the Endangered Species Act, but the BLM still recognizes the species as a special status species and as a species of conservation concern by the USFWS. New site-specific information regarding observations of spectacled eiders based on surveys performed for ConocoPhillips. Site-specific information on polar bear sightings and den locations provided by ConocoPhillips and the U.S. Geological Survey, respectively. Information on potential denning habitat provided by U.S. Geological Survey.
Sociocultural	No appreciable change since BLM (2004)	Updated population data based on 2010 U.S. Census results. Updated economic data. Community health and welfare information based on a Health Baseline Report produced by the State of Alaska Department of Health and Human Services (DHSS 2016).

Resource	Changes in Nature of Resource	New Project Information or Regulatory Controls
Subsistence	No appreciable change since BLM (2004); however, continuing development in the vicinity of Nuiqsut puts additional pressure on subsistence access and resources	Updated information regarding subsistence activities published in 2016 by Stephen R. Braund & Associates.
Cultural Resources	No appreciable change since BLM (2004)	Site-specific information on cultural resources in the area based on several archaeological surveys and State Historic Preservation Office consultation.
Land Use	Two new land use plans in the NPR-A: 2008 Northeast NPR-A Integrated Activity Plan Record of Decision and 2013 NPR-A Integrated Activity Plan Record of Decision Both new land use plans designate a 0.5-mile setback from Tiŋmiaqsiġvik (Ublutuoch) River and include restrictions for permanent facilities Both 2008 and 2013 records of decision authorize new lease sales in the project study area Selected land in project study area transferred to Kuukpik Corporation (2010 conveyance), and subsurface transferred to Arctic Slope Regional Corporation. Administration of some oil and gas leases transferred to Arctic Slope Regional Corporation (Kuukpik land) New leases, exploration, and development on state land and water New OCS leases and planned exploration CD3 and CD4 constructed and operating CD5 constructed in 2015, currently in drilling phase. GMT1 began construction in February 2017 Nuiqsut Spur Road is constructed and in use Inter- and intra-state gas pipeline(s) permitting underway	For purposes of the analysis, Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek setbacks are considered to be in effect on Kuukpik land as well as federally managed land. A permit from the land owner (Kuukpik) will be required for road and pipelines on private land. The cumulative impacts analysis of BLM (2014) and the Nanushuk Project Draft Environmental Impact Statement (U.S. Army Corps of Engineers 2017) address relevant new and reasonably foreseeable projects as used in the analysis.

1.5 Public Involvement

Public involvement is an important part of the NEPA process. The Council on Environmental Quality regulations require agencies to make diligent effort to involve the public in preparing and implementing their NEPA procedures [40 CFR 1506.6(a)]. Typically, public involvement begins with scoping and continues throughout preparation of the analysis and the decision (BLM 2008c, Section 6.9).

1.5.1 Scoping

Additional scoping for a supplemental EIS is not required [40 CFR 1501.9(c)(4)]; however, scoping is an effective process by which the BLM can acquire internal and external input on the issues, impacts, and potential alternatives to be addressed, as well as determine the extent to which those issues and impacts will be analyzed. The intent of scoping is to focus the analysis on significant issues and reasonable alternatives to eliminate extraneous discussion, and reduce the length of the EIS (BLM 2008c, Section 9.1.3).

The BLM solicited public scoping comments on the GMT2 Project in the Notice of Intent to Prepare a Supplemental EIS, published in the *Federal Register* on July 29, 2016. Scoping comments were formally accepted through September 30, 2016, but scoping comments received after that date have also been considered in identifying the range of issues and additional mitigation measures to be addressed in the supplemental EIS.

In all, 27 sets of comments were received from private citizens, environmental organizations, and government agencies, including the North Slope Borough, Kuukpik Corporation, and the Native Village of Nuiqsut. The comments were tabulated and a number of themes were identified. These include:

- Potential impacts of past and proposed development on community health;
- Potential impacts on the availability of key subsistence resources, particularly caribou and fish, and access to those resources;
- Potential impacts of increased development and activity on the local lifestyle, on wildlife, and associated cumulative impacts;
- Potential impacts on fish and wildlife and their habitats;
- Existing impacts of noise and disturbance created by aircraft and concern over additional and cumulative impacts;
- Potential impacts of existing and proposed development on local water quality and associated effects on people and wildlife;
- Potential impacts of existing development and proposed development on air quality, including the need for a comprehensive assessment and modeling of pollutants to determine near-field and far-field impacts, cumulative impacts, and impacts on Nuiqsut (e.g., particulates, NO_2);
- Effects of greenhouse gas emissions and climate change;
- Need to consider a range of alternatives to the proposed project, including a roadless alternative, alternative source of support services (e.g., Nuiqsut), and the environmentally preferable or least environmentally damaging alternative;
- Effectiveness of mitigation and permit requirements; spill mitigation; and
- Ensure meaningful public involvement, specifically for Nuiqsut.

A number of local, state, and federal agencies have been involved in identifying issues for the supplemental EIS. Key agency issues to date have focused on:

- Impacts of road development on hydrology and sheet flow;
- Impacts on air quality;
- Impacts on aquatic resources; and
- Impacts on and of oil and gas development.

1.5.2 Other Stakeholder Opportunities

The draft supplemental EIS will be available for public comment for a period not less than 45 days. The BLM will respond to all public comments in the final supplemental EIS and will consider any comments in its record of decision.

Chapter 2. Proposed Project and Alternatives

The Greater Mooses Tooth 2 Project (GMT2 Project) is the second satellite to be developed in the Greater Mooses Tooth Unit (GMT Unit), which is located in the northeast area of the National Petroleum Reserve in Alaska (NPR-A) on Alaska's North Slope near the Beaufort Sea. The project was originally analyzed in the Alpine Satellite Development Plan EIS (BLM 2004, Section 2.3–2.4). The first development in the GMT Unit was Greater Mooses Tooth 1 (GMT1), which is described in detail in BLM (2015, Section 2.4–2.5). Construction of GMT1 began in February 2017 and production is expected to begin in winter 2018.

2.1 GMT2 Project Changes Over Time

The GMT2 Project has undergone several changes since it was originally proposed in BLM (2004). These changes are described below.

2.1.1 Project as Proposed in 2004 Alpine Satellite Development Plan Record of Decision

The preferred alternative described in BLM (2004) specified that a 9.1-acre drill pad would be constructed on federally managed lands (now interim conveyed to an Alaska Native Claims Settlement Act corporation). Produced fluids would be transported by pipeline to the Alpine Central Processing Facility. An approximately 6.3-mile gravel access road would parallel the pipeline from GMT2 to the GMT1 junction. Gravel would be extracted from the Clover potential gravel source. Upon completion of construction and drilling activities, crews based at Colville Delta 1/Alpine Central Processing Facility would service and maintain the GMT2 pad.

The BLM record of decision adopting the preferred alternative relocated a substantial portion of the road and pipeline between GMT2 and GMT1 to reduce permanent oilfield infrastructure in the Fish Creek Setback (Alpine Satellite Development Plan Record of Decision [BLM 2004a, page 17]).

The Alpine Satellite Development Plan EIS preferred alternative was adopted by BLM (2004a) with the following modifications: the road and pipeline bridge across the Tiŋmiaqsiġvik (Ublutuoch River) would extend from bank to bank, defined as the active flow-way and the frequently active floodplain between topographical rises, and would be approximately 350-feet long; the adoption of mitigation measures described in the record of decision (BLM 2004a); and adoption of a conservation recommendation included by the USFWS in the Endangered Species Act biological opinion. The project adopted by the BLM (BLM 2004a) serves as the basis of the ConocoPhillips's proposed action in the application for permit to drill.

2.1.2 Project Evaluated by the BLM in 2012 and 2014

Following the issuance of the Alpine Satellite Development Plan EIS and Record of Decision (BLM 2004a and 2004b), the proposed location of the GMT2 pad was revised. In both BLM (2012) and BLM (2014), the location of the GMT2 drill pad (BLM 2014, Map 4.6.2; Section 5 U009N002E) is south of the location adopted in 2004 (Figure 1.1.1-2; Section 20 U010N002E) within the Colville River Special Area. Previously evaluated drill pad locations are presented in Map 2.1-1. The 2012/2014 GMT2 drill pad (BLM 2012 and 2014) was relocated for optimum access to the reservoir, as described below.

After data collection conducted during the drilling and testing of a series of Spark and Rendezvous exploration wells, the extent of the subsurface petroleum resource has been under continuing study. In both the NPR-A Integrated Activity Plan/EIS (BLM 2012) and the GMT1 Supplemental Environmental

Impact Statement (supplemental EIS) (BLM 2014), the proposed location of GMT2 is south of the 2004 location to optimize production potential.

The Spark-Rendezvous accumulation, which will be accessed by GMT2, is a reservoir system that includes gas plus condensate at shallower depths in the northern part and oil at greater depths in the southern part.

Of the five oil discoveries in the Alpine sandstone in Northeast NPR-A, the Spark-Rendezvous accumulation is the largest reservoir system. Alpine West, Lookout, and Pioneer are oil accumulations with little or no free gas. A fourth discovery, Mitre, appears to be predominantly a gas accumulation with an oil leg in the south. The U.S. Geological Survey estimates that 120 to 200 million barrels of oil (including oil and condensate) and 1.9 to 3.0 trillion cubic feet of gas may be technically recoverable from these accumulations (Houseknecht et al. 2010).

Based on this updated information, the GMT2 pad location was moved approximately 3.2 miles south to better access the oil reservoir. This revised GMT2 pad location was described and evaluated in the NPR-A Integrated Activity Plan EIS (BLM 2012, page 51) and the GMT1 Supplemental EIS (BLM 2014, page 498). While better for production than the original locations, there are environmental considerations for this site. This relocated GMT2 drill pad location was in the Colville River Special Area.

The Colville River Special Area was designated in 1977 (BLM 2008d [Colville River Special Area Management Plan]). In making this designation, the Secretary of the Interior stated that the “central Colville River and some of its tributaries provide critical nesting habitat for the Arctic peregrine falcon, an endangered species. The bluffs and cliffs along the Colville River provide nesting sites with the adjacent areas being utilized as food hunting areas.” (BLM 2004a, page 27). The Colville River Special Area is approximately 2.44 million acres and includes lands around the Colville River.

2.1.3 2015 GMT2 Project Proposed by ConocoPhillips

In developing the proposed project, ConocoPhillips again moved the location of the GMT2 pad, this time moving the location outside the Colville River Special Area to minimize the potential for impacts to peregrine falcons. This location is acceptable with respect to oil production, and mitigates the potential for impacts on peregrine falcons. The proposed location is 0.9 mile north of the 2012/2014 location and 0.11 mile north of the Colville River Special Area boundary. The three proposed locations of the GMT2 drill pad (i.e., adopted in the 2004 Alpine Satellite Development Plan Record of Decision, evaluated in BLM 2012 and BLM 2014, and proposed in the 2015 Application for Permit to Drill) are shown on Map 2.1-1.

2.1.4 Summary of Changes in the GMT2 Project Over Time

The currently proposed GMT2 Project (which will be considered as Alternative A) is similar to the project approved for permitting in BLM (2004a) and that evaluated in BLM (2012) and BLM (2014). Some changes in the GMT2 Project are based on changes in the GMT1 Project approved for federal permitting (BLM 2015; U.S. Army Corps of Engineers 2015), which is approximately 1.9 miles southeast of the location originally adopted by the BLM (2004a). Notable changes, including the reason for the change, are provided in Table 2.1-1.

Table 2.1-1. Summary of changes in the GMT2 Project over time

Component	2004 Alpine Satellite Development Plan Adopted Alternative [a]	2012/2014 Project [b]	2015 GMT2 Project Proposed by ConocoPhillips [c]	Change in Impacts
Drill Pad	9.1 acres	13.0 acres The drill pad footprint increased by 3.9 acres to expand the drilling potential (from 20 to 33 wells) and to accommodate current drilling, operational, and safety practices	14.0 acres The drill pad footprint increased by approximately 1 acre to expand the drilling potential (up to 48 wells)	Increased impacts due to larger pad size
Number of Wells	20	Approximately 33	Up to 48	Increased production due to doubling of number of wells
Access Road	6.3 miles	8.7 miles Road lengthened 2.4 miles as a result of the relocation of the Nigliq Channel bridge to the south (CD5 project) and route changes to the road caused by the changed drill pad location	8.2 miles Road shorted 0.6 mile due to change in drill pad location Three 1.2-acre subsistence pullouts were added to the access road to allow better access and use of area to be developed for subsistence hunters	Increased impacts from the 2004 project due to increase in road length. Decrease from 2012/2014 project due to shorter road
Pipeline System	6.4 miles	9.1 miles Pipeline length increased due to change in pad location	8.6 miles Pipeline length decreased due to change in pad location	Increased impacts from the 2004 project due to increase in pipeline length; decrease from 2012/2014 project due to shorter pipeline length
Bridges	None	None	None	No change
Facilities in Setbacks or Special Areas	Facilities in Fish Creek Setback [d] Most of the road and pipeline between GMT1 (CD6) and GMT2 (CD7) would be within the 3-mile Fish Creek Setback	Drill pad in Colville River Special Area Drill pad was relocated south of the original location into the Colville River Special Area because newer subsurface data refined the reservoir target locations	No facilities in sensitive areas The drill pad was moved north out of the Colville River Special Area and avoids the Fish Creek Setback area that was of concern in 2004 (about 2.3 miles south of the 2004 drill site location) (see Map 2.1-2)	Decrease in impacts to sensitive areas due to no facilities being located in sensitive areas

Component	2004 Alpine Satellite Development Plan Adopted Alternative [a]	2012/2014 Project [b]	2015 GMT2 Project Proposed by ConocoPhillips [c]	Change in Impacts
Total Gravel Footprint	50.6 acres	86.6 acres Increase in gravel footprint (36 acres) is a result of the increased drill pad size and re-routing of road due to change in the location of the drill pad	78.0 acres Decrease in gravel footprint (8.6 acres) is a result of the re-routing of road due to change in the location of the drill pad	Increased impacts from the 2004 project due to increase in pad size and road length; decrease from 2012/2014 project due to shorter road
Total Gravel Requirement	339,000 cubic yards	625,500 cubic yards [e] Increase in required gravel (286,500 cubic yards) is a result of the increased size of drill pad and re-routing of road due to change in the location of the drill pad	671,300 cubic yards [e]	Increased impacts from the 2004 project due to increase in pad size and road length
Gravel Source	Proposed Clover mine site	Arctic Slope Regional Corporation Mine site Existing gravel mine is sufficient to provide resources; not necessary to develop new gravel site	Arctic Slope Regional Corporation Mine site	Geographic location of impacts would be confined to previously disturbed areas

[a] Project components for the 2004 GMT2 Project were described in the Alpine Satellite Development Plan Record of Decision (BLM 2004b).

[b] Project components for the 2012/2014 GMT2 Project were described in the 2014 GMT1 Supplemental EIS (BLM 2014). All miles, acres, and cubic yards of fill were estimates from those documents developed for comparison purposes only.

[c] Project components for the current GMT2 Development Project were obtained from detailed permit drawings included as Appendix A of this supplemental EIS.

[d] The 2004 drill site was interim conveyed to Kuukpik Corporation in 2010 (BLM 2015f).

[e] Differences between total gravel requirements included in BLM (2014) and the current GMT2 Development Project gravel requirement are due to more detailed engineering and design information. The differences do not reflect additional gravel requirements.

2.2 Lease Stipulations and Best Management Practices

ConocoPhillips is subject to the best management practices in the 2013 NPR-A Integrated Activity Plan/EIS Record of Decision (BLM 2013), and lease stipulations in the 2008 Northeast NPR-A EIS Record of Decision, which were in place when ConocoPhillips renewed its lease in 2008. While it appears that these stipulations and best management practices are not inconsistent with each other, to the extent any are found to be inconsistent, the 2008 lease stipulations are expected to control management decisions (BLM 2014, page 20).

ConocoPhillips may request a deviation from these applicable stipulations and best management practices, based on procedures described in BLM (2013 and 2014, page 20) that consider whether BLM objectives will be met. In adopting the Alpine Satellite Development Plan preferred alternative, the BLM (2004a) approved deviations to three lease stipulations controlling activities in the NPR-A at that time (i.e., BLM [1998a]). The BLM also approved deviations from three lease stipulations for the GMT1 Project (BLM 2015). In both cases, deviation from one of the three stipulations (E-2) is also applicable to GMT2.

For the proposed GMT2 Project, ConocoPhillips is requesting a deviation from Stipulation E-2, and BMP E-7(c) as discussed below:

- Stipulation E-2 is based on BLM 1998 Lease Stipulation 41, which prohibited oil infrastructure within 500 feet of water bodies. The original Stipulation 41 was re-designated as Lease Stipulation E-2 in BLM (2008a) and carried forward in BLM (2013a), with the most recent 500-foot setback restricted to fish-bearing water bodies. In 2004 and again in 2015, BLM approved deviations to the lease stipulation know known as E-2 because of technical infeasibility of total compliance due to the hydrology and number of water bodies in the area as well as implementation of other measures that would protect water bodies (e.g., use of secondary containment) (BLM 2004a, pages 3, 4, and 16–20; and 2015a, pages 6, 7, and 19). Maps 2.5-2 and 2.6-2 show the deviations that would be required under each project alternative.
- BMP E-7(c) requires that a minimum separation distance of 500 feet between pipelines and roads be maintained. The purpose of the 500-foot minimum distance between roads and pipelines is to minimize disruption of caribou movement and subsistence use. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs, and possible burial within the roads will be considered by the authorized officer, in this case the Arctic Office Manager. For the proposed GMT2 Project, four stretches of road would not meet this requirement, as described in Section 2.7.4. BLM-approved deviation from BMP E-7(c) for GMT1 (BLM 2015, pages 7 and 20). Approval of the GMT1 deviation from BMP E-7(c) was based on topography as well as supplemental mitigation measures such as speed limits and other design and operation measures that reduce impacts to subsistence resources (BLM 2015, page 20). Maps 2.5-2 and 2.6-2 show the deviations that would be required under each project alternative.

2.3 Alternatives to the Proposed Project

The National Environmental Policy Act of 1969 (NEPA) directs the BLM to “study, develop, and describe appropriate alternatives to recommend courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources…” [NEPA, Section 102(2)(E)]. In determining the alternatives to be considered in satisfying the purpose and need, the emphasis is on what is reasonable rather than on whether the ConocoPhillips likes or is itself capable of implementing an alternative (40 CFR 1502.14; BLM NEPA Handbook.p.49). “Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant." (Council on Environmental Quality, 1981 as amended– Question 2a, CEQ, Forty Most Asked Questions Concerning CEQs NEPA Regulations.)

Guidelines developed under Section 404(b)(1) of the Clean Water Act direct the U.S. Army Corps of Engineers to use the overall project purpose (based on the ConocoPhillips's purpose and need) to define alternatives and determine which alternative is the least environmentally damaging practicable alternative. Where an activity is not "water dependent," practicable alternatives that do not involve special aquatic sites are presumed to be available, and presumed to have less adverse impact to the aquatic ecosystem, unless it is clearly demonstrated otherwise [40 CFR Section 230.10(a)(3)]. The term "practicable" means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose [40 CFR Section 230.3(q)].

2.3.1 Alternatives Selection Process

In supplementing BLM (2004), this supplemental EIS began the process of developing alternatives with an appraisal of the full range of applicable alternatives that were considered by the BLM and cooperating agencies in BLM (2004) and BLM (2014).

2.3.1.1 Development and Screening of Alternatives

BLM and cooperating agencies held a series of meetings to develop, screen, and select alternatives for full analysis in the supplemental EIS, as summarized in Table 2.3-1. The BLM used the following criteria to evaluate the reasonableness of proposed alternatives:

- Is the alternative illegal?
- Does the alternative meet the purpose and need for the project?
- Is the alternative technologically feasible?
- Is the alternative economically feasible?
- Does the alternative duplicate other alternatives being considered?
- Does the alternative cause unreasonable social or environmental harm?

Table 2.3-1. Alternatives development meeting summary

Meeting Date	Meeting Participants	Meeting Objective and Summary
09/14/2016	BLM, Bureau of Ocean Energy Management, EPA, USFWS, Iñupiat Community of the Arctic Slope, North Slope Borough, Native Village of Nuiqsut, State of Alaska, U.S. Army Corps of Engineers	**GMT2 Cooperating Agency Meeting:** Discussion of preliminary alternatives. Requested feedback from cooperating agencies on how to change preliminary alternatives. Discussion of an alternate alignment for the GMT1–GMT2 Access Road (Alternative B). Discussion of roadless alternatives.
10/13/2016	BLM, Bureau of Ocean Energy Management, EPA, USFWS, North Slope Borough, Native Village of Nuiqsut, State of Alaska, U.S. Army Corps of Engineers	Discussion of screening criteria, discussion of screening out the roadless alternative with seasonal drilling based on economic feasibility. Discussion of how to adjust alternatives to minimize impacts.
10/13/2016	Native Village of Nuiqsut, BLM	**Government to Government with Nuiqsut:** Discussion of project alternatives and subsistence access.
12/14/2016	BLM, Bureau of Ocean Energy Management, EPA, USFWS, North Slope Borough, State of Alaska, U.S. Army Corps of Engineers	Final call for input on alternatives.
01/10/2017	BLM, EPA, USFWS, North Slope Borough, State of Alaska, U.S. Army Corps of Engineers, Native Village of Nuiqsut	Decision made to drop roadless alternative with seasonal drilling based on economic analysis.

2.3.2 Alternatives Considered But Not Carried Forward

A range of alternatives was evaluated in BLM (2004). At that time, alternatives that were considered, but not carried forward for further detailed analysis, included: buried pipelines; pipelines elevated more than 7 feet; pile-supported production pads; drill pad(s) at substantially different locations; supporting development from a Nuiqsut Operations Center; and development with access other than gravel road or air. The rationale that eliminated these alternatives from further consideration is provided in BLM (2004, Section 2.7). Drilling from different locations using extended-reach drilling is an evolving technology; however, extended-reach drilling is still not technically feasible for the GMT2 Project based on well completion requirements to develop the reservoir and variations in subsurface geology. The BLM (2004a, page 17) noted that extended-reach drilling is problematic due to the geologically unstable shales in this area that tend to collapse.

BLM (2014) considered five action alternatives for the GMT1 Project, and all of these alternatives were examined as potential alternatives for the GMT2 Project. Two alternatives that were analyzed in the GMT1 Supplemental EIS were not carried forward in the GMT2 Supplemental EIS. The first was based on coordinating development from a Nuiqsut Operations Center; this alternative was eliminated because it was dependent on use of the Nuiqsut Spur Road, a private road owned by the Kuukpik Corporation. Kuukpik Corporation reiterated their intent to maintain this road as a private road for the residents of Nuiqsut and not allow commercial uses by outside entities. Without access to the Nuiqsut Spur Road, an alternative in which development projects used Nuiqsut as a hub was not feasible, and this alternative was not considered in the GMT2 Supplemental EIS. A roadless alternative with seasonal drilling was also considered in the GMT1 Supplemental EIS and was eliminated in the GMT2 Supplemental EIS. Part of the BLM's criteria for reasonableness was the economic viability of each project alternative. The proponent's proposed project, the roadless alternative with year-round drilling and the roadless alternative with seasonal drilling were all analyzed for economic viability as part of the screening process. These three alternatives were analyzed under two different prices for oil, $62 per barrel and $123 per barrel. The roadless alternative with seasonal drilling was the only alternative that was not economically viable under either price scenario, and it was eliminated from further analysis.

2.3.3 Alternatives Carried Forward in the Supplemental EIS

As noted above in Section 2.3.2, BLM and other cooperating agencies reconsidered the action alternatives analyzed in BLM (2004) and BLM (2014), and brought forward certain components of those alternatives in order to create conceptually similar, updated versions of these alternatives for the GMT2 Project Supplemental EIS. In this supplemental EIS, Alternative A is the GMT2 Project as proposed by ConocoPhillips, which is based on the preferred alternative of BLM (2004). Alternative B is an alternate alignment of the GMT1–GMT2 Access Road which follows the watershed boundary between the Fish Creek and the Tinmiaqsiugvik River drainage basins. Alternative C is based on the roadless alternative with year-round drilling proposed in BLM (2014). The no-action alternative must be evaluated in the supplemental EIS [40 CFR 1502.14(d)].

Table 2.3-2 summarizes the major components of the action alternatives. The project component values, such as road lengths and pad acreage, are approximations based on best available data. Due to differences in data processing systems (e.g., GIS) and methodologies (e.g., number rounding), the values presented in the final supplemental EIS may differ slightly from values presented in other project-related documents (such as permit drawings). These differences have been reviewed and determined to be insignificant to the analysis as well as to the overall permitting process.

The BLM has identified Alternative A, the Proponent's Proposal, as the Agency's preferred alternative in this draft supplemental EIS. This is not a final decision. The BLM will consider input from all stakeholders submitted during the public comment period before identifying the Agency's final preferred alternative in the final supplemental EIS. The identification of a preferred alternative does not constitute a commitment or decision in principle, and there is no requirement to select the preferred alternative in the Agency's record of decision. If warranted, the BLM may select a different alternative than the preferred alternative in its record of decision.

Table 2.3-2. Summary of major project components for each action alternative

Component	Alternative A (Proposed Action, Draft Preferred Alternative)	Alternative B (Different Road Alignment)	Alternative C (Limited Access, Year-round Drilling)
Drill Pad	14.0 acres	14.0 acres	19.1 acres
Major On-site Facilities: Drill Pad	▪ Emergency shutdown module ▪ Fuel gas module ▪ Test separator module ▪ Remote electrical and instrumentation module ▪ Pig launching and receiving module ▪ Chemical injection module (including indoor chemical totes) ▪ Production heater skid ▪ Metering module ▪ Communication tower ▪ High mast lights ▪ Switchgear-module ▪ Chemical storage with containment and truck loading at GMT1 ▪ Well houses ▪ Transformer platforms (two, oil-insulated) ▪ Low pressure and high pressure pipe rack	▪ Emergency shutdown module ▪ Fuel gas module ▪ Test separator module ▪ Remote electrical and instrumentation module ▪ Pig launching and receiving module ▪ Chemical injection module (including indoor chemical totes) ▪ Production heater skid ▪ Metering module ▪ Communication tower ▪ High mast lights ▪ Switchgear-module ▪ Chemical storage with containment and truck loading at GMT1 ▪ Well houses ▪ Transformer platforms (two, oil-insulated) ▪ Low pressure and high pressure pipe rack	Limited access requires that certain services, equipment, and supplies otherwise provided at the CD1/Alpine Central Processing Facility would need to be duplicated at the site. These components will be required in addition to what is needed for Alternative A. Details are presented in Section 2.6.
Occupied Structure Pad	None	None	18.4 acres
Air Access Facilities	None	None	Airstrip and apron, 47.3 acres
Access Road	8.2 miles, 62.8 acres (GMT1–GMT2 Access Road)	9.3 miles, 72 acres (GMT1–GMT2 Access Road)	0.9 mile, 7.2 acres (Airstrip Access Road)
Subsistence Tundra Access Road Pullouts [a]	3 pullouts, 1.2 acres	3 pullouts, 1.2 acres	None
Pipeline System	8.6 miles	9.4 miles	8.6 miles
Pipeline Vertical Support Members [b]	Vertical support members: 0.1 acre	Vertical support members: 0.1 acre	Vertical support members: 0.1 acre
Ancillary Pipelines	None	None	Diesel & mineral oil supply (through same pipeline), 2-inch Water supply, 2-inch
Bridges	None	None	None
Culverts [c]	46	50	5

Component	**Alternative A (Proposed Action, Draft Preferred Alternative)**	**Alternative B (Different Road Alignment)**	**Alternative C (Limited Access, Year-round Drilling)**
Ice Roads	Year 1–2: 52.6 miles Year 2–3: 43.9 miles Post-construction: None	Year 1–2: 51.9 miles Year 2–3: 43.3 miles Post-construction: None	Year 1–2: 51.6 miles Year 2–3: 51.2 miles Post-construction: 7.0 miles annually
Total Gravel Footprint [d]	78.0 acres	87.2 acres	92.0 acres
Total Gravel Requirement	671,300 cubic yards	747,300 cubic yards	930,000 cubic yards
Total Water Use	395 million gallons	398 million gallons	691 million gallons

Note: The project component values, such as road lengths and pad acreage, are approximations based on best available data.

[a] Three planned subsistence tundra access pullouts with ramps on Alternative A GMT1–GMT2 Access Road, 0.4 acre each = 1.2 acres total.

[b] Approximately 800 vertical support members will be required between GMT1 and GMT2 based upon a 55-foot average spacing. Each vertical support member has a 24-inch diameter, resulting in a total ground disturbance of 0.1 acre.

[c] Culverts are spaced at approximately every 1,000 feet across access roads (i.e., the GMT1–GMT2 Access Road and the Airstrip Access Road). Culverts will not be placed across pads and the airstrip. The exact location, spacing, size, and quantity of culverts will be determined during a summer field survey prior to construction. Culverts will be placed to ensure that natural drainage is maintained in accordance with U.S. Army Corps of Engineers permit special conditions.

[d] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

2.4 Features Common to All Alternatives

The following section provides descriptions of features that are common to several of the action alternatives. Specific descriptions of components that vary from the general descriptions presented in this section are presented in descriptions of each specific alternative in Sections 2.5 through 2.8.

2.4.1 Schedule

The construction and operation of all action alternatives would follow one of two schedules. The difference in these schedules deals with the construction of the GMT2 Project; drilling and operations are the same under each schedule. Under the first construction schedule, ConocoPhillips proposes to construct the GMT2 facilities over the course of two ice road seasons (winter through spring) spanning 3 calendar years. Under the second construction schedule, ConocoPhillips proposes to construct the GMT2 facilities over the course of three ice road seasons spanning 4 calendar years. As detailed design progresses, the schedule may be modified. However, the identified work would generally occur in the indicated seasons and sequence.

2.4.1.1 Construction Schedule 1

- 1Q–3Q of Year 0: Record of decision signed by BLM, final investment decision by ConocoPhillips
- 4Q of Year 0: Order long-lead materials for the GMT2 Project (e.g., pipeline steel)
- 4Q of Year 1: Begin first season ice road construction in support of GMT2
- 1Q of Year 2: Gravel mining, construction of gravel roads, pads, and airstrips (if relevant), begin pipeline construction (e.g., vertical support members)
- 2Q–3Q of Year 2: Work gravel, perform GMT1 and Alpine Central Processing Facility/CD1 tie-in work
- 4Q of Year 2: Begin second season ice road construction in support of GMT2 construction
- 1Q of Year 3: Install vertical support members, pipelines, power and telecom cables, and facilities
- 2Q–3Q of Year 3: Install GMT2 modules, GMT2 pad pipe racks, and GMT2 pad tie-ins
- 4Q of Year 3: Complete construction and hydrotest
- 2Q of Year 3–Year 10: Drill up to 48 wells, first oil anticipated in 4Q of Year 3.
- Year 11–Year 32: Project in routine operations phase

2.4.1.2 Construction Schedule 2

- 1Q–3Q of Year 0: Record of decision signed by BLM, final investment decision by ConocoPhillips
- 4Q of Year 0: Order long-lead materials for the GMT2 Project (e.g., pipeline steel). Begin first season ice road construction in support of GMT2.
- 1Q of Year 1: Gravel mining, construction of gravel roads, pads and airstrips (if relevant)
- 2Q–3Q of Year 1: Work gravel
- 4Q of Year 1: Begin second season ice road construction in support of GMT2 construction
- 1Q of Year 2: Begin pipeline construction, install vertical support members
- 2Q–3Q of Year 2: Perform GMT1 and Alpine Central Processing Facility/CD1 tie-in work
- 4Q of Year 2: Begin third season ice road construction in support of GMT2 construction
- 1Q of Year 3: Finish pipeline construction, install power and telecom cables, build facilities
- 2Q–3Q of Year 3: Install GMT2 modules, GMT2 pad pipe racks, and GMT2 pad tie-ins
- 4Q of Year 3: Complete construction and hydrotest
- 2Q of Year 3–Year 10: Drill up to 48 wells, first oil anticipated in 4Q of Year 3.
- Year 11–Year 32: Project in routine operations phase

It is expected that drilling would continue until all planned wells are completed and wells will be drilled consecutively for the purposes of this document. However, ConocoPhillips will determine the timing of drilling based upon economics and rig availability. Drilling is expected to progress at a rate of 54 days needed per well, or a total of 2,592 days needed (54 days per well [times] 48 wells).

2.4.2 Location

All action alternatives have project components in the same general location. The location of the proposed GMT2 drill pad, pipelines, and the existing Arctic Slope Regional Corporation Mine site do not vary among the alternatives. The proposed GMT2 pad is in Section 32, Township 10N, Range 2E (T10N, R2E) Umiat Meridian (UM). The pipeline corridor crosses through Section 3, T10N, R3E UM; and Sections 1, 11, 12, 14, 22, 23, 27, 32, 33, and 34, T10N, R2E UM.

The Arctic Slope Regional Corporation Mine site is 4.5 miles east of Nuiqsut and east of the east channel of the Colville River within T10N, R5E, Sections 10, 11, 14, and 15 UM, at latitude 70.225 °N and longitude -150.803 °W. The Arctic Slope Regional Corporation Mine site is a commercial gravel material source owned and operated by Arctic Slope Regional Corporation. Gravel extraction from the Arctic Slope Regional Corporation Mine site is permitted separately as described in Section 2.4.6.

2.4.3 Drill Pad and Support Facilities

The proposed GMT2 pad would be constructed with gravel and be a minimum of 5-feet thick with side slopes of 2-feet wide to 1-foot high (2:1) (Appendix A, Sheet 31 of 33). Additional pad thickness would be provided if needed for thermal protection of permafrost. The pad surface designs and locations vary among alternatives and are discussed in their respective sections.

The drill pad is sized and designed to allow for all drilling and operation of site facilities, wellhead shelters, drill rig movement, drilling material storage, and well work equipment. Up to 48 wells (approximately half production wells, half injection wells) at 20-foot wellhead spacing are planned (Appendix A, Sheet 21 of 33). Hydraulic fracture stimulation of some wells is planned during winter when an ice road connects CD1/Alpine Central Processing Facility to Kuparuk for access to equipment and supplies. Insulated conductors and thermosyphons would be used to reduce subsidence and protect structural components from freeze-thaw damage.

The GMT2 drill pad under all action alternatives would include the following on-pad facilities:

- Emergency shutdown module
- Fuel gas module
- Test separator module
- Remote electrical and instrumentation module
- Pig launching/receiving module
- Chemical injection module (including tanks within module, containment, and exterior tank fill connection)
- Production heater skid
- Metering module
- Communication tower
- High mast lights
- Switchgear-module
- Well houses
- Two oil-insulated transformer platforms
- Low pressure and high pressure pipe rack

All action alternatives will also include chemical storage with containment and truck loading at the GMT1 pad for bulk loading and unloading. Additional facilities would be needed under Alternative C, described in Sections 2.7.

No processing of production fluids beyond royalty determinations and process fluid heating is planned at the drill site. The pad would be oriented roughly northeast to southwest in line with wind rose data from Nuiqsut to minimize snow accumulation on the site.

Electric power for GMT2 operations would be provided by the CD1/Alpine Central Processing Facility power system. Power cables would be suspended from the pipeline horizontal support members via a messenger cable, as shown in Appendix A, Sheets 23 through 27 of 33. The drill rig and drill camp would use a temporary power connection, fueled by ultra-low sulfur diesel until the permanent GMT2 drill site power supply system is commissioned. Alternative fuel usage will be evaluated as technology becomes available in accordance with Supplemental BMP 1: Air Quality of the GMT1 Record of Decision (BLM 2015). Natural gas, gasoline, and other fuel mixtures producing less carbon dioxide (CO_2), sulfur dioxide (SO_2) and particulate matter will be incorporated if and when practicable. A fiber optic cable providing communication support between GMT1 and GMT2 would be suspended from horizontal support members via the same messenger cable as the powerlines, as shown in Appendix A, Sheet 23 of 33.

2.4.4 Pipelines

The GMT2 Project would produce oil, gas, and water that would be carried from the GMT2 pad by pipelines going to the Alpine Central Processing Facility at CD1 for processing. Sales quality crude oil processed at the Alpine Central Processing Facility would be transported from CD1 via the existing Alpine Oil Pipeline and Kuparuk Pipeline to the Trans-Alaska Pipeline System for shipment to market.

Miscible injectant and injection water (for enhanced oil recovery) would be delivered by pipeline to the GMT2 pad from CD1/Alpine Central Processing Facility. Lean gas for artificial lift would also be transported from CD1/Alpine Central Processing Facility. The production crude and water injection pipelines would be designed to allow pipeline inspection and maintenance (e.g., pigging) between GMT2 pad and CD1/Alpine Central Processing Facility. Pipeline design would comply with the American Society of Mechanical Engineers Codes B31.4 and B31.8, applicable federal and state standards, and ConocoPhillips internal standards. All pipelines would be hydrotested prior to startup as required by the code of construction (e.g., B31.4 and B31.8).

Pipelines would be supported on common vertical support members placed approximately 55 feet apart. Fiber optic cable and power cables would be suspended from the same vertical support members via messenger cable attached to the horizontal support members. The decision to use messenger cables rather than cable trays (as authorized by BLM [2004a]) was based on ConocoPhillips's experience showing that over time cable trays do not have sufficient structural integrity to span the distance between vertical support members; messenger cables are the current industry standard.

Pipelines (including suspended cables) would be a minimum of 7 feet above ground. This also decreases the risk of reduced clearance between the snow surface and the bottom of pipelines, especially during harsh winters (Lawhead et al. 2006b).

The proposed GMT2 Project includes two major pipeline segments as addressed below.

2.4.4.1 GMT2 to GMT1 Pipeline Segment

The GMT2 to GMT1 pipeline segment would require approximately 800 new vertical support members placed approximately 55-feet apart. The GMT2 to GMT1 pipeline route is shown in Appendix A, Sheets 7 through 12. Details of the GMT2 to GMT1 pipeline segment are shown in Appendix A, Sheet 23 and include:

- 20-inch produced fluids pipeline: crude oil, gas, and water transported from GMT2 to GMT1
- 14-inch injection water pipeline: seawater or produced water transported to GMT2 from GMT1; at GMT1 it will connect to a 14-inch waterline from Alpine Central Processing Facility
- 6-inch gas pipeline: lean gas transported to GMT2 from GMT1 for gas injection/artificial lift; at GMT1 it will connect to a 6-inch gasline from Alpine Central Processing Facility
- 6-inch miscible injectant pipeline: miscible injectant transported to GMT2 from GMT1 for injection to support enhanced oil recovery; at GMT1 it will connect to a 6-inch gasline from Alpine Central Processing Facility
- Power and fiber optic communication cables suspended from horizontal support members via messenger cable
- Space for a future 24-inch pipeline

2.4.4.2 GMT1 to CD1/Alpine Central Processing Facility Pipeline Segments

Pipelines required as part of the GMT2 Project would be placed on permitted or existing vertical support members within the existing right-of-way from GMT1 to CD1/Alpine Central Processing Facility. The GMT1 to CD1/Alpine Central Processing Facility pipeline route is shown in Appendix A, Sheets 12 through 20. Details of the GMT1 to CD1/Alpine Central Processing Facility pipeline segments are shown in Appendix A, Sheets 24 through 27, and include:

- GMT1 to CD5: A power cable suspended from permitted horizontal support members via a new messenger cable
- CD5 to CD4N: A 20-inch produced fluids pipeline placed on existing racks and a power cable suspended from existing horizontal support members via a new messenger cable
- CD4N to CD2 Junction: A 20-inch produced fluids pipeline placed on permitted racks, an 8-inch miscible injectant pipeline placed on permitted racks, and a power cable suspended from permitted horizontal support members via a new messenger cable
- CD2 Junction to CD1/Alpine Central Processing Facility: A 20-inch produced fluids pipeline placed on permitted racks, an 8-inch miscible injectant pipeline placed on permitted racks, and a power cable suspended horizontal support members from permitted via a new messenger cable

2.4.4.3 Valves and Vertical Loops

No manual valves or automatic valves, or vertical loops will be installed as part of the GMT2 to GMT1 pipeline segment because it does not include any major water crossings. Manual valves will be installed over water crossings along other segments (e.g., east of GMT1) as required by the Alpine Satellite Development Plan Record of Decision (BLM 2004a). This is consistent with industry standards.

2.4.5 Ice Roads

Ice roads are used to support Year 1 and Year 2 construction activities as well as general vehicle access to Alpine facilities in all alternatives. Typically, ice road construction is dependent upon ground temperature and precipitation (i.e., snow for pre-packing of routes) and begins in November–December. Vehicle access via ice road depends on dates of opening and closing of the ice road and the distance from the main Alpine operations. The useable ice road season for travel to GMT2 is shorter than that of other projects such as CD3 by the logistical challenges of constructing and completing a more remote ice road. The ice road length for GMT2 will be approximately three times longer than the ice road needed for CD3, which will result in a 20 percent decrease in the useable ice road season.

The earliest opening dates and latest closure dates for ice roads between drill site 2L (in Kuparuk Field) to CD1/Alpine Central Processing Facility and between drill sites CD2 and CD3 for the 11-year period 2004 through 2014 are provided in Table 2.4-1. Based on these data, for the GMT2 Project, the ice road season (ice road is constructed and available for use) is defined as February 1 through April 20 of each year.

Table 2.4-1. Summary of historical ice road opening/closure, 2004–2014

Open/Close Dates	Ice Road from Drill Site 2L to Alpine Central Processing Facility	Ice Road from CD2 to CD3
Earliest Date Open	January 16	January 4
Latest Date Open	February 2	January 26
Earliest Date Closed	April 27	April 27
Latest Date Closed	May 7	May 7
Range of Days Open	91 to 107	104 to 121

The annual ice road season for GMT2 is expected to be 80 days and will last from February 1 through April 20. The shorter ice road season correlates well with the 80-day ice road season documented for exploration projects which have occurred in NPR-A over the last decade.

2.4.6 Gravel Supply Options

The Arctic Slope Regional Corporation Mine site is the proposed gravel source for all alternatives. The Arctic Slope Regional Corporation Mine site is an existing commercial gravel source on the East Channel of the Colville River, approximately 6 miles southeast of CD4, 21.0 miles east of GMT2, and 4.5 miles east-northeast of Nuiqsut. The Arctic Slope Regional Corporation Mine site is on Alaska Native Claims Settlement Act Native corporation land: the surface estate is owned by Kuukpik Corporation, and Arctic Slope Regional Corporation owns the subsurface estate including sand and gravel resources.

The Clover potential gravel source was approved as the gravel source in BLM (2004a, page 3). The Clover mine site is a 65-acre potential undeveloped gravel source within the NPR-A. Issuance of BLM permits for the extraction and sale of gravel was approved in 2004. BLM (2004a) included mitigation requiring that the mine (Clover site) be rehabilitated, based on the rehabilitation plan included as Appendix O of BLM (2004a), including interim reclamation (BLM 2004a, page 23). The Clover site would require further NEPA analysis should ConocoPhillips or another group propose to develop it in the future.

In 1997, the Arctic Slope Regional Corporation Mine site received permit authorization from the U.S. Army Corps of Engineers for the 10-year, phased development of the 150-acre site including the excavation of up to 5 million cubic yards of sand and gravel material. Extraction of material from within the 67-acre Phase 1 operating area produced 1.03 million cubic yards of gravel (U.S. Army Corps of Engineers 2012c). Subsequent reclamation of Phase 1 has foreclosed the area to future mining, although overburden material may still be disposed of onsite to facilitate creation of bird nesting islands and shallow water habitat.

In 2004, Arctic Slope Regional Corporation obtained permits from the U.S. Army Corps of Engineers to continue extraction of gravel material from the 83-acre Phase 2 area of the mine site. Two cells have been mined within the Phase 2 operating area: approximately 20 acres in 2005 and 5 acres in 2007 (U.S. Army Corps of Engineers 2012c). Additional gravel extraction from Phase 2 was authorized under permit POA-1996-869-M4 for up to 2 million cubic yards from two cells: Cell #1 in the eastern portion and Cell #2 in the western portion (U.S. Army Corps of Engineers 2013).

A total of 1.1 million cubic yards of gravel was used for two recent projects: approximately 595,700 cubic yards for CD5 (U.S. Army Corps of Engineers 2011) and approximately 455,000 cubic yards for the Nuiqsut Spur Road project (U.S. Army Corps of Engineers 2014a). Another 628,000 cubic yards of gravel is expected to be used for the GMT1 Project which began construction in January 2017. Gravel for CD5 and the Nuiqsut Spur Road was taken from Arctic Slope Regional Corporation Mine site Phase 2. Gravel for the GMT1 Project came from a 45-acre parcel in Phase 3 of the Arctic Slope Regional Corporation Mine site, which was authorized under permit POA-1996-869-M10.

The Arctic Slope Regional Corporation Mine site includes a total of 580 acres: 150 that have been permitted (Phase 1 and 2) and 430 new acres (Phase 3) that are underlain with known sand and gravel deposits (U.S. Army Corps of Engineers 2012c). Phase 3 is located immediately south of the Phase 2. Assuming that gravel within Phase 3 is similar to quantities of gravel per acre as identified within Phase 2 (BLM 2014), gravel from the Arctic Slope Regional Corporation Mine site is potentially available for use in the GMT2 Project.

Phase 3 is only partially permitted; authorization would have to be obtained from the U.S. Army Corps of Engineers prior to gravel extraction for the construction of GMT2. Upon permitting, the material in this area will be available for use by public and private projects in the Colville River Delta area and adjacent areas. Winter geotechnical work would occur as needed to delineate and assess sand and gravel resources. All gravel mining work would be performed in the winter season (U.S. Army Corps of Engineers 2012c).

A general relationship of 1 acre disturbed for a gravel mine to meet the gravel needs for 5 acres of gravel pad, road, airstrip, or other development is identified in BLM (2012, Section 4.2.2, page 26). However, more specific information regarding the Arctic Slope Regional Corporation Mine site is available since it was recently used for CD5 and the Nuiqsut Spur Road. Based upon this information, 23 acres of the Arctic Slope Regional Corporation Mine site footprint is expected to be disturbed to provide gravel for the GMT2 Project.

Mined gravel would be transported from the Arctic Slope Regional Corporation Mine site to the GMT2 gravel use areas (e.g., gravel pads, airstrip, road locations) over ice roads during Year 1.

Because the Arctic Slope Regional Corporation Mine site is an existing commercial mine, some impacts such as disturbance of vegetation and habitat associated with removal of overburden, and creation of ramps are potentially less than for developing a new mine in an undisturbed location. These impacts have been considered by the U.S. Army Corps of Engineers in issuing permits for the mine (U.S. Army Corps of Engineers 2016). Impacts that could be caused by or result from mining at the Arctic Slope Regional Corporation Mine site are addressed for each affected resource in Sections 4.2, 4.3, and 4.4 of this supplemental EIS, as applicable.

The gravel mining site will be rehabilitated as required under the approved Arctic Slope Regional Corporation Gravel Mine Reclamation Plan (U.S. Army Corps of Engineers 2016). BLM (2014) noted that a reclamation plan was developed for the Arctic Slope Regional Corporation Mine site as part of the original permitting process, and that a revised reclamation plan was approved by the U.S. Army Corps of Engineers in 2004 for Phase 1 and 2 areas. The reclamation and mitigation goal is for waterfowl habitat with a matrix of undisturbed tundra, deep water, shallow and very shallow littoral, and waterfowl nesting islands. All reclamation work will occur as part of an overall gravel mining operation because both the overburden material and heavy equipment necessary for the activities would be available (BLM 2014).

2.4.7 Camp Requirements, Locations, and Availability

The following camps may be used to support GMT2 construction and operations:

- Existing facilities at CD1/Alpine Central Processing Facility.
- One or more camps in Nuiqsut, or existing facilities such as the Nuiqsut Hotel. Workers would only be based in Nuiqsut during the winter and would access GMT2 via ice road.
- A camp located at the Kuukpik 10-acre pad at the junction of the CD5 road and Nuiqsut Spur Road.
- A temporary construction camp on an ice pad, located near a drill site that can utilize power from the Alpine Central Processing Facility power grid.
- GMT2 Camp(s): camps located at the GMT2 drill pad or occupied structure pad.

2.4.8 Water Use

Fresh water would be required for domestic use at remote construction camps and for construction and maintenance of ice roads and ice pads. Potable water requirements are based on a demand of 100 gallons per day per person. Freshwater may be used for hydrostatic testing. Approximately 1.5 million gallons of water per mile are used for typical 35- to 50-foot wide ice road construction; the pipeline construction ice road is wider, and requires more water. Ice roads would typically be available for use for 80 days each winter season.

Water for construction and maintenance of ice roads and pads would be withdrawn from lakes in the vicinity of the GMT2 construction activities as allowed by State of Alaska temporary water use authorizations and fish habitat permits where necessary. Water use is also presented in the discussion of each alternative.

Drilling water requirements are estimated to be 2 million gallons per well. A 10-acre ice pad, requiring 2.5 million gallons of water would be required to support drilling activities under all alternatives. Water for drilling may be withdrawn from lakes in the vicinity of the project as allowed by temporary water use authorizations and fish habitat permits where necessary. See Table 2.3-2 for water use for each project alternatives.

2.4.9 Erosion Control Measures

The GMT2 Project would follow the Alpine Facilities Erosion Control Plan, which will be updated to include the GMT2 Project. The Alpine Facilities Erosion Control Plan outlines procedures for operation, monitoring, and maintenance of various erosion control methods. Erosion control at CD1/Alpine Central Processing Facility is accomplished using a combination of biotechnical and engineering control (physical armor) methods. Temporary erosion protection would be placed before breakup following the first construction season to provide protection from a flood event. The temporary protection would be replaced with permanent erosion protection once the gravel had been allowed to season (settle and drain). Alpine's Storm Water Pollution Prevention Plan will be amended to cover management of GMT2 and drainage for other pads.

The Alpine Facility Erosion Control Plan also contains snow removal and dust control measures. Snow removal plans include the use of snow-blowing equipment to minimize gravel carryover to the tundra and placing cleared snow in designated areas. The Alpine Facility Erosion Control Plan discusses snow removal and gravel deposition removal. ConocoPhillips selects snow push areas annually, based on avoiding areas of thermokarsting, proximity to water bodies, and evaluating how the area looks based on previous years' activities. Snow clearing typically results in small amounts of gravel being pushed onto the tundra. As noted in the Alpine Erosion Control Plan, gravel removal from tundra will typically be performed by personnel using hand tools, but may require the use of heavy equipment for large depositions. Gravel deposition due to snow removal will be minimized to the maximum extent possible and gravel removal will be conducted in accordance with all U.S. Army Corps of Engineers regulations and permit stipulations. The dust control plan includes watering gravel roads to minimize dust impacts on the tundra and maintain the integrity of the roads.

2.4.10 Spill Prevention and Response

GMT2 Project facilities have been designed to minimize the possibility of spills. Section 4.5 provides a detailed discussion of the impacts associated with potential spills. In addition, ConocoPhillips will implement a pipeline maintenance and inspection program and an employee spill prevention training program to further reduce the likelihood of spills occurring.

ConocoPhillips designs and constructs pipelines to comply with applicable state, federal, and local regulations. In addition, ConocoPhillips will go beyond those minimum requirements, as described below. The pipelines would be constructed of high-strength steel and would have wall thicknesses equal to or in excess of regulatory requirements. Welds would be validated using non-destructive examination (i.e., radiography and ultrasonic) during pipeline construction to ensure their integrity, and the pipelines would be tested hydrostatically prior to operation. The production crude and water injection pipelines will be fully capable of using pigs[1] for cleaning and corrosion inspection operations.

If a spill occurs on a pad, the fluid is expected to remain on the pad, unless the spill is near the pad edge or exceeds the retention capacity of the pad. The retention capacity of the gravel pad is estimated at 0.125 barrels per cubic yard of gravel for the purpose of planning spill response (Alaska Clean Seas 2015). In the event of a release, all contaminated gravel will be picked up as soon as possible to comply with permit stipulations and determine the extent of the spill. Fuel transfers near pad edges will be limited as much as possible in order to mitigate the risk of a spill leaving the pad.

ConocoPhillips's design of production facilities includes provisions for secondary containment for hydrocarbon-based and hazardous materials, as required by state and federal regulatory requirements.

In addition to regulations governing spill prevention and response, the GMT2 Project would also be managed under the 2013 BLM BMPs A-1 through A-7, and E4. ConocoPhillips will also adhere to the supplemental best management practices for spill prevention and response included in the GMT1 Record of Decision (BLM 2015): Supplemental BMP Practice 1, which updates BMP A-4, Supplemental BMP Practice 2, which updates BMP A-3, Supplemental BMP Practice 3, which updates BMP A-3, Supplemental BMP Practice 4, which provides additional clarification for BMP A-3, and Supplemental BMP Practice 5, which updates BMP E-4.

2.4.10.1 Spill Prevention

Spill prevention and response measures that would be used during construction and operation at the GMT2 pad are outlined in the Alpine Development Participating Area Oil Discharge Prevention and Contingency Plan and Alpine Spill Prevention, Control, and Countermeasures Plan (ConocoPhillips 2015a). The intent of these plans is to demonstrate ConocoPhillips's capability to prevent oil spills from entering the water and land and to ensure rapid response if a spill event occurs. The Alpine Oil Discharge Prevention and Contingency Plan complies with State of Alaska requirements in AS 46.04.030(10)(A), 18 AAC 75 for spill prevention, and federal EPA regulations in 40 CFR Part 112, Subpart D (Facility Response Plans). The Spill Prevention, Control, and Countermeasures Plan complies with the federal EPA regulations in 40 CFR 112.

ConocoPhillips would implement these plans to minimize accidental oil spill impacts. The current Alaska Department of Environmental Conservation approved Alpine Oil Discharge Prevention and Contingency Plan would be amended to include the GMT2 pad. Through the amended Alpine Oil Discharge Prevention and Contingency Plan, ConocoPhillips will demonstrate that readily accessible inventories of appropriate oil spill response equipment and personnel at Alpine will be available for use at the drill site. In addition,

[1] "Pig" refers to pipeline inspection and maintenance tools. A pig is a cylindrical metal tool that is carried along with the flow of oil in the pipeline. Different types of pigs perform different functions, from scrubbing and removing buildup from the inside of the pipeline to inspecting the structural integrity of the pipeline.

the spill response cooperative, Alaska Clean Seas, is ConocoPhillips's primary response action contractor. Alaska Clean Seas provides trained personnel to manage all stages of a spill response, from containment and recovery to cleanup.

There is potential for pipeline spills where the pipeline crosses under the road, due to corrosion of the underground portion of the pipe (i.e., GMT1 to CD1/Alpine Central Processing Facility pipeline segments). The likelihood of corrosion occurring is reduced through pipeline design and monitoring. ConocoPhillips maintains a corrosion control program and an inspection program that includes ultrasonic inspection, radiographic inspection, coupon monitoring, metal loss detection pigs and geometry pigs, and forward-looking-infrared technology. The inspection programs are American Petroleum Institute Standard 570-based programs that focus inspection efforts on areas of greatest potential. These programs are described in the Alpine Oil Discharge Prevention and Contingency Plan.

The Alpine Spill Prevention, Control, and Countermeasures Plan is implemented to prevent oil discharge to waters of the U.S. It describes ConocoPhillips's spill prevention programs in place that minimizes the potential for oil discharges to water at Alpine facilities. The Alpine Spill Prevention, Control, and Countermeasures Plan would be amended to include GMT2.

2.4.10.2 Spill Response

The threat to rivers and streams from a possible pipeline spill between the GMT2 drill pad and CD1/Alpine Central Processing Facility would be minimized by quickly intercepting, containing, and recovering spilled oil near the waterway-pipeline crossing points. The response strategy for GMT2 Project involves two approaches: a design component approach, and an equipment pre-staging approach, as described below:

- **Design Component:** The pipelines would generally be north (downstream) of the road from CD4N westward until just east of GMT1 pad. Placing the pipelines on the downstream side (i.e., north) side of the road would prevent ice impacts to the pipelines during breakup because the road would act as a barrier to ice. Road stream crossings would be used as primary control points to contain potential spilled oil. The road could be used for access and staging for spill response.
- **Equipment Pre-Staging:** Spill response equipment would be placed at the GMT2 drill pad for an initial response. This strategy would facilitate the rapid deployment of equipment by personnel. The effective response time would be considerably reduced by this pre-staging concept and this would expedite equipment deployment to contain and recover spilled oil to minimize the affected area. During summer, pre-staged containment boom placed at strategic locations near selected river channels would facilitate a rapid response. Pre-deployed boom may also be placed within selected river channels to mitigate a spill.

2.4.10.3 Spill Training and Inspections

ConocoPhillips provides regular training for its employees on the importance of preventing oil or hazardous materials spills. ConocoPhillips provides new-employee orientation, annual environmental training seminars, and appropriate certification classes for specific issues, covering spill prevention. ConocoPhillips employees participate in frequent safety meetings, which address spill prevention issues, as appropriate. The ConocoPhillips Incident Management Team participates in regularly scheduled training programs and conducts spill response drills in coordination with federal and state agencies. Employees are encouraged to participate in the North Slope Spill Response Team. Alaska Clean Seas provides annual spill response training to the North Slope Spill Response Team members in order to ensure continuous availability of skilled spill responders on the North Slope.

ConocoPhillips is required to conduct visual examinations of pipelines and facility piping at least monthly during operations. ConocoPhillips is capable of providing aerial overflights as necessary to allow inspection both visually and with the aid of forward looking infrared (FLIR) technology. FLIR technology allows identification of spills based on the temperature “signature” resulting when warm fluid (oil) leaks. This technology is capable of detecting warm spots in low-light conditions or when other circumstances such as light fog or drifted snow limit visibility. FLIR technology also has the ability to identify trouble spots along the pipeline, such as damaged insulation, before a problem occurs. ConocoPhillips would also conduct regular visual inspections of facilities and pipelines from gravel roads under Alternative A. Inspections would be conducted via ice road and aircraft under Alternative C.

2.4.11 Fuel and Chemical Storage

Diesel will be stored in temporary tanks onsite during construction under all alternatives. During the drilling and operations phase (after first oil) fluids that may be stored in permanent tankage include diesel, corrosion inhibitor, scale inhibitor, methanol, emulsion breaker, and foam inhibitor. No other fuels or chemicals will be stored onsite at the GMT2 pad.

Fuel storage would comply with state and federal oil pollution prevention requirements, according to the Alpine Development Participating Area Oil Discharge Prevention and Contingency Plan and the Alpine Spill Prevention, Control, and Countermeasures Plan. Secondary containment for fuel storage tanks would be sized as appropriate to container type and according to governing regulatory requirements in 18 AAC 75 and 40 CFR 112. Fuel and chemical storage associated with the GMT2 Project would also be managed under BLM stipulations (BLM 2008a) and BMPs A-3, A-4, and A-5 (BLM 2013a). In addition ConocoPhillips will adhere to the supplemental best management practices for fuel and chemical storage included in the GMT1 Record of Decision (BLM 2015) (see Section 2.4.10).

2.4.12 Waste Handling and Disposal

Sanitary wastes that may be generated from the various camps would be hauled to an approved disposal site or treated and discharged under the Alaska Pollutant Discharge Elimination System General Permit AKG332000. Food waste would be incinerated either at GMT2 or at Alpine Central Processing Facility and non-burnable waste would be recycled or transported to the North Slope Borough landfill at Deadhorse. Other hazardous and solid waste associated with the GMT2 Project would be managed under Alaska Department of Environmental Conservation and EPA regulations as well as BLM stipulations (BLM 2008a) and BMPs A-1, A-2, A-6, and A-7 (BLM 2013a). Drilling wastes (i.e., muds and cuttings) would be disposed of through annular disposal onsite and/or transported to an approved disposal well such as the Alpine Central Processing Facility disposal well at CD1. Annular disposal is pumping down the well through the space between two casing strings, known as the annulus with the mud and cuttings entering an approved horizon below the outer casing string’s shoe. Drill cuttings may be washed and reused. Reserve pits are not required and will not be constructed. A temporary storage cell may be constructed for staging of muds and cuttings prior to disposal. Any temporary storage would comply with the Alaska Department of Environmental Conservation solid waste permit and would not result in any additional impacts to the waters of the U.S. Produced water would be processed at Alpine Central Processing Facility and re-injected to the subsurface as part of pressure maintenance/waterflood for secondary recovery. Well-work waste materials would be managed according to the Alaska Waste Disposal and Reuse Guide. No Class I disposal well and injection facility would be located on the GMT2 pad due to lack of an acceptable disposal horizon at this location; therefore, Class I wastes would be transported offsite for disposal at CD1/Alpine Central Processing Facility, Prudhoe Bay drill site 4 grind and inject, or another appropriate facility.

In addition to regulations governing waste handling and disposal, the GMT2 Project would also be managed under the 2013 BLM BMPs A-1 through A-7, and E4. ConocoPhillips will also adhere to the supplemental best management practices for waste handling included in the GMT1 Record of Decision (BLM 2015) (see Section 2.4.10).

2.4.13 Abandonment and Reclamation

The abandonment and reclamation of GMT2 Project facilities will be determined at or before the time of abandonment. The plan for GMT2 abandonment and reclamation is subject to a number of federal, state, and local authorities as well as private landowners. Other stakeholders would also provide comment on the abandonment and reclamation plan. Controlling factors may include:

- BLM leases, applications for permit to drill and rights of way
- U.S. Army Corps of Engineers Section 404 Permit
- State of Alaska easement
- Alaska Oil and Gas Conservation Commission requirements for plugging and abandonment of wells
- North Slope Borough Title 19
- Kuukpik Surface Access Agreement

The abandonment and reclamation of project facilities may involve removing gravel pads and roads or alternatively leaving these in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Depending on the types of abandonment and reclamation that occurs, summer road and air traffic could cause similar impacts to those experienced during construction and operations activities, but at potentially lower intensity levels and for shorter durations.

If the gravel is removed as part of the reclamation process, it could be used for other development projects. To assist with abandonment and reclamation, BLM holds a bond from companies conducing development activities within the NPR-A as discussed in Section 4.8. This bond ensures that the company will cover the full cost of reclamation. Reclamation standards are determined by BLM authorized officer and will be determined at the time of reclamation.

2.5 Alternative A: ConocoPhillips's Proposed Project, Draft Preferred Alternative

ConocoPhillips's proposed GMT2 Project (Alternative A) includes a drill pad, a gravel access road (GMT1–GMT2 Access Road), and pipelines, as described below. Alternative A is depicted in Map 2.5-1. More detailed design drawings for the GMT2 Project are included in Appendix A.

Construction is expected to take 2 years as described in Section 2.4.1. Drilling is expected to begin in May of Year 3, with first oil expected at the end of Year 3. To complete all 48 wells, drilling would continue year-round for approximately 7 years. Operations would continue as needed to achieve economic and production goals, which is currently estimated to be 30 years, post construction.

2.5.1 Project Components

Table 2.5-1 summarizes the major infrastructure components of Alternative A, the proposed action.

Table 2.5-1. Infrastructure for Alternative A, proposed action

Component	Alternative A, Proposed Action
Gravel Drill Pad	14.0 acres
Wells	Up to 48
Access Road	8.2 miles, 62.8 acres
Tundra Access Road Pullouts	3 pullouts, 1.2 acres (0.4 acre each)
Elevated Pipelines on Vertical Support Members	8.6 miles from GMT2 to GMT1; 0.1 acres 9.8 miles of crude oil pipeline from CD5 to CD1/Alpine Central Processing Facility (on existing vertical support members); 3.3 miles of miscible injectant pipeline from CD4/CD5 intersection to CD1/Alpine Central Processing Facility (on existing vertical support members)
Bridges	None
Gravel Supply	Arctic Slope Regional Corporation Mine site
Total Gravel Footprint [a]	78.0 acres
Total Gravel Requirement	671,300 cubic yards
Ice Roads	Year 1–2: 52.6 miles Year 2–3: 43.9 miles

[a] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

2.5.2 Location

The proposed Alternative A GMT2 pad location and pipeline route are described in Section 2.4.2. The road corridor for Alternative A crosses through Section 31, T11N, R3E UM; Section 6, T10N, R3E UM; and Sections 1, 11, 12, 14, 22, 23, 27, 32, 33, and 34, T10N, R2E UM.

In siting the GMT2 pad, the gravel GMT1–GMT2 Access Road, and the pipeline, eight criteria were considered: (1) keeping infrastructure out of the Colville River Special Area, (2) wetland habitat, (3) archaeological resources, (4) hydrology and drainage, (5) topography, (6) minimizing gravel footprint, (7) load weight requirements (road), and (8) local community interests.

2.5.3 Drill Pad and Support Facilities

The proposed Alternative A GMT2 drill pad and facilities are described in Section 2.4.3.

Total operational power required for the proposed Alternative A, including emergency shutdown module, fuel gas module, test separator module, remote electrical and instrumentation module, pig launching and receiving module, chemical injection module, production heater skid, pad lighting, heat trace and other drill site power requirements (shown in Appendix A on Sheet 21 of 33) is expected to be between 1.0 to 2.0 megawatts electrical, depending on season (summer versus winter). Additional power for the rig during drilling is approximately 2.0 megawatts.

2.5.4 Access

Alternative A includes access via gravel road from GMT1 (GMT1–GMT2 Access Road) and seasonal ice roads to support construction, drilling, and operations. Alternative A does not include an airstrip or associated facilities and pads, although helicopters can directly access the site. Planned use of fixed-wing aircraft associated with Alternative A is for transport of personnel, equipment, and supplies to the existing airstrip at the Alpine CD1/Alpine Central Processing Facility. Use of helicopters will be limited to emergency response to the GMT2 pad, ice road clean-up during construction years, and required monitoring studies. Helicopters will depart from Alpine CD1/Alpine Central Processing Facility and land directly on the tundra.

2.5.4.1 Roads

Alternative A will include a gravel road with culverts and ice roads during the construction phase.

GMT1 to GMT2 Road

An 8.2-mile long gravel road (GMT1–GMT2 Access Road) will connect GMT2 to GMT1 and the existing Alpine Field road system. The road will include three subsistence tundra access road pullouts to allow local residents to access the area for subsistence use. The GMT1–GMT2 Access Road would be a minimum of 5-feet high with side slopes of 2:1 (Appendix A, Sheet 31 of 33) and designed to maintain the existing thermal regime. The road would be 32-feet wide (crown width), which is wide enough to allow drill rig travel.

Where possible, the road would be constructed at least 500 feet from pipelines to minimize caribou disturbance (Lawhead et al. 2006a), as recommended by Cronin et al. (1994) to support greater crossing success. This also prevents excessive snow accumulation from snow drifts. Four stretches of the GMT1–GMT2 Access Road would not meet this requirement: a 0.7-mile long portion located west of lake M9925; a 0.7-mile long portion northeast of lake M9922; a 0.9-mile long portion east of lake Z06006; and a 0.4-mile long portion north of lake R0062 (Map 2.5-2). Pipelines are typically constructed within 1,000 feet of roads to allow for visual inspection for leak detection from the road; the GMT2 to GMT1 pipeline segment is within 1,000 feet of the road or pad for its entire length. With more sophisticated leak detection methods now available, such as monitoring from aircraft equipped with thermal imaging equipment, some newer pipelines have been constructed without using this 1,000-foot constraint.

The Alternative A pipeline and road routing between GMT2 and GMT1 would require deviations from two BLM requirements, as described in Section 2.2: Lease stipulation E-2, which requires a 500-foot setback from waterbodies and BMP E-7(c) which requires a minimum separation distance of 500 feet between pipelines and roads.

The location of the GMT1–GMT2 Access Road as proposed west and northwest (downgradient) of the pipeline route would allow the road to act as a barrier to protect waters in Fish Creek drainage in the event of a potential pipeline spill.

Bridges and Culverts

No new major stream or river crossings are proposed for the GMT2 Project; therefore, no bridges will be required. The route includes a culvert crossing over the small unnamed beaded stream pool outlet draining from Lake M9925.

Culverts will be placed to ensure that natural drainage is maintained in accordance with U.S. Army Corps of Engineers permit special conditions. The typical design of culverts is shown in Appendix A, Sheets 33 of 33. Preliminary culvert locations for cross-flow will be selected based on aerial photography. ConocoPhillips (or its contractor) will then walk the road alignment to optimize final culvert locations, noting low areas where culverts are needed, and review the data with the Alaska Department of Fish and Game (regulatory agency for potential effects on fish) for concurrence. Thus, the final design for the size, number, and location of the culverts will be complete after the field survey is completed. The estimated spacing of culverts is every 1,000 feet; however, some culverts may be closer than the 1,000-feet spacing as is common on roads associated with oil and gas development on the North Slope. The culverts would be installed per the final design prior to breakup of the first construction season, but additional culverts may be placed after breakup as site-specific needs are further assessed with the Alaska Department of Fish and Game and the U.S. Army Corps of Engineers.

Ice Roads and Pads

Ice roads would be constructed to access the gravel source and construction areas (e.g., road, drill pad, and pipelines). Proposed ice road routes for Alternative A (proposed project) are depicted on Map 2.5-3. Due to heavy equipment size and frequency of construction traffic, safety considerations dictate use of separate ice roads for pipeline construction, gravel placement, lake access, and general traffic.

During Year 1–2 of construction, ice pads would be built at the gravel source and along the gravel haul route. During Year 2–3 of construction, ice pads would be built at both ends of the pipeline route, plus an additional pad for construction laydown. All action alternatives would include a 10-acre ice pad for each year of drilling. A summary of ice roads and pads that would be constructed under Alternative A is presented in Table 2.5-2.

Table 2.5-2. Summary of ice roads and pads for Alternative A, proposed action

Project Phase	Ice Structure	Length/Area of Structure
Construction (Year 1–2)	Ice Road	52.6 miles
Construction (Year 1–2)	Ice Pad	175 acres
Construction (Year 2–3)	Ice Road	43.9 miles
Construction (Year 2–3)	Ice Pad	135 acres
Drilling (Year 3–10)	Ice Road	None
Drilling (Year 3–10)	Ice Pad	10 acres

2.5.4.2 Vehicle Traffic

Under Alternative A, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel GMT1–GMT2 Access Road, once it is constructed. Table 2.5-3 provides a summary of estimated vehicle traffic trips that would be required for Alternative A. More detail on vehicle traffic is provided in Appendix B.

In Year 1, traffic would be primarily associated with pre-construction activities from mid-November through December. Activities would consist of pre-packing snow and constructing ice roads in preparation for the following construction season in Year 2.

Alternative A vehicle traffic levels would be the highest during the first construction season (Year 1 to Year 2). Construction of the ice roads would be completed in January and construction of the gravel road, gravel drill pad, and installation of a portion of the pipeline scope would occur February through April. Gravel conditioning work would occur in August and September. Ice road pre-packing and construction for the second construction season (Year 2 to Year 3) would occur mid-November through December of Year 2.

In Year 3, traffic would occur on the ice roads and the gravel GMT1–GMT2 Access Road. Vehicles would support pipeline and facilities construction and the beginning of drilling. Completion of the pipeline installation would occur February through April via ice road. Facility construction will occur February through December. After April, all vehicle traffic would be on the GMT1–GMT2 Access Road. Drilling would begin in May.

In Year 4, drilling would be ongoing and vehicle traffic would be at levels greatly reduced from previous years and would be along the GMT1–GMT2 Access Road. Vehicle traffic associated with routine operations would begin after first oil in December of Year 3 and would continue for the life of the drill site to support the facility.

Table 2.5-3. Summary of vehicle trips for Alternative A, proposed action

Project Phase	Number of Trips	Miles Traveled
Construction (Year 1–2)	93,600	931,400
Construction (Year 2–3)	72,500	408,300
First Year of Drilling (Year 3)	6,100	153,100
Annual Ice Road	None	None
Annual Infill Drilling (Years 4–10) [a]	57,000 (9,000 annually)	1,416,700 (223,800 annually)
Routine Operations [b]	161,000 (700 annually)	287,500 (12,500 annually)
Total [c]	390,200	3,197,000

[a] Infill drilling refers to the period of time during which up to 48 development wells will be drilled on the GMT2 pad. Total trips and total miles for annual infill drilling assumes 6.33 years of drilling post construction.

[b] Routine operations will begin once infill drilling is complete. Routine operations assumes that the Alternative A wellwork crew will travel from CD1/Alpine Central Processing Facility as needed along the GMT1–GMT2 Access Road and an annual ice road will not be required. Total trips and total miles for routine operations assumes a project lifespan of 23 years post drilling.

[c] Totals are rounded to the nearest hundred. Trips are one way.

2.5.4.3 Air Transport

Aircraft traffic would support transportation of work crews, materials, and equipment from Fairbanks, Anchorage, or Deadhorse. Under Alternative A, aircraft would typically utilize the existing CD1/Alpine Central Processing Facility airstrip. Flights would primarily support personnel and equipment transport required for construction and the start of drilling. Estimated air traffic associated with Alternative A is described below.

2.5.4.4 Aircraft Traffic

Under Alternative A, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel GMT1–GMT2 Access Road, once it is constructed. All fixed-wing flights listed will land in CD1/Alpine Central Processing Facility and helicopters will base out of CD1/Alpine Central Processing Facility. Aircraft would maintain altitude of 1,000 feet or more except during takeoff and landing (within 3.6 miles of the airstrip). Flight paths would depend on prevailing winds, but would generally align with the airstrip orientation. Table 2.5-4 provides a summary of estimated aircraft trips that would be required for Alternative A. More detail on aircraft traffic is provided in Appendix B.

During construction, aircraft trips are limited to between 5 and 15 flights per month for crew changes. Helicopter landings to support environmental studies and ice road cleanup will occur from May through September.

Once construction of the GMT2 pad and GMT1–GMT2 Access Road are complete there will be no need for routine additional fixed-wing flights as post-construction drilling needs will be handled by flights into CD1/Alpine Central Processing Facility that are already part of the ongoing operations. Operation and maintenance will be handled by staff at the CD1/Alpine Central Processing Facility who will travel by the GMT1–GMT2 Access Road. Helicopter landings to support environmental studies will occur from May through September until the end of operations.

Table 2.5-4. Summary of flights for Alternative A, proposed action

Project Phase	Otter/CASA [a]	DC-6 [b]	Helicopter [c, d]	Total Flights
Construction (Year 1–2)	125	0	538	663
Construction (Year 2–3)	145	0	494	639
Drilling (Year 4–10) [e]	0	0	540 (90 annually)	540 (90 annually)
Annual Operations Post-Drilling [f]	0	0	2,070 (90 annually)	2,070 (90 annually)
Total Flights [g]	270	0	3,642	**3,912**

[a] Otter/CASA flights will take off from Kuparuk or Deadhorse and land at CD1/Alpine Central Processing Facility.

[b] DC-6 flights will take off from Deadhorse and land at CD1/Alpine Central Processing Facility.

[c] Helicopter numbers refer to landings within the NPR-A. Helicopter visits to spill response equipment pre-staged as part of the GMT2 Project are included in helicopter landing numbers.

[d] Helicopter landings for ice road cleanup are estimated at five landings per mile of ice road. Ice road cleanup will only occur from May–September of Year 2 and Year 3. Helicopters will take off from Alpine CD1/Alpine Central Processing Facility and land along the ice road route. Helicopter flights during drilling and annual operations years will support required monitoring and studies and will take off from CD1/Alpine Central Processing Facility. Landing/overflight areas within the NPR-A for monitoring helicopter flights will differ based on the study.

[e] Drilling flights were calculated by multiplying the annual total by 6 years of drilling.

[f] Total trips for annual operations assumes a project lifespan of 23 years post drilling.

[g] A single “flight” is defined as a landing and subsequent takeoff.

2.5.5 Gravel Requirements

Under Alternative A, a total of approximately 671,300 cubic yards of material required for this project would be used to fill approximately 78.1 acres. Table 2.5-5 lists the amount of material that would be used for project components. See Appendix A, Sheet 5 for a description of project infrastructure.

Table 2.5-5. Gravel use for Alternative A, proposed project [a, b]

Facility	Footprint (Acres)	Fill Quantity (Cubic Yards)	Notes/Dimensions
GMT2 Pad	14.0	152,000	See Appendix A, Sheet 5 and Sheet 21 for description of dimensions
GMT1–GMT2 Access Road	62.8	510,000	Length: 8.2 miles; crown width: 32 feet; minimum thickness: 5 ft
Road Pullouts for Subsistence Tundra Access	1.2	9,300	3 pullouts, 0.4 acres each
Total Gravel Requirement	78.0	671,300	None

[a] Values are approximate and may change during final design.

[b] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1. Approximately 800 vertical support members with 55-foot average spacing will be required.

2.5.6 Camps

The following camps are proposed to support construction and operation of the proposed GMT2 Project. All camps except the GMT2 Camp currently exist to support other development projects:

- Alpine Camp: 150 beds would be reserved for construction use at the man camp located at CD1/Alpine Central Processing Facility on the gravel pad which is connected to the existing CD1/Alpine Central Processing Facility electric grid. Workers would access the GMT2 pad via ice road and the GMT1–GMT2 Access Road.
- Nuiqsut Hotel: existing commercial hotel located in Nuiqsut and connected to the existing community electric grid. A total of 90 beds would be required for 120 days to support winter construction work. Workers would travel to the GMT2 construction site via ice road.

- Kuukpik Camp: a camp may be located on the existing Kuukpik 10-acre pad at the junction of the CD5 road and the Nuiqsut Spur Road. This camp would be connected to the existing CD1/Alpine Central Processing Facility grid and would utilize diesel generators as a backup power source. It would supply 65 beds for 120 days to support winter construction work (Year 1 to Year 3), and 70 beds for 245 days to support summer activities in Year 3. Workers would access the GMT2 pad via ice road and the GMT1–GMT2 Access Road.
- GMT2 Camp: a 75-man rig camp located at the GMT2 drill pad and connected to the existing Alpine electric grid via power cable from CD1/Alpine Central Processing Facility once a connection is established. Prior to electric power being available, the camp will be powered via diesel generators.

During construction (Years 1 to 3), offsite camp facilities including Alpine Camp, Nuiqsut Hotel, and Kuukpik Camp will be used. Drilling would be supported by a crew (workers to support drilling and well tie-in) based in a 75-man rig camp on the drill pad. This camp would be placed on the GMT2 Drill Pad as early as May of Year 3. After drilling, operations and maintenance personnel would typically commute from CD1/Alpine Central Processing Facility or Kuparuk and no additional camp facilities would be required.

2.5.7 Water Use

Fresh water would be required for domestic use at remote construction camps and for construction and maintenance of ice roads and ice pads. Potable water requirements are based on a demand of 100 gallons per day per person. Freshwater may be used for hydrostatic testing. Approximately 1.0 million gallons of water per mile are used for 35-foot wide ice road construction; ice roads for pipeline construction are wider than typical ice roads and may require two to four times that volume depending on the width. The ice road used to haul gravel from the Arctic Slope Regional Corporation Mine site will be a 35-foot ice road, and the ice road along the GMT2 Access Road and pipeline route will be wider to allow for pipeline construction. Ice roads would typically be available for use approximately 80 days each winter season, depending on local conditions.

A summary of estimated water use for Alternative A is provided in Table 2.5-6. More detailed water use data are provided in Appendix B. Water for construction and maintenance of ice roads and pads would be withdrawn from lakes in the vicinity of the GMT2 Project as approved by State of Alaska temporary water use authorizations and fish habitat permits where necessary.

Table 2.5-6. Summary of water use for Alternative A, proposed action

Project Phase [a]	Water Use (million gallons) [b]
Construction (Years 1–3)	239
Drilling (Years 3–10)	144
Operations (Years 11–33)	12
Total Water Use	**395**

[a] Water use totals are for the stated project phase timeframe.
[b] Totals are rounded to the nearest million gallons.

2.5.8 Spill Prevention and Response

ConocoPhillips' proposed GMT2 Project includes the GMT1–GMT2 Access Road, a gravel road connecting the GMT2 drill site to GMT1, which will provide year-round vehicle access to CD1/Alpine Central Processing Facility through existing and permitted roads. Alpine Central Processing Facility is a centralized facility that provides support to satellite drill sites in a variety of ways, including the equipment, personnel, and other support necessary to be able to respond to potential emergencies. The road connection to the resources at Alpine Central Processing Facility is an important part of the project design. In addition, ConocoPhillips would conduct regular ground-based visual inspections of facilities and pipelines from gravel roads under this alternative.

The spill response strategy for GMT2 under Alternative A involves two approaches: a design component approach, and an equipment pre-staging approach, as described below:

- **Design Component Approach:** Placement of the pipeline south of the road allows the road to act as a barrier to prevent oil from migrating into valuable streams and wetlands where the road is downgradient of the pipeline (eastern half of the GMT1–GMT2 Access Road; see Section 4.2.2). Additionally, there are several culverts planned for the GMT2 Access Road stream crossings and wetlands protection. The culvert crossings would be used as the primary control points to contain potential spilled oil from reaching streams and wetlands in the project area. The road could be used for access and staging for spill response.
- **Equipment Pre-Staging Approach:** Spill response equipment would be placed at the drill site for an initial response. This strategy would facilitate the rapid deployment of equipment by personnel. The effective response time would be considerably reduced by this pre-staging concept and this would expedite equipment deployment to contain and recover spilled oil and to minimize the affected area. During summer, pre-staged containment booms placed at strategic locations near selected river channels would facilitate a rapid response. Pre-deployed booms may also be placed within selected river channels to mitigate a spill.

ConocoPhillips would conduct regular ground-based visual inspections of facilities and pipelines, including the pipeline from GMT1 to GMT2 from gravel roads under Alternative A.

2.6 Alternative B: Alternate Alignment of GMT1–GMT2 Access Road

Alternative B includes a drill pad, a gravel access road (GMT1–GMT2 Access Road), and pipelines, as described below. Alternative B was developed to have the GMT1–GMT2 Access Road follow the watershed boundary between Fish Creek and the Tinmiaqsiugvik River drainage basins. This could potentially move the road to higher ground and prevent contamination of two watersheds in the event of a spill. Alternative B is depicted in Map 2.6-1. More detailed design drawings for the GMT2 Project are included in Sheets 2, 7, 8, and 13-33 of Appendix A.

Construction is expected to take 2 years as described in Section 2.4.1. Drilling is expected to begin in May of Year 3, with first oil expected at the end of Year 3. To complete all 48 wells, drilling would continue year-round for approximately 7 years. Operations would continue as needed to achieve economic and production goals, which is currently estimated to be 30 years, post construction.

2.6.1 Project Components

Table 2.6-1 summarizes the major infrastructure components of Alternative B, alternate road alignment.

Table 2.6-1. Infrastructure for Alternative B, alternate road alignment

Component	Alternative B, Alternate Road Alignment
Gravel Drill Pad	14.0 acres
Wells	Up to 48
Access Road	9.3 miles, 72 acres
Tundra Access Road Pullouts	3 pullouts, 1.2 acres (0.4 acre each)
Elevated Pipelines on Vertical Support Members	9.4 miles from GMT2 to GMT1; 0.1 acres 9.8 miles, crude oil pipeline from CD5 to CD1/Alpine Central Processing Facility (on existing vertical support members); 3.3 miles, miscible injectant pipeline from CD4/CD5 intersection to CD1/Alpine Central Processing Facility (on existing vertical support members)
Bridges	None
Gravel Supply	Arctic Slope Regional Corporation Mine site
Total Gravel Footprint [a]	87.2 acres
Total Gravel Requirement	747,300 cubic yards
Ice Roads	Year 1–2: 51.9 miles Year 2–3: 43.3 miles

[a] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

2.6.2 Location

The proposed Alternative B GMT2 pad location and pipeline route are described in Section 2.4.2. The road corridor for Alternative B crosses through Section 31, T11N, R3E UM; Section 6, 7 and 18, T10N, R3E UM; and Sections 13, 14, 22, 23, 27, 32, 33, and 34, T10N, R2E UM.

In siting the GMT2 pad, the gravel GMT1–GMT2 Access Road, and the pipeline, eight criteria were considered: (1) keeping infrastructure out of the Colville River Special Area and Fish Creek Setback, (2) wetland habitat, (3) archaeological resources, (4) hydrology and drainage, (5) topography, (6) minimizing gravel footprint, (7) load weight requirements (road), and (8) local community interests.

2.6.3 Drill Pad and Support Facilities

The proposed Alternative B GMT2 drill pad and facilities are described in Section 2.4.3.

Total operational power required for the proposed Alternative B, including emergency shutdown module, fuel gas module, test separator module, remote electrical and instrumentation module, pig launching and receiving module, chemical injection module, production heater skid, pad lighting, heat trace and other drill site power requirements (shown in Appendix A on Sheet 21 of 33) is expected to be between 1.0–2.0 megawatts electrical, depending on season (summer versus winter). Additional power for the rig during drilling is approximately 2.0 megawatts.

2.6.4 Access

Alternative B includes access via gravel road from GMT1 (GMT1–GMT2 Access Road) and seasonal ice roads to support construction, drilling, and operations. Alternative B does not include an airstrip or associated facilities and pads, although helicopters can directly access the site. Planned use of fixed-wing aircraft associated with Alternative B is for transport of personnel, equipment, and supplies to the existing airstrip at the Alpine CD1/Alpine Central Processing Facility. Use of helicopters will be limited to emergency response to the GMT2 pad, ice road clean-up during construction years, and required monitoring studies. Helicopters will depart from Alpine CD1/Alpine Central Processing Facility and land directly on the tundra.

2.6.4.1 Roads

Alternative B will include a gravel road with culverts and ice roads during the construction phase.

GMT1 to GMT2 Road

A 9.3-mile long gravel road (GMT1–GMT2 Access Road) will connect GMT2 to GMT1 and the existing Alpine Field road system. The road will include three subsistence tundra access road pullouts to allow local residents to access the area for subsistence use. The GMT1–GMT2 Access Road would be a minimum of 5-feet high with side slopes of 2:1 (Appendix A, Sheet 31 of 33) and designed to maintain the existing thermal regime. The road would be 32-feet wide (crown width), which is wide enough to allow drill rig travel.

Where possible, the road would be constructed at least 500 feet from pipelines to minimize caribou disturbance (Lawhead et al. 2006a), as recommended by Cronin et al. (1994) to support greater crossing success. This also prevents excessive snow accumulation from snow drifts. Two stretches of the GMT1–GMT2 Access Road would not meet this requirement: a 0.6-mile long portion located west of lake Z06005 (Map 2.6-2). Pipelines are typically constructed within 1,000 feet of roads to allow for visual inspection for leak detection from the road; the GMT2 to GMT1 pipeline segment is within 1,000 feet of the road or pad for its entire length. With more sophisticated leak detection methods now available, such as monitoring from aircraft equipped with thermal imaging equipment, some newer pipelines have been constructed without using this 1,000-foot constraint.

The Alternative B pipeline and road routing between GMT2 and GMT1 would require deviations from two BLM requirements, as described in Section 2.2: Lease Stipulation E-2, which requires a 500-foot setback from waterbodies, and BMP E-7(c) which requires a minimum separation distance of 500 feet between pipelines and roads. A total of 0.9 miles of the road around the north and eastern side of Lake M9925 would be within 500 feet of the waterbody and two sections of the road would be less than 500 feet apart as described above.

For the portion of the road located in the Fish Creek drainage, the location of the GMT1–GMT2 Access Road as proposed west and northwest (downgradient) of the pipeline route would allow the road to act as a barrier to protect waters in Fish Creek drainage in the event of a potential pipeline spill.

Bridges and Culverts

No new major stream or river crossings are proposed for the GMT2 Project, therefore no bridges will be required.

Culverts will be placed to ensure that natural drainage is maintained in accordance with U.S. Army Corps of Engineers permit special conditions. The typical design of culverts is shown in Appendix A, Sheets 33 of 33. Preliminary culvert locations for cross-flow will be selected based on aerial photography. ConocoPhillips (or its contractor) will then walk the road alignment to optimize final culvert locations, noting low areas where culverts are needed, and review the data with the Alaska Department of Fish and Game (regulatory agency for potential effects on fish) for concurrence. Thus, the final design for the size, number, and location of the culverts will be complete after the field survey is completed. The estimated spacing of culverts is every 1,000 feet; however, some culverts may be closer than the 1,000 feet spacing as is common on roads associated with oil and gas development on the North Slope. The culverts would be installed per the final design prior to breakup of the first construction season, but additional culverts may be placed after breakup as site-specific needs are further assessed with the Alaska Department of Fish and Game and the U.S. Army Corps of Engineers.

Ice Roads and Pads

Ice roads would be constructed to access the gravel source and construction areas (e.g., road, drill pad, and pipelines). Proposed ice road routes for Alternative B are depicted on Map 2.5-3. Due to heavy equipment size and frequency of construction traffic, safety considerations dictate use of separate ice roads for pipeline construction, gravel placement, lake access, and general traffic.

During Year 1–2 of construction, ice pads would be built at the gravel source and along the gravel haul route. During Year 2–3 of construction, ice pads would be built at both ends of the pipeline route, plus an additional pad for construction laydown. All action alternatives would include a 10-acre ice pad for each year of drilling. A summary of ice roads and pads that would be constructed under Alternative B are presented in Table 2.6-2.

Table 2.6-2. Summary of ice roads and pads for Alternative B, alternate road alignment [a]

Project Phase	Ice Structure	Length/Area of Structure
Construction (Year 1–2)	Ice Road	51.9 miles
Construction (Year 1–2)	Ice Pad	175 acres
Construction (Year 2–3)	Ice Road	43.3 miles
Construction (Year 2–3)	Ice Pad	135 acres
Drilling	Ice Road	None
Post Construction	Ice Pad	10 acres

[a] Although total length of ice roads for Alternative B is less than Alternative A, Alternative B will require more water to construct ice roads due to Alternative B's longer pipeline segment between GMT1 and GMT2. The ice road width required to support pipeline construction needs 2 to 4 times more water volume compared to a typical ice road. See Map 2.6-3 for more details.

2.6.4.2 Vehicle Traffic

Under Alternative B, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel GMT1–GMT2 Access Road, once it is constructed. Table 2.6-3 provides a summary of estimated vehicle traffic trips that would be required for Alternative B. More detail on vehicle traffic is provided in Appendix B.

In Year 1, traffic would be primarily associated with pre-construction activities from mid-November through December. Activities would consist of pre-packing snow and constructing ice roads in preparation for the following construction season in Year 2.

Alternative B vehicle traffic levels would be the highest during the first construction season (Year 1 to Year 2). Construction of the ice roads would be completed in January and construction of the gravel road, gravel drill pad, and installation of a portion of the pipeline scope would occur February through April. Gravel conditioning work would occur in August and September. Ice road pre-packing and construction for the second construction season (Year 2 to Year 3) would occur mid-November through December of Year 2.

In Year 3, traffic would occur on the ice roads and the gravel GMT1–GMT2 Access Road. Vehicles would support pipeline and facilities construction and the beginning of drilling. Completion of the pipeline installation would occur February through April via ice road. Facility construction will occur February through December. After April, all vehicle traffic would be on the GMT1–GMT2 Access Road. Drilling would begin in May of Year 3.

In Year 4, drilling would be ongoing and vehicle traffic would be at levels greatly reduced from previous years and would be along the GMT1–GMT2 Access Road. Vehicle traffic associated with routine operations would begin after first oil in December of Year 3 and would continue for the life of the drill site to support the facility.

Table 2.6-3. Summary of vehicle trips for Alternative B, alternate road alignment

Project Phase	Number of Trips	Miles Traveled
Construction (Year 1–2)	98,200	1,024,000
Construction (Year 2–3)	72,600	409,300
First Year of Drilling (Year 3)	6,100	159,200
Annual Ice Road	None	None
Annual Infill Drilling (Years 4–10) [a]	57,000 (9,000 annually)	1,473,600 (232,800 annually)
Routine Operations [b]	161,000 (700 annually)	310,500 (13,500 annually)
Total [c]	**394,900**	**3,376,600**

[a] Infill drilling refers to the period of time during which up to 48 development wells will be drilled on the GMT2 pad. Total trips and total miles for annual infill drilling assumes 6.33 years of infill drilling.

[b] Routine operations assumes that the Alternative B wellwork crew will travel from CD1/Alpine Central Processing Facility as needed along the GMT1–GMT2 Access Road and an annual ice road will not be required. Routine operations will begin after first oil. Total trips and total miles for routine operations assumes a project lifespan of 23 years post drilling.

[c] Totals are rounded to the nearest hundred. Trips are one way.

2.6.4.3 Air Transport

Aircraft traffic would support transportation of work crews, materials, and equipment from Fairbanks, Anchorage, or Deadhorse. Under Alternative B, aircraft would typically utilize the existing CD1/Alpine Central Processing Facility airstrip. Flights would primarily support personnel and equipment transport required for construction and the start of drilling. Estimated air traffic associated with Alternative B is described below.

2.6.4.4 Aircraft Traffic

Under Alternative B, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel GMT1–GMT2 Access Road, once it is constructed. All fixed-wing flights listed will land in CD1/Alpine Central Processing Facility and helicopters will base out of CD1/Alpine Central Processing Facility. Aircraft would maintain altitude of 1,000 feet or more except during takeoff and landing (within 3.6 miles of the airstrip). Flight paths would depend on prevailing winds, but would generally align with the airstrip orientation. Table 2.6-4 provides a summary of estimated aircraft trips that would be required for Alternative B. More detail on aircraft traffic is provided in Appendix B.

During construction, aircraft trips are limited to between 5 and 15 flights per month for crew changes. Helicopter landings to support environmental studies and ice road cleanup will occur from May through September.

Once construction of the GMT2 pad and GMT1–GMT2 Access Road are complete there will be no need for routine additional fixed-wing flights as post-construction drilling needs will be handled by flights into CD1/Alpine Central Processing Facility that are already part of the ongoing operations. Operation and maintenance will be handled by staff at the CD1/Alpine Central Processing Facility who will travel by the GMT1–GMT2 Access Road. Helicopter landings to support environmental studies will occur from May through September until the end of operations.

Table 2.6-4. Summary of flights for Alternative B, alternate road alignment

Project Phase	Otter/CASA [a]	DC-6 [b]	Helicopter [c, d]	Total Flights
Construction (Year 1–2)	125	0	538	663
Construction (Year 2–3)	145	0	494	639
Drilling (Year 4–10) [e]	0	0	540 (90 annually)	540 (90 annually)
Annual Operations Post-Drilling [f]	0	0	2,070 (90 annually)	2,070 (90 annually)
Total Flights [g]	270	0	3,642	**3,912**

[a] Otter/CASA flights will take off from Kuparuk or Deadhorse and land at CD1/Alpine Central Processing Facility.

[b] DC-6 flights will take off from Deadhorse and land at CD1/Alpine Central Processing Facility.

[c] Helicopter numbers refer to landings within the NPR-A. Helicopter visits to spill response equipment pre-staged as part of the GMT2 Project are included in helicopter landing numbers.

[d] Helicopter landings for ice road cleanup are estimated at five landings per mile of ice road. Ice road cleanup will only occur from May–September of Year 2 and Year 3. Helicopters will take off from Alpine CD1/Alpine Central Processing Facility and land along the ice road route. Helicopter flights during drilling and annual operations years will support required monitoring and studies and will take off from CD1/Alpine Central Processing Facility. Landing/overflight areas within the NPR-A for monitoring helicopter flights will differ based on the study.

[e] Drilling flights were calculated by multiplying the annual total by 6 years of drilling.

[f] Total trips for annual operations assumes a project lifespan of 23 years post drilling.

[g] A single “flight” is defined as a landing and subsequent takeoff.

2.6.5 Gravel Requirements

Under Alternative B, a total of approximately 747,300 cubic yards of material required for this project would be used to fill approximately 87.2 acres. Table 2.6-5 lists the amount of material that would be used for project components. See Appendix A, Sheet 5, for a description of project infrastructure.

Table 2.6-5. Gravel use for Alternative B, alternate road alignment [a, b]

Facility	Footprint (Acres)	Fill Quantity (Cubic Yards)	Notes/Dimensions
GMT2 Pad	14.0	152,000	See Appendix A, Sheet 21 of 33 for description of dimensions
GMT1–GMT2 Access Road	72	586,000	Length: 9.3 miles; crown width: 32 feet; minimum thickness: 5 feet
Road Pullouts for Subsistence Tundra Access	1.2	9,300	3 pullouts, 0.4 acres each
Total Gravel Requirement	87.2	747,300	None

[a] Values are approximate and may change during final design.

[b] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1. Approximately 800 vertical support members with 55-foot average spacing will be required.

2.6.6 Camps

The following camps are proposed to support construction and operation of the proposed GMT2 Project. All camps except the GMT2 Camp currently exist to support other development projects:

- **Alpine Camp:** 150 beds would be reserved for construction use at the man camp located at CD1/Alpine Central Processing Facility on the gravel pad which is connected to the existing CD1/Alpine Central Processing Facility electric grid. Workers would access the GMT2 pad via ice road and the GMT1–GMT2 Access Road.
- **Nuiqsut Hotel:** existing commercial hotel located in Nuiqsut and connected to the existing community electric grid. A total of 90 beds would be required for 120 days to support winter construction work. Workers would travel to the GMT2 construction site via ice road.

- **Kuukpik Camp:** a camp may be located on the existing Kuukpik 10-acre pad at the junction of the CD5 road and the Nuiqsut Spur Road. This camp would be connected to the existing CD1/Alpine Central Processing Facility grid and would utilize diesel generators as a backup power source. It would supply 65 beds for 120 days to support winter construction work (Year 1 to Year 3), and 70 beds for 245 days to support summer activities in Year 3. Workers would access the GMT2 pad via ice road and the GMT1–GMT2 Access Road.
- **GMT2 Camp:** a 75-man rig camp located at the GMT2 drill pad and connected to the existing Alpine electric grid via power cable from CD1/Alpine Central Processing Facility once a connection is established. Prior to electric power being available, the camp will be powered via diesel generators.

During construction (Years 1 to 3), offsite camp facilities including Alpine Camp, Nuiqsut Hotel, and Kuukpik Camp will be used. Drilling would be supported by a crew (workers to support drilling and well tie-in) based in a 75-man rig camp on the drill pad. This camp would be placed on the GMT2 Drill Pad as early as May of Year 3. After drilling, operations and maintenance personnel would typically commute from CD1/Alpine Central Processing Facility or Kuparuk and no additional camp facilities would be required.

2.6.7 Water Use

Fresh water would be required for domestic use at remote construction camps and for construction and maintenance of ice roads and ice pads. Potable water requirements are based on a demand of 100 gallons per day per person. Freshwater may be used for hydrostatic testing. Approximately 1.0 million gallons of water per mile are used for 35-foot wide ice road construction; ice roads for pipeline construction are wider than typical ice roads and may require two to four times that volume depending on the width. The ice road used to haul gravel from the Arctic Slope Regional Corporation Mine site will be a 35-foot ice road, and the ice road along the GMT2 Access Road and pipeline route will be wider to allow for pipeline construction. Ice roads would typically be available for use approximately 80 days each winter season, depending on local conditions.

A summary of estimated water use for Alternative B is provided in Table 2.6-6. More detailed water use data are provided in Appendix B. Water for construction and maintenance of ice roads and pads would be withdrawn from lakes in the vicinity of the GMT2 Project as approved by State of Alaska temporary water use authorizations and fish habitat permits where necessary.

Table 2.6-6. Summary of water use for Alternative B, alternate road alignment

Project Phase [a]	Water Use (million gallons) [b]
Construction (Years 1–3)	242
Drilling (Years 3–10)	144
Operations (Years 11–33)	12
Total Water Use	**398**

[a] Water Use totals are for the stated project phase.
[b] Totals are rounded to the nearest million gallons.

2.6.8 Spill Prevention and Response

Alternative B includes the GMT1–GMT2 Access Road, a gravel road connecting the GMT2 drill site to GMT1, which will provide year-round vehicle access to CD1/Alpine Central Processing Facility through existing and permitted roads. Alpine Central Processing Facility is a centralized facility that provides support to satellite drill sites in a variety of ways, including the equipment, personnel, and other support that are necessary to be able to respond to potential emergencies. The road connection to the resources at Alpine Central Processing Facility is an important part of the project design. In addition, ConocoPhillips would conduct regular ground-based visual inspections of facilities and pipelines from gravel roads under this alternative.

The spill response strategy for GMT2 under Alternative B involves two approaches: a design component approach, and an equipment pre-staging approach, as described below:

- **Design Component Approach:** Placement of the pipeline south of the road allows the road to act as a barrier to prevent oil from migrating into valuable streams and wetlands where the road is downgradient of the pipeline (eastern half of the GMT1–GMT2 Access Road; see Section 4.2.2). Additionally, there are several culverts planned for the GMT2 Access Road stream crossings and wetlands protection. The culvert crossings would be used as the primary control points to contain potential spilled oil from reaching streams and wetlands in the project area. The road could be used for access and staging for spill response.
- **Equipment Pre-Staging Approach:** Spill response equipment would be placed at the drill site for an initial response. This strategy would facilitate the rapid deployment of equipment by personnel. The effective response time would be considerably reduced by this pre-staging concept and this would expedite equipment deployment to contain and recover spilled oil and to minimize the affected area. During summer, pre-staged containment booms placed at strategic locations near selected river channels would facilitate a rapid response. Pre-deployed booms may also be placed within selected river channels to mitigate a spill.

ConocoPhillips would conduct regular ground-based visual inspections of facilities and pipelines, including the pipeline from GMT1 to GMT2 from gravel roads under Alternative B.

2.7 Alternative C: Roadless Development

Alternative C is similar to Alternative A, but there is no gravel access road from GMT1 to GMT2 and the rest of the Alpine Field development area. Access would be by aircraft and ice road (winter only).

Alternative C includes a drill pad, an occupied pad, an airstrip and associated facilities, a local access road, and pipelines. The airstrip provides year-round access to GMT2 in lieu of a gravel road. A local gravel access road would connect the drill pad, occupied pad, and air access facilities (airstrip and apron). During winter, ice roads would be constructed to access the site. Movement of the drill rig to and from other drill sites would be limited to the ice-road season restricting the ability to mobilize/demobilize the rig for work at other drill sites when it cannot work at GMT2. Alternative C is depicted in Map 2.7-1 and 2.7-2.

As for other action alternatives, construction is expected to take 2 years, as described in Section 2.4.1. Drilling is expected to begin in May of Year 2, with first oil expected the end of Year 2. To drill up to 48 wells, drilling would continue year-round until Year 9 (7.1 years total). Operations would continue as needed to achieve economic and production goals, which is currently estimated to be 30 years, post construction.

2.7.1 Project Components

The major components required for Alternative C are provided in Table 2.7-1.

Table 2.7-1. Infrastructure for Alternative C

Component	Alternative C
Gravel Drill Pad	19.1 acres
Wells	Up to 48
Occupied Structure Pad	18.4 acres
Air Access Facilities	47.3 acres (airstrip and apron)
Airstrip Access Road	0.9 mile, 7.2 acres
Elevated Pipelines on Vertical Support Members	8.6 miles from GMT2 to GMT1; 0.1 acres 9.8 miles, crude oil pipeline from CD5 to CD1/Alpine Central Processing Facility (on existing vertical support members); 3.3 miles, MI pipeline from CD4/CD5 intersection to CD1/Alpine Central Processing Facility (on existing vertical support members)
Gravel Supply	Arctic Slope Regional Corporation Mine site
Total Gravel Footprint	92.0 acres
Ice Roads	51.6 miles (Year 1) 51.2 miles (Year 2) 7.0 miles (from GMT2 to GMT1 for every year post construction period)

[a] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT1 and GMT2.

2.7.2 Location

The proposed Alternative C GMT2 drill pad location and pipeline route are described in Section 2.4.2. The occupied structure pad, air access facilities (airstrip and apron), and the Airstrip Access Road are located in Section 33, T10N, R2E UM (occupied structure pad); Sections 27, 28, and 33, T10N, R2E UM; and Section 31, T11N, R3E UM (air access facilities); and Sections 32 and 33, T10N, R2E UM (Airstrip Access Road). The Alternative C occupied structure pad, air access facilities, and Airport Access Road would be roughly northeast of the GMT2 drill pad as shown in Maps 2.7-1 and 2.7-2.

In siting these facilities, the same criteria were used as used for siting of Alternative A: keeping infrastructure out of the Colville River Special Area, wetland habitats, archaeological resources, hydrology and drainage, topography, minimizing gravel footprint, load weight requirements (road), and local community interests.

2.7.3 Drill Pad and Support Facilities

Major project components are summarized in Table 2.7-1. Major facilities and features include those described in Section 2.4.3. In addition, Alternative C would require that certain facilities, services, equipment, and supplies (otherwise provided at CD1/Alpine Central Processing Facility) would need to be duplicated at or near the drill pad as described below.

Air access facilities would consist of a 5,000-foot gravel airstrip and parking aprons. The airstrip would be capable of supporting a Hercules C-130 aircraft to transport a relief well drill rig in the event of a blowout or other emergency.

An occupied structure pad would be connected to the airport apron and would provide space for personnel housing and material storage. A new mud plant and bulk cement facility would be required for year-round drilling because the existing plant at CD1/Alpine Central Processing Facility must remain in place to service drilling operations at the other satellites. On-site wastewater and solid waste treatment or management would be required (see Section 2.4.12). In addition to housing, the following facilities will be located on this pad.

- Mud plant and bulk cement facility
- Cement and mud storage silos
- Water storage (muds make-up)
- Mineral oil, diesel and brine tankage (muds make-up)
- Muds make-up pump module
- Wastewater tankage (three tanks)
- Water tankage and supply pump (potable)
- Waste staging area
- Waste incinerator
- Emergency generator
- On-site waste processing
- Redundant equipment storage/parking
- Bull rail for vehicle block heaters
- Warm and cold storage facilities
- Equipment/fleet maintenance shop
- Emergency response facility

The GMT2 drill pad would be accessed via the 0.9-mile long Airport Access Road from the occupied pad/air access facilities. A tank farm would be needed to provide appropriate storage volumes for all operating fluids such as methanol and anti-corrosion chemicals. Diesel fuel for powering drilling support equipment, well work operations, fueling vehicle and equipment fleet, and freeze protect of wells would be transported via a new 2-inch diesel pipeline from CD1/Alpine Central Processing Facility. The 2-inch diesel pipeline would also be used for periodic shipments of mineral oil to the mud plant during the non-ice road season. Water would be supplied via a 2-inch heat traced water pipeline from CD1/Alpine Central Processing Facility. Drilling wastes (i.e., muds and cutting) that cannot be managed using annular disposal onsite, would be stored in tanks and transported for disposal at CD1/Alpine Central Processing Facility during winter ice road season. Camp waste during the post-construction drilling and operating period would be incinerated on-site. In addition to the infrastructure described in Section 2.4.3, the following facilities would be required.

- Fuel storage with supply pump
- Fueling station
- Bulk loading station/ops and drilling fluid tankage
- Drilling tubulars and tools storage
- Vehicle storage (with bull rail)
- Redundant emergency response equipment storage

Alternative C would require approximately 3.5 to 4.5 megawatts electrical (depending on season, i.e., summer versus winter). Higher power requirements over Alternative A are due to the necessary additional project components and facilities. Additional power for rig during drilling is approximately 2.0 megawatts.

Alternative C facilities would be re-supplied during the ice road season to support the required long-term storage of drilling and operating fluid and supplies.

2.7.4 Access

Alternative C includes year-round access via aircraft and seasonal access by ice roads to support construction, drilling, and operations. Alternative C does not include a gravel road to access GMT1 and the Alpine Field road system. A local gravel road will be constructed to provide access to the drill site from the occupied structure pad/air access facilities.

2.7.4.1 Road

Local Gravel Access Road

An approximately 0.9-mile gravel road would be constructed to access the GMT2 drill pad from the occupied pad/air access facilities. This is the only permanent road in Alternative C.

Ice Roads and Pads

When conditions allow, primary access to the GMT2 site would be by ice road. Ice roads would be constructed to access the gravel source and construction areas (e.g., drill pad, occupied pad, airstrip and pipelines). Due to the heavy equipment size and trip frequency of construction traffic, safety considerations dictate use of separate ice roads for pipeline construction, gravel placement, lake access for water supply, and general traffic. Proposed ice road routes for Alternative C are shown on Map 2.7-3.

During Year 1 to 2 of construction, ice pads would be built at the gravel source and along the gravel haul route. During Year 2 to 3 of construction, ice pads would be built at both ends of the pipeline route, plus an additional pad for construction laydown.

Post construction, a 7.0-mile ice road would be constructed each year from the GMT1 drill pad to GMT2 to access the drill site by vehicle. Alternative C would include a 10-acre ice pad for each year of drilling, and a 2-acre ice pad each year for operations and maintenance. A summary of ice roads and pads that would be constructed under Alternative C are presented in Table 2.7-2.

Table 2.7-2. Summary of ice roads and pads for Alternative C

Project Phase	Ice Structure	Length/Area of Structure
Construction (Year 1–2)	Ice Road	51.6 miles
Construction (Year 1–2)	Ice Pad	205 acres
Construction (Year 2–3)	Ice Road	51.2 miles
Construction (Year 2–3)	Ice Pad	175 acres
Post Construction	Ice Road	7.0 miles
Drilling (Years 3–10)	Ice Pad	10 acres
Post Drilling (Years 10–32)	Ice Pad	2 acres

2.7.4.2 Vehicle Traffic

The design of components in Alternative C separates the GMT2 drill pad from the occupied structure pad (e.g., man camp) to comply with aircraft safety regulations. A 0.9-mile gravel Airstrip Access Road would connect the GMT2 pad with the occupied structure pad. A summary of estimated vehicle traffic for Alternative C, including potential traffic on the Airport Access Road, is presented in Table 2.7-3. More detail on vehicle traffic is provided in Appendix B.

Mid-November through December of Year 1, vehicle traffic would be the same as that for Alternative A—supporting pre-packing and ice road construction.

In Year 2, construction of the ice roads would be completed in January. Vehicle traffic in Alternative C would be the most intense from February through April to support gravel hauling and construction of gravel pads, the Airstrip Access Road, and the airstrip, as well as a portion of the pipeline scope. Gravel conditioning work would occur in August and September. Ice road pre-packing and construction for the Year 2 to Year 3 construction season would occur mid-November through December of Year 2.

In Year 3, traffic between Alpine facilities would occur during the construction and operation of ice roads (January through April; November and December) with local access between the GMT2 drill pad and occupied pad/airstrip occurring via the Airstrip Access Road. Pipeline and facilities construction would continue and pipeline installation completion would occur February through April via ice road. After April, all vehicle traffic would be on the local access road. Drilling would begin in May.

In Year 4 of the project life, drilling would be ongoing and vehicle traffic would be at levels greatly reduced from previous years and would be along the Airstrip Access Road.

With year-round drilling and year-round operations, traffic levels are expected to maintain the same levels as Year 4 for the remainder of the project, but may decrease somewhat when drilling is completed and fewer personnel and support supplies are required.

Table 2.7-3. Summary of vehicle trips for Alternative C

Project Phase	Number of Trips [a]	Miles Traveled
Construction (Year 1–2)	106,700	1,356,600
Construction (Year 2–3)	75,100	335,900
First Year of Drilling (Year 3)	5,300	5,300
Annual Ice Road [b]	34,800 (5,500 annually)	207,600 (32,800 annually)
Annual Infill Drilling (Years 4–10) [b]	142,400 (22,500 annually)	1,082,400 (171,000 annually)
Routine Operations [c]	501,400 (21,800 annually)	1,616,900 (70,300 annually)
Total [d]	**865,700**	**4,604,700**

[a] Trips are one way. Construction trips are performed on the ice road. Drilling and routine operation trips are primarily performed on the 1-mile gravel road connecting the drill pad to the camp pad.

[b] Infill drilling refers to the period of time during which up to 48 development wells will be drilled on the GMT2 pad. Total trips and total miles assumes 6.33 years of annual infill drilling.

[c] Total trips and total miles for routine operations assumes a project lifespan of 23 years post drilling.

[d] Totals are rounded to the nearest hundred.

2.7.4.3 Air Transport

Air access is supported by a 5,000-foot gravel airstrip with parking aprons. The airstrip would be capable of supporting a Hercules C-130 aircraft, but the Otter/CASA class aircraft will be the most commonly used aircraft. An approximate 1-mile exclusion zone around the GMT2 drill pad separating the GMT2 drill pad from Air Access Facilities is required in accordance with 14 CFR 77.19(e) to ensure the safety of aircraft taking off and landing at the airstrip. Other factors contributing to the exclusion zone include the height of the drill rig and the setback distances required by the Federal Aviation Administration for approach and takeoff. Helicopters will also be used to support Alternative C.

Transportation to GMT2 pad from the existing CD1/Alpine Central Processing Facility would be via aircraft approximately 9 months of the year (May through January). Although aircraft can access the site year-round, access would be primarily via ice road approximately 80 days of the year (February 1 through April 20).

2.7.4.4 Aircraft Traffic

Air access to GMT2 via fixed-wing would begin upon completion of the GMT2 airstrip in the second construction season (Year 2–3). Prior to this, all fixed-wing flights listed will land in CD1/Alpine Central Processing Facility and air access would be limited to helicopter access. Aircraft would maintain altitude of 1,000 feet or more except during takeoff and landing (within 3.6 miles of the airstrip). Flight paths would depend on prevailing winds, but would generally align with the airstrip orientation. Table 2.7-4 lists estimated aircraft trips that would be required for Alternative C.

No airstrip or camp would be available at GMT2 during the first construction season (Year 1–2), since this infrastructure will be under construction. Construction crews will stage out of Alpine-area camps as discussed in Section 2.7.6, “Camps.” Otter/CASA flights to support construction crews during winter of Year 1–2 will land at CD1/Alpine Central Processing Facility. From May to October of Year 2 there will be two helicopter flights per day to support gravel-working crews at GMT2. From May to September approximately 400 helicopter flights will support special studies and ice road cleanup activities.

GMT2 air access facilities will become available in April/May of Year 3 and flights supporting drilling and operations will begin using the GMT2 airstrip. From May to September approximately 400 helicopter flights will support special studies and ice road cleanup activities.

Beginning in Year 4 and continuing through Year 9, crew changes and cargo transport will be performed by aircraft at the GMT2 airstrip: approximately 40 crew change (Otter/CASA) flights per month during ice road season and 90 flights per month outside of ice road season; and approximately 5 cargo (CD-6 or C-130) flights per month during ice road season and 23 flights per month outside of ice road season. Pipeline inspection flights (Otter/CASA) will remain at once a week. In addition, approximately 36 helicopter landings will occur to support ice road cleanup activities and 107 helicopter landings will occur to support special studies. Helicopter flights will generally occur between May and September. Helicopter visits to spill response equipment related to the GMT2 Project are included in the estimated helicopter landings.

Upon completion of drilling activities in Year 10 (i.e., operation only), crew change and cargo transport flights will reduce to approximately four crew change (Otter/CASA) flights per month during ice road season and 20 flights per month outside of ice road season; and approximately three cargo (CD-6 or C-130) flights per month. Pipeline inspection flights (Otter/CASA) will remain at once a week. Helicopter landings for ice road cleanup activities and special studies would remain the same.

Table 2.7-4. Summary of aircraft flights for Alternative C

Project Phase	Otter/CASA [a]	DC-6/C-130 [b]	Helicopter [c, d]	Total Flights
Construction (Year 1–2)	125	4	647	776
Construction (Year 2–3)	1,010	193	413	1,616
Drilling (Year 4–10) [e]	6,126 (983 annually)	1,399 (227 annually)	858 (143 annually)	8,383 (1,353 annually)
Annual Operations Post-Drilling [f]	5,281 (228 annually)	974 (42 annually)	3,289 (143 annually)	9,544 (413 annually)
Total Flights [g]	**12,542**	**2,570**	**5,207**	**20,319**

[a] Otter/CASA flights will take off from Kuparuk or CD1/Alpine Central Processing Facility and land at the GMT2 airstrip after airstrip construction is completed.

[b] DC-6/C130 flights will take off from Deadhorse and land at the GMT2 airstrip after airstrip construction is completed.

[c] Helicopter numbers refer to landings within the NPR-A. Helicopter visits to spill response equipment pre-staged as part of the GMT2 Project are included in helicopter landing numbers.

[d] Helicopter landings for ice road cleanup are estimated at five landings per mile of ice road. Ice road cleanup will occur from May–September from Year 2 until the end of the project. Helicopters would take off from the CD1/Alpine Central Processing Facility airstrip and land along the ice road route.

[e] Drilling flights were calculated by adding up the monthly totals for the drilling timeframe (6.33 years post construction) for each year of drilling. See Appendix B for monthly flight totals.

[f] Totals for annual operations assumes a project lifespan of 23 years post drilling.

[g] A single "flight" is defined as a landing and subsequent takeoff.

2.7.5 Gravel Requirements

Under Alternative C, a total of approximately 930,000 cubic yards of material required for this project would be used to fill approximately 92.0 acres. Table 2.7-5 lists the amount of material that would be used for project components.

Table 2.7-5. Gravel use for Alternative C

Facility	Footprint (Acres)	Fill Quantity (Cubic Yards)	Notes/Dimensions
GMT2 Drill Pad	19.1	207,000	Roughly 510 feet by 1,363 feet
Occupied Structure Pad	18.4	168,000	Roughly 835 feet by 820 feet
Air Access Facilities	47.3	497,000	5,000-foot-long airstrip
Airstrip Access Road	7.2	58,000	0.9-mile long; 32 feet crown width and minimum 5 feet thickness
Total Gravel Requirement [a, b]	92.0	930,000	None

[a] Values are approximate and may change during final design.

[b] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1. Approximately 800 vertical support members with 55-foot average spacing will be required.

2.7.6 Camps

The following camps are proposed to support construction and operation for GMT2 Project Alternative C:

- **Alpine Camp:** 150 beds would be reserved for construction use at the man camp located at CD1/Alpine Central Processing Facility on the gravel pad which is connected to the existing CD1/Alpine Central Processing Facility electric grid. The camp would remain onsite year-round through the construction period and is required to support both winter and summer work.
- **Nuiqsut Hotel:** existing commercial hotel located in Nuiqsut and connected to the existing community electric grid. A total of 90 beds would be required for 120 days to support winter construction work.

- **Kuukpik Camp:** a camp may be located on the existing Kuukpik 10-acre pad at the junction of the CD5 road and the Nuiqsut Spur Road. This camp would be connected to the existing CD1/Alpine Central Processing Facility grid and would utilize diesel generators as a backup power source. It would supply 65 beds for 120 days to support winter construction work (Year 1 and Year 2).
- **Temporary Camp:** a 140-man camp located on an ice pad for 120 days to support winter construction during Year 2. This camp would be located adjacent to a drill site (such as CD5 or GMT1) that can supply power from the Alpine Central Processing Facility electric grid.
- **GMT2 Camps:** camps located at the GMT2 Occupied Structure Pad and connected to the existing Alpine electric grid via power cable from CD1/Alpine Central Processing Facility

As in the other action alternatives, construction is expected to take 2 years as described in Section 2.4.1. During construction (Years 1 and 2), offsite camp facilities including Alpine Camp, Nuiqsut Hotel, and Kuukpik Camp will be used. In addition, a temporary camp would be located on an ice pad at GMT2 to support Year 2 winter construction activities to complete construction of additional roadless facilities.

Drilling is expected to begin in May of Year 2 (2020) and would be supported by 225 personnel housed on the occupied structure pad in the following camps: 120 person drilling support separated into a 75-man rig camp plus 45 additional stand-alone rig support; an 80-man well operations/well tie-in camp housing welders, instrument technicians, electricians, flowback crew, and wellwork crews). A 25-man, full-service operation camp would be on the occupied structure pad. Drilling activities would continue for 7.1 years. Operation (i.e., production) would begin after the estimated first oil date (December 2020), and would be concurrent with drilling the remainder of the 48 wells. Post-construction operation would continue for 30 years to 2050. Upon completion of drilling activities, a 25-man camp would be located on the occupied structure pad to house personnel to provide full-service operations.

2.7.7 Water Use

Water for use at the site (e.g., personal water use) would be provided via a 2-inch water pipeline from the Alpine Central Processing Facility. Water use from local lakes would be required for ice pads, road, and bridges. Alternative C would require construction of a 7.0-mile annual resupply ice road every year for 30 years to support drilling and operations. A summary of estimated water use for Alternative C is provided in Table 2.7-6. More detailed water use data are provided in Appendix B.

Table 2.7-6. Summary of water use for Alternative C [a]

Project Phase	Water Use (million gallons)
Construction (Years 1–3)	266
Drilling (Years 3–10)	222
Operations (Years 3–33)	203
Total Water Use	**691**

[a] Water use figures are rounded to the nearest million gallons.

2.7.8 Spill Prevention and Response

Alternative C would require redundant emergency response facilities and equipment storage at the occupied structure pad. Outside the ice road season, any equipment not available locally (at the GMT2 or occupied structure pad) would be brought in by aircraft to the GMT2 airstrip. For additional discussion of spill response, see Section 4.5.

Pipeline inspections would be conducted via ice road and aircraft under Alternative C. Pipeline inspections and maintenance and emergency response activities (including training and drills) would depend upon aircraft logistics and weather restrictions for approximately 9 months per year and would occur from ice roads for approximately 80 days per year. Mobilization of emergency response equipment, supplies, and personnel housed at the CD1/Alpine Central Processing Facility would require dependency on aircraft support and could be challenging, particularly during periods of adverse weather. Response time for safety or medical emergencies could also be compromised when aircraft support is restricted by adverse weather. Due to adverse weather, air travel has been restricted at CD1/Alpine Central Processing Facility 13 to 22 percent each year for years 2009–2013 (ConocoPhillips MNAD 2015). In the event of bad weather at Alpine, a response effort could be staged out of Nuiqsut, as often the weather is different in both locations. Therefore, the same would be true if the weather was bad in Nuiqsut, a response effort could be staged out of Alpine. Alpine would be the primary location to stage a response.

Under Alternative C, the incremental challenges associated with responding in a timely manner to emergency life-saving and spill events would increase safety and environmental risks throughout the life of the project. Dedicated response resources are available at CD1/Alpine Central Processing Facility including full-service medical, fire, and spill response personnel, facilities, and equipment.

2.8 Alternative D: No Action

Under Alternative D (no action), the current conditions and expected future condition in the absence of the project are evaluated. ConocoPhillips's application for permit to drill, application for discharge into waters of the U.S., and related authorizations would not be approved.

The following regulatory guidance (BLM 2015d) provides framework for the analysis:

> The U.S. Court of Appeals in Sierra Club v Peterson 717 F.2d 1409 (D.C. Cir. 1983) found that "on land leased without an NSO [no surface occupancy] stipulation, the U.S. Department of the Interior (DOI) cannot deny the permit to drill…once the land is leased the DOI no longer had the authority to preclude surface-disturbing activities even if the environmental impact of such activity is significant. The Department can only impose mitigation upon a lessee who pursues surface-disturbing exploration and/or drilling activities." The court goes on to say "notwithstanding the assurance that a later site-specific environmental analysis would be made, in issuing these leases the DOI has made an irrevocable commitment to allow some surface-disturbing activities including drilling and road building."

Alternative D assumes continuing exploration work as required under the GMT Unit Agreement. Alternative D also assumes permitted studies in the NPR-A would continue, with continued use of aircraft in the project vicinity (see Section 3.4.4.1, Local Transportation). The no-action alternative further assumes that the GMT1 Project would be constructed, since that authorization is independent of the proposed project.

No water use beyond what is currently required is expected to occur as a result of Alternative D. There would be no additional gravel use or footprint for Alternative D.

Vehicle traffic for Alternative D is expected to be the same as currently expected from current and expected future conditions: no vehicle traffic is expected due to the lack of gravel or ice road to support the GMT2 Project.

Aircraft traffic for Alternative D is should be the same as currently expected from current activities and from future expected activities. Table 2.8-1 shows the baseline (current) ConocoPhillips flights without GMT2 Project and includes biological and hydrological studies. More detailed information is provided in Appendix B.

Table 2.8-1. Summary of ConocoPhillips current aircraft flights [a, b]

Flight Purpose	Aircraft Type	Flights Projected for 2018	Flights Projected for 2019 and Beyond
Construction Crew Support [c]	Otter/CASA	2,071	1,981
Construction Cargo [d]	DC-6	360	366
Special Studies/Ice Road Cleanup [e]	Helicopter	1,070	765
Annual Total	N/A	**3,501**	**3,112**

[a] A single flight is defined as a landing and subsequent takeoff.

[b] Helicopter numbers refer to landings within the NPR-A.

[c] Aircraft supporting crew changes would take off from Kuparuk or Deadhorse and land at the CD1/Alpine Central Processing Facility airstrip.

[d] Construction cargo flights will land at the CD1/Alpine Central Processing Facility airstrip. Point of origin for these flights will be Kuparuk, Deadhorse, Fairbanks or Anchorage depending on the cargo being transported.

[e] Special studies and ice road cleanup flights will originate at the CD1/Alpine Central Processing Facility airstrip. Landing/overflight area will be determined by the ice road location or study being conducted.

2.9 Comparison of Alternatives

All action alternatives (Alternatives A, B, and C) require similar types of facilities (gravel pads and roads/air access facilities) with a similar gravel footprint. The pipeline route is the same for all action alternatives except Alternative B. All action alternatives have the same construction, drilling and operation schedule. The amount of gravel required varies between alternatives with Alternative C requiring approximately 45 to 50 percent more than Alternative A.

Major project components and on-site facilities and schedules are listed and detailed descriptions of each alternative are provided in Sections 2.5 through 2.8. Table 2.9-1 provides a summary of differences between the alternatives.

Table 2.9-1. Comparison of components, facilities, and access for the action alternatives

Project Component	Alternative A Draft Preferred Alternative	Alternative B	Alternative C
Drill Pad	14.0 acres	14.0 acres	19.1 acres
Wells	Up to 48	Up to 48	Up to 48
Occupied Structure Pad	None	None	18.4 acres
Air Access Facilities	None	None	47.3 acres; airstrip and apron
GMT1–GMT2 Access Road	8.2 miles; 62.8 acres of fill	9.4 miles, 72 acres of fill	None
Tundra Access Subsistence Pullouts	3 pullouts	3 pullouts	None
Airstrip Access Road	None	None	0.9 mile, 7.2 acres
Ice Roads and Pads	Year 1–2: 52.6 mile ice road, 175-acre ice pad Year 2–3: 43.9 mile ice road, 135-acre ice pad Year 3–10: 10-acre ice pad to support drilling	Year 1–2: 51.9-mile ice road, 175-acre ice pad Year 2–3: 43.3-mile ice road, 135-acre ice pad Year 3–10: 10-acre ice pad to support drilling	Year 1–2: 51.6-mile ice road, 205-acre ice pad Year 2–3: 51.2-mile ice road, 175-acre ice pad Years 3–10: 7.0-mile ice road, 10-acre ice pad Years 11–32: 7.0-mile ice road, 2.0-acre ice pad
Total Water Requirements	395 million gallons	398 million gallons	691 million gallons
GMT1–GMT2 Pipeline System	8.6 miles; 0.1 acre of fill from new vertical support members	9.4 miles, 0.1 acre of fill from new vertical support members	8.6 miles; 0.1 acre of fill from new vertical support members
Ancillary Pipelines	None	None	Diesel and mineral oil supply, 2-inch water supply, 2-inch
Total Gravel Footprint	78.0 acres	87.2 acres	92.0 acres
Gravel Supply	Arctic Slope Regional Corporation Mine site	Arctic Slope Regional Corporation Mine site	Arctic Slope Regional Corporation Mine site
Total Gravel Requirement	671,300 cubic yards	747,300 cubic yards	930,000 cubic yards
Construction Schedule	4Q Year 1–3Q Year 3	4Q Year 1–3Q Year 3	4Q Year 1–3Q Year 3
Drilling Timeframe	7.1 years, 2Q Year 3–Year 10	7.1 years, 2Q Year 3–Year 10	7.1 years, 2Q Year 3–Year 10
Post-Construction Operation	30 years	30 years	30 years
Lodging Requirements, Construction	Year 1–2: 305 beds Year 2–3: 305 beds in winter, 70 beds in summer	Year 1–2: 305 beds Year 2–3: 305 beds in winter, 70 beds in summer	Year 1–2: 305 beds Year 2–3: 445 beds in winter, 140 beds in summer
Lodging Requirements, Drilling	75-bed drilling camp	75-bed drilling camp	120-bed drilling camp 80-bed operations camp
Lodging Requirements, Operations	None	None	25-bed operations camp
Access	Year-round access via gravel road	Year-round access via gravel road	Year-round access by aircraft only; seasonal access by ice road

2.9.1 Access

The number of vehicle trips and miles traveled to support construction is relatively similar for all action alternatives, but is slightly lower for Alternative A. For drilling and operations the number of trips and miles traveled is also relatively similar for all action alternatives. A summary of vehicle trips required for each alternative is provided in Table 2.9-2.

Table 2.9-2. Summary of total vehicle trips for project alternatives

Project Phase	Alternative A Draft Preferred Alternative	Alternative B	Alternative C
Vehicle Trips: Construction Years 1–2	93,600	98,200	106,700
Vehicle Trips: Construction Years 2–3	72,500	72,600	75,100
Vehicle Trips: First Year of Drilling	6,100	6,100	5,300
Vehicle Trips: Post-Construction Ice Road [a]	None	None	5,500 annually
Vehicle Trips: Infill Drilling [b]	56,970 (9,000 annually)	56,970 (9,000 annually)	142,425 (22,500 annually)
Vehicle Trips: Routine Operations [c]	161,000 (700 annually)	161,000 (700 annually)	501,400 (21,800 annually)
Total Trips [d]	**390,170**	**394,900**	**865,700**
Miles Traveled: Construction Years 1–2	931,400 miles	1,024,000 miles	1,356,600 miles
Miles Traveled: Construction Years 2–3	408,300 miles	409,300 miles	335,900 miles
Miles Traveled: First Year of Drilling	153,100 miles	159,200 miles	None
Miles Traveled: Annual Ice Road	None	None	35,600 miles
Miles Traveled: Infill Drilling	1,416,654 miles (223,800 annually)	1,473,600 miles (232,800 annually)	43,800 miles annually
Miles Traveled: Routine Operations	287,500 miles (12,500 annually)	310,500 miles (13,500 annually)	1,616,900 miles (70,300 annually)
Total Miles [d]	**3,197,000 miles**	**3,376,600 miles**	**4,604,700 miles**

[a] Annual ice roads will be needed for Alternative C for every year that drilling is taking place. For Alternative C, an ice road will be constructed for 6.33 years; vehicle trips and miles traveled for the annual ice road phase were calculated by multiplying the annual total by 6.33.

[b] Infill drilling is expected to take 6.33 years for Alternatives A, B and C. Vehicle trips and miles traveled for the infill drilling phase were calculated by multiplying the annual total by 6.33.

[c] Total trips and total miles for routine operations assumes a project lifespan of 23 years post-drilling.

[d] Totals are rounded to the nearest hundred.

The number of aircraft flights required differs dramatically between alternatives. Alternative C requires 14 times the number of flights required by Alternative A. These include all types of flights, such as crew changes using both Otter/CASA aircraft and helicopter, cargo flights, pipeline inspection flights, and helicopter-based special studies and cleanup activities. A summary of aircraft flights required for each alternative is provided in Table 2.9-3.

Table 2.9-3. Summary of total aircraft flights for project alternatives

Aircraft Type	Alternative A Draft Preferred Alternative	Alternative B	Alternative C
Otter/CASA	270	270	12,542
DC 6/C-130	None	None	2,570
Helicopter [a, b]	3,642	3,642	5,207
Total [c, d]	**3,912**	**3,912**	**20,319**

[a] Helicopter numbers refer to landings within the NPR-A. Helicopter visits to spill response equipment pre-staged as part of the GMT2 Project are included in helicopter landing numbers.

[b] Helicopter landings for ice road cleanup are estimated at five landings per mile of ice road. Ice road cleanup will only occur from May–September of Year 2 and Year 3.

[c] Total flights are divided across the GMT2 Project's estimated 30-year lifespan.

[d] A single "flight" is defined as a landing and subsequent takeoff.

2.9.2 Spill Prevention and Response

Spill prevention and response would be different depending upon the alternative selected.

For Alternatives A and B, visual observations of the pipeline and facilities would be conducted from the GMT1–GMT2 Access Road. For Alternative C, road access would be limited to the annual ice road; all other access would be via aircraft. Conducting visual observations and investigation of pipelines from the gravel road would significantly reduce the number and frequency of aircraft over flights needed to visually inspect the pipelines. Annual summer deployment of boom and pre-staged equipment along the pipeline route and its subsequent removal prior to winter could be effectively managed from a gravel road for some strategic locations, which would also reduce the number and frequency of aircraft flights required to deploy and then remove the equipment. In addition, the gravel road would support equipment staging and provide immediate access points for response vehicles and/or vessels, in the event of a pipeline spill; this would increase response effectiveness and reduce the potential for disturbance to tundra and wildlife caused by response activities.

Dedicated oil spill response resources, including full-service medical, fire, and spill response personnel, facilities, and equipment are available at CD1/Alpine Central Processing Facility. Under Alternatives A and B, these resources would be accessible to GMT2 via the GMT1–GMT2 Access Road. Because no road access is available for Alternative C (except for during ice road season), these resources would not be available. It is not feasible to duplicate these resources at each drill site. Much of the equipment should be kept in warm storage buildings to maintain response readiness. It also requires continuous inspection and maintenance to be ready for emergency response. Workers needed to maintain this equipment would also require housing. The resources maintained at CD1/Alpine Central Processing Facility will be separated by approximately 23 miles of tundra, rivers, and lakes from GMT2 (7.0 miles from GMT1 via the approved CD5–GMT1 Road). The GMT1–GMT2 Access Road would allow year-round transport and mobilization of these resources and ensure they can be reliably made available for timely incident response.

Hazardous conditions from a worst-case well control discharge at GMT2 facilities could require site evacuation and locally staged equipment could become inaccessible or unusable due to oiling or unsafe operating conditions. Permanent road access to GMT2 provides assurance that response equipment and resources would be rapidly available and deployable.

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Chapter 3. Affected Environment

3.1 Introduction

The objective of this section of the supplemental EIS is to summarize the affected environment, as described in BLM (2004a) and BLM (2014), and supplement it with new information to determine whether the impacts of the proposed project are still within the range of impacts analyzed in BLM (2004a).

3.1.1 Project Study Area

The GMT2 Project facilities are located entirely within the Northeast NPR-A, on the North Slope of Alaska, immediately west of the Colville River Delta. The project study area defined for this supplemental EIS is depicted on Map 3.1-1. The study area extends approximately 2.5 miles in radius from proposed project facilities and encompasses 158,480 acres. Resources have a varied geographic scope; details regarding the specific area of impact analysis for each resource are included in the discussion of that resource.

3.1.2 Existing and Planned Infrastructure

The proposed GMT2 pad lies approximately 16.5 miles west of Nuiqsut, a community of about 400 people (see Section 3.4.1 for more information). An approximately 4,500-foot airstrip, owned and operated by the North Slope Borough, serves Nuiqsut year-round. Seasonal ice roads to Alpine facilities are typically extended to Nuiqsut, allowing access to the Prudhoe Bay road system during the winter.

During the winters of 2014 to 2016, Kuukpik Corporation constructed the 5.8-mile gravel road (Nuiqsut Spur Road) from Nuiqsut to the Colville Delta 5 (CD5) access road (Map 3.1-1), including a new gravel storage pad (Nuiqsut Laydown Pad) near the juncture. The Nuiqsut Spur Road is intended to increase access to subsistence resources; provide access for training and employment of local residents at the Alpine oilfield; improve access from Alpine to Nuiqsut to facilitate local business opportunities (e.g., camp facilities); and provide year-round transportation for life/safety/health response, spill response (e.g., mutual aid), and medical emergencies according to the mutual aid agreement between ConocoPhillips and the North Slope Borough.

In early 2015, Conoco Phillips received authorization from the BLM (2015a) and the U.S. Army Corps of Engineers (2015) for construction of the GMT1 Project, which consists of a 7.6-mile gravel road, an 11.8-acre gravel pad, and an 8.3-mile pipeline. The purpose of the GMT1 Project is to support development and transportation of petroleum reserves within the Greater Mooses Tooth Unit. Construction of GMT1 began in February 2017.

The main Alpine development complex at the Colville Delta 1(CD1)/Alpine Central Processing Facility is approximately 20 miles northeast of the proposed GMT2 pad, as shown in Map 3.1-1. The gravel CD5–CD4 Access Road and bridges were completed in 2015. Alpine Central Processing Facility is not connected by gravel road to the existing North Slope road system, and is only accessed by seasonal ice road and by air.

There are several cabins in the area. A number of federal and industry exploration wells are in the project area, but no development has occurred at these sites. Several small weather stations are located west of the project area.

3.1.3 Hazardous and Solid Waste Sites

The Alpine Satellite Development Plan EIS (BLM 2004, Section 3.1.2.3), the Northeast NPR-A Supplemental Integrated Activity Plan/EIS (BLM 2008, Section 3.2.10), and the NPR-A Integrated Activity Plan/EIS (BLM 2012, Section 3.2.11) provide information on hazardous and solid waste sites in and around the Alpine Field and within the NPR-A. Hazardous and solid waste sites are associated with past activities including oil and gas exploration, winter petroleum seismic exploration operations, Department of Defense activities, and current activities including landfills and fuel storage. Other uses, including overland transport, research, and recreation and subsistence activities, have resulted in incidental fuel spills.

3.1.3.1 Known Hazardous and Solid Waste Sites Within the Project Study Area

To identify known contaminated sites within the project study area, the Alaska Department of Environmental Conservation Contaminated Sites Database and EPA Superfund Enterprise Management System on-line databases were reviewed. One contaminated site, the North Slope Borough Nuiqsut Power Plant (Alaska Department of Environmental Conservation Hazard ID 25937), was identified within the project study area on the Alaska Department of Environmental Conservation Contaminated Sites Database. Petroleum contaminated soil was encountered at the Nuiqsut Power Plant site in 2012 during excavation activities to replace underground fuel piping between the power plant and the washeteria after a problem with the piping integrity was identified. No known sites were listed on the EPA Superfund Enterprise Management System within the project area.

A review of the Alaska Department of Environmental Conservation Solid Waste Sites web map shows two solid waste sites within the project study area, the Nuiqsut Landfill, and the ConocoPhillips Alpine Grind and Inject Facility. The Nuiqsut Landfill is an Alaska Department of Environmental Conservation Class III permitted landfill (permit number SWGPNSB-21) for domestic and commercial refuse generated in the community of Nuiqsut. The landfill does not accept acids, corrosives, solvents, contaminated/polluted soils, oily wastes, explosives, hazardous wastes, radioactive waste, unsterilized medical wastes, polychlorinated biphenyls, containers holding in excess of 1 gallon of liquid, or regulated asbestos-containing materials.

The ConocoPhillips Alpine Grind and Inject Facility is an Alaska Department of Environmental Conservation-permitted facility (permit number SWXA006-19) authorized for the treatment and storage of Resource Conservation and Recovery Act exempt exploration and production waste (drilling waste) and Resource Conservation and Recovery Act non-exempt non-hazardous waste. Storage facilities currently consist of two permanent cells at the CD2 pad and several temporary cells at the CD2 and CD5 pads.

3.1.3.2 Alpine Hazardous Waste Generation

The EPA Hazardous Waste Biennial Report collects data on the generation, management, and minimization of hazardous waste, and is reported for odd number years. A search of the biennial report database shows the Alpine Oil Field (handler ID AKR000003806) generated 47.6 tons of waste during the 2015 reporting period. The majority of the waste generated, 45.5 tons, was compressed gas, which was disposed of on-site using underground injection. The remaining 2.1 tons of waste consisted of paint, paint thinner, batteries, compressed gas, contaminated debris, and other liquid and solid wastes. These wastes were shipped off-site for disposal.

3.1.3.3 Alpine Spill History

The Alaska Department of Environmental Conservation Spills Database lists 252 spills reported within the Alpine Oil Field for the entire operating period, 1998 through March 2017. For this document, materials that could be spilled are categorized as crude oil, non-crude oil, process water, and other hazardous substances. The total volume of spills for the operational period is approximately 15, 975 gallons. Non-crude oil (diesel, hydraulic oil, engine oil, etc.) and process water make up the largest volume of substances spilled. From the start of operations in 1998 to March of 2017, approximately 7,700 gallons of non-crude oil or 48 percent of the total volume, was spilled, and approximately 5,600 gallons of process water, or 35 percent of the total volume, was spilled. This is a change from the analysis in the GMT1 EIS (BLM 2014, Section 3.1.3), which shows process water making up 45 percent of the total volume spilled, and non-crude making up 33 percent of the total volume spilled, based on the spills reported from the start of operations in 1998 to October 2013.

There have been 62 reported spills from October 2013 to March 2017. The largest spill reported in this timeframe was 3,000 gallons of diesel as a result of an overfill, which accounts for 73 percent of the 4,102 gallons spilled. Table 3.1-1 shows a breakdown of the substances spilled by cause, and the volume released. Spills prior to October 2013 are discussed in detail in the GMT1 EIS (BLM 2014, Section 3.1.3).

Table 3.1-1. Summary of Alpine Oil Field spills in gallons (October 2013 to March 2017)

Substance Released	Due to Human Factors	Due to Structural/Mechanical	Total Released
Crude Oil	2.0	7.0	9.0
Non-Crude Oil	3,474.0	283.0	3,757.0
Process Water	210.0	57.0	267.0
Hazardous Substances	0.7	68.0	68.7
Grand Total	3,686.7	415.0	4,101.7

3.2 Physical Characteristics

The following description of physical characteristics of the project study area is structured and organized to match BLM (2004a) and BLM (2014).

3.2.1 Terrestrial Environment

The terrestrial environment remains essentially the same as described in BLM (2004); however, there is an increased understanding of the role of climate change in the Arctic, which is described in Section 3.2.4, Climate Change.

3.2.1.1 Physiography

The North Slope of Alaska encompasses three physiographic provinces: the Arctic Coastal Plain, the Arctic Foothills, and the Brooks Range. The project study area is situated entirely within the Arctic Coastal Plain Province. The Arctic Coastal Plain is an area characterized by low topographic relief, numerous lakes, meandering stream channels, and polygonal-patterned ground. It rises gradually from sea level to a maximum elevation of roughly 600 feet, and is comprised of two distinct zones: tundra lowlands and coastal area. The geomorphic classification of the project study area is shown in Map 3.2-1. The areal extent of each geomorphic unit occurring with the project study area is listed in Table 3.2-1.

Table 3.2-1. Geomorphic units in the GMT2 Project area

Geomorphic Unit	Acres
Thaw Basin, Ice-rich Margin	26,280
Alluvial-Marine Deposit	24,281
Aquatic Geomorphic Unit, Fresh	22,171
Delta Inactive Overbank Deposit	18,305
Thaw Basin, Ice-rich Center	11,687
Old Alluvial Terrace	7,743
Aquatic Geomorphic Unit, Brackish	6,008
Delta Abandoned Overbank Deposit	5,898
Delta Active Channel Deposit	4,628
Delta Thaw Basin, Ice-poor	3,594
Thaw Basin, Ice-poor Margin	2,537
Delta Active Overbank Deposit	1,871
Eolian Inactive Sand Deposit	1,553
Thaw Basin, Ice-rich Undifferentiated	1,396
Meander Inactive Overbank Deposit	1,373
Lowland Headwater Floodplain	881
Delta Inactive Channel Deposit	877
Delta Thaw Basin, Ice-rich	825
Thaw Basin, Ice-poor Center	740
Thaw Basin, Ice-poor Undifferentiated	529
Human Modified	459
Eolian Active Sand Deposit	459
Thaw Basin Pingo	174
Eolian Inactive Sand Dune	159
Eolian Active Sand Dune	123
Solifluction Deposit	62
Meander Inactive Channel Deposit	62
Meander Abandoned Overbank Deposit	63
Recent Alluvial Terrace	26
Meander Active Overbank Deposit	19
Inactive Tidal Flat	8
Meander Active Channel Deposit	5
Not Mapped	10,636
Project Area Total	**155,431**

3.2.1.2 Geology and Minerals

The proposed project is in the NPR-A, where the geology has been studied by the U.S. Geological Survey for more than 100 years. Information on geology of the project study area is presented by BLM (2004, Section 3.2.1.2), BLM (2008, Section 3.2.4) and BLM (2012, Section 3.2.5).

Supplemental site-specific information relevant to the evaluation of geology and mineral resources within the project study area was not identified.

3.2.1.3 Petroleum Resources

The petroleum geology of the NPR-A, exploration efforts, leasing activity, and oil and gas potential is described in BLM (2008, Section 3.2.5) and BLM (2012, Section 3.2.6).

Geologists assess oil and gas potential of the area by defined geologic plays, each with unique characteristics. In 2010, the U.S. Geological Survey assessed the undiscovered technically recoverable oil resource in the NPR-A at 896 million barrels (MMbbl) (BLM 2012, Section 3.2.6.3). Based on data from industry exploration, the U.S. Geological Survey estimated that 120 to 200 MMbbl of discovered oil (oil and condensate) may also be technically recoverable in the NPR-A (U.S. Geological Survey 2010). Other information on geology is provided in BLM (2004, Section 3.2.1.2) and BLM (2012, Section 3.2.5).

3.2.1.4 Soils and Permafrost

Soils and permafrost within the Northeast NPR-A within the project study area are described in BLM (2004a, Section 3.2.1.3–3.2.1.4), with additional information in BLM (2014, Section 3.2.1.4). Soils and permafrost remain essentially the same as described in BLM (2004a) and BLM (2014).

The soils in the region are shallow and wet, with deep permafrost beneath. In the project study area, vegetation covers much of the surface, with an associated layer of ice-rich organic silt, silt, and sandy silt. Detailed results of soil samples collected around the general project study area are reported in Geomorphology of the Northeast Planning Area, NPR-A, by Jorgenson et al. (2003a). The project study area is underlain by continuous permafrost, which on the North Slope, ranges from depths of about 650 feet to more than 2,000 feet. During the Arctic summer, solar radiation thaws a shallow layer of soil at the surface, creating a seasonally unfrozen zone termed the active layer. Beneath the active layer, almost all material remains frozen; segregated and massive ice formations are common. A continuing supply of available water is required to maintain many of these features and without new water they may degrade rapidly, resulting in a change of vegetation and ecosystems. Permafrost impedes the infiltration of surface water, resulting in saturated surface soils. Vegetation insulates the permafrost, and disturbance of surface vegetation can increase melting of permafrost and result in subsidence. The potential for subsidence varies with ice content of the soils. As noted above, the alluvial-marine deposits in the project study area contain fairly high mean ice volumes. These same deposits are typically found out of the active floodplain, yielding a lower potential to impound water which would promote permafrost degradation (BLM 2004, Section 3.2.1.3).

3.2.1.5 Sand and Gravel Resources

Sand and gravel resources in the project study area and the region are discussed in BLM (2004, Section 3.2.1.5), BLM (2008, Section 3.2.8), and BLM (2012, Section 3.2.9). The sand and gravel material sites identified within the project study area include the existing Arctic Slope Regional Corporation Mine site located east of the Colville River and the proposed Clover site on the west side of the river described in BLM (2004, page 160). The Arctic Slope Regional Corporation Mine site is the gravel source proposed for the GMT2 Project. The location of this site is identified in Maps 3.1-1 and 3.2-1.

The area west of the Colville River is characterized by an apparent scarcity of suitable gravel for construction (BLM 2012, Section 3.2.9).

3.2.1.6 Paleontological Resources

Paleontological resources associated within the project study area were described in BLM (2004, Section 3.2.1.6) and updated in BLM (2012, Section 3.2.7). This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location and potential socioeconomic impacts on a narrower scale. This section incorporates and expands upon the GMT1

Supplemental Environmental Impact Statement (BLM 2014, Section 3.2.1.6) and ConocoPhillips Alaska's Final GMT2 Modified NEPA Analysis Document (ConocoPhillips 2016 Section 3.2.1.6).

Study Area

The study area for paleontological resources includes all areas where the project may directly or indirectly impact paleontological materials. This analysis is tiered off the Alpine development plan (BLM 2004) and includes areas where activities in support of GMT2 may be located, including the GMT1 footprint. The direct impact analysis area represents locations subjected to direct ground-disturbing activities, including existing, proposed, and alternative development footprints for GMT1 and GMT2. Paleontological resources that are not in the direct path of construction and supporting activities can still be affected by project development. For example, development can provide easier access to otherwise remote and difficult-to-access paleontological site locations, resulting in increased foot or vehicle traffic. Increased traffic can intensify erosion and/or increase the chances that paleontological resources will be altered or even pilfered. The indirect impact analysis area is the project study area and lands beyond existing project facilities and proposed GMT2 Project.

The project area was selected to include all major project components of the proposed GMT2 Project and alternatives or where supporting activities may be located. This includes new permanent infrastructure such as the road, airstrip, pads, and pipeline; existing infrastructure that will be used as part of the project such as Alpine Processing Facility/CD1 (processing of produced fluids, origination of vehicle trips) and Nuiqsut (potential housing for construction crews), the Arctic Slope Regional Corporation Mine site (gravel source), and ice roads. To ensure that the project area is large enough to account for any changes or routing of project components, it generally extends 2.5 miles from existing project facilities, and 5 miles from new proposed GMT2 Access Road, pipeline, and pad development. The area of potential effect for direct, indirect, and cumulative impacts for paleontological resources by alternative will be detailed further in the section on environmental consequences for paleontological resources.

Data Sources

Recent paleontological surveys (e.g., Druckenmiller 2015, 2016; Fiorillo 2014; Groves and Mann 2015; Mann and Groves 2016) provide the most current site location and condition information in the NPR-A. Although no paleontology-specific surveys have been conducted for the GMT2 area, paleontological remains are also investigated and documented as they are encountered during cultural resource surveys (Potter et al. 2003, 2004; Reanier 2009a, 2009b, 2014a, 2014b; Reanier and Kunz 2010; Stephen R. Braund and Associates 2013) or reported to archaeologists.

The results of these paleontological and archaeological surveys, including locations and descriptions of discovered sites, are housed at the Alaska Heritage Resources Survey (Alaska Heritage Resources Survey)—a statewide GIS database of archaeological and paleontological sites that provides locational information and coordinates, descriptions of site characteristics, features, associated materials, chronology and time period, site condition, and other important site information. The Alaska Heritage Resources Survey is the primary source of information for paleontological properties in the project area, but there are certain limitations to the data. Data reported in the Alaska Heritage Resources Survey comes from a variety of sources and can be inconsistent. Many of the sites were recorded before the advent of GPS technology, so reported locations and site extents are often imprecise. While ongoing efforts are underway to update the database, many of the sites have not been frequently updated and may have been removed or destroyed since being reported, may not resemble provided descriptions, or may not be described accurately or in detail. Despite these limitations, the geospatial data in the Alaska Heritage Resources Survey database represents the best available information for paleontological site locations within the project area (BLM 2014, page 172).

Paleontological Overview

Most rock formations in the NPR-A dating from the late Paleozoic and onward contain some fossils traces, the earliest of which is a 380-million-year-old lungfish tooth plate (Lindsey 1986). Much of the bedrock underlying the NPR-A has a marine origin, which includes fossil brachiopods, cephalopods, gastropods, pelecypods, sponges, bryozoans, corals, and crinoids. The first evidence of terrestrial plant fossils are noted in roughly 160 million-year-old Jurassic formations, and the NPR-A produces some of the best examples of the flora of that 100 million-year-old mid-Cretaceous period found anywhere in North America (Lindsey 1986). These plant fossils document a change from a warm to a cool climate with modern conifers beginning to appear on the North Slope.

Late Cretaceous vertebrate fossils dating from 70 to 65 million years ago (mya) are also common in the NPR-A. Most of the known fossil deposits of this age are found in the extensive bluffs of the Colville River downstream from Umiat. Research at the Liscomb Bone Bed along the Colville River has been a hotbed of paleontological research over the last several decades. Initial research at Liscomb provided new insights regarding dinosaur physiology, in terms of the un-reptile-like ability to survive in a cold, dark environment, and the impacts of the associated implications regarding dinosaur extinction theories (Brouwers et al. 1987; Clemens and Nelms 1993; Fiorillo and Gangloff 2000; Gangloff 1997; Gangloff and Fiorillo 2010; Paul 1988; Richet al. 2002). Recent work in the Liscomb Bone Bed produced evidence of several species of dinosaur not previously known to be present in the Arctic and also the possibility of several new species that may be endemic to the Arctic (Druckenmiller 2010). Recent work by Gangloff and Fiorillo (2010) also appears to support the theory that Arctic Late Cretaceous dinosaurs were permanent residents of the region rather than migratory. These new findings are extremely significant and further emphasize that the value of this “world class” paleontological resource, which is the largest, most species-comprehensive, polar dinosaur locale in the world, cannot be overstated. To date the following dinosaurs have been identified from the Liscomb Bone Bed: Hadrosaurus, Pachyrhinossaurs, Thescelosaurus, Troodon, Dromaeosaurus, Saurornitholestes, Tryannosaurus, and Ornithomimosaurus (Druckenmiller 2010; Fiorillo et al. 2009; Gangloff et al. 2005).

Dinosaur tracks and skin imprints have been identified on the Awuna, Kuk, Kokolik, and Avingak rivers, some of which were of species not previously known to have been present in the NPR-A. An Ichthyosaur skeleton from the Upper Triassic (approximately 210 mya) was located and recovered along the North Face of the Brooks Range from Cutaway Creek, a tributary of the Kuna River. Other than a single hadrosaur bone found on Axel Heiberg Island, the dinosaur remains in the NPR-A not only represent the farthest north occurrence of dinosaurs in North America but account for about 99 percent of the known polar dinosaur remains worldwide.

The mammalian fossil remains most commonly found in the NPR-A date from 50,000 to 12,000 years ago, the final episode of the Pleistocene, and are abundant in many of the Quaternary deposits across the region (Guthrie and Stoker 1990; Hamilton and Ashley 1993; Matheus 1998, 2000; Matheus et al. 2003). Like dinosaur remains, most of the Pleistocene fossils are found as the result of stream erosion. The bones of horses, mammoths, antelope, bison, bears, lions, muskoxen, caribou, and moose are a resource of important data reflecting the climate, environment, and ecosystem that existed when the first humans entered the Western Hemisphere from the Old World (Dale Guthrie 2006; Kunz and Mann 1997; Kunz et al. 1999; Mann et al. 2008). The genetic information in these fossils also provides valuable information regarding the impacts of and responses to episodes of past climate change on populations of Arctic megafauna (Groves et al. 2009). Other information on paleontological resources is provided in BLM (2004, Section 3.2.1.6) and BLM (2012, Section 3.2.7).

Fossil-bearing locales of Pleistocene mammals are more numerous than those of dinosaurs because they are much younger, Late Pleistocene in age (45,000–12,000 years ago), and in most cases not as deeply buried and therefore are more easily exposed. In most cases Pleistocene mammal remains are not fossilized (mineralized) and therefore are a good source of bio-molecular material, which can provide insights into past environmental conditions, and also can be dated very accurately by the radiocarbon method. Pleistocene fossils have been recovered from the Colville River and most of it tributary streams and from the Ikpikpuk, Titaluk, and Meade rivers and their tributary streams (Matheus 1998, 2000). Pleistocene faunal remains have also been identified in deflated sand dunes of Pleistocene age on the coastal plain.

Pleistocene fossils have been recorded from all the physiographic provinces within the NPR-A, but are most common in the northern portion of the Arctic Foothills and the southern portion of the Arctic Coastal Plain Provinces. It is probable that dinosaur remains are as ubiquitous across the NPR-A as are Pleistocene remains, but are too deeply buried to be exposed except under special circumstances. The principal reason that dinosaurs are known primarily from the Colville River is that a river of that magnitude is required to down-cut deep enough to expose fossils of Cretaceous or greater age. Most of the paleontological resources in the NPR-A are protected from most types of impact by virtue of their isolation and remoteness. The bulk of the deposits are deeply buried and frozen under a landscape that is covered by snow 9 months of the year. It is through exposure on eroding bluff faces that most paleontological remains are discovered, but this also exposes these resources to the threats of erosion and unauthorized collection or looting, and therefore the loss of valuable and important scientific and educational material.

Paleontological Resources in the Project Area

As shown in Table 3.2-2, there are seven total paleontological sites located in the project area listed in the Alaska Heritage Resources Survey database (Alaska Department of Natural Resources OHA 2017). These resources are almost exclusively Pleistocene in age, namely sites relating to mammoths, with exceptions being one undated site that contains bird and small mammal remains and two other sites containing Pleistocene gastropod (snail) species. However, the conditions of these sites vary as recent attempts have failed to relocate HAR-00038 and HAR-00039, while no attempt to relocate HAR-00031 has been reported; the current conditions of these sites remain unknown. BLM archaeologists collected the exposed mammoth femur at HAR-00057 and found nothing further at the site after excavating the surrounding area. The mammoth scapula at HAR-00170 was found after having been moved from its original location (therefore lacking important contextual information) and was also removed. HAR-00066 and HAR-00067 are the only intact paleontological site confirmed to be in the study area, thus these are the only sites that are considered in the environmental consequences analysis presented in Chapter 4.

Table 3.2-2. Paleontological sites located in GMT2 Project area

Alaska Heritage Resources Survey	Site Description	Site Condition (Year)
HAR-00031	Mammoth remains in bluff section of Colville River	Unknown (1986)
HAR-00038	Middle Pleistocene gastropods invertebrates	Field surveys could not relocate (1986)
HAR-00039	Middle Pleistocene gastropods invertebrates	Field surveys could not relocate (1986)
HAR-00057	Mammoth femur sticking vertically from ground	Removed and completely excavated (2003)
HAR-00066	Fragmentary mammal fossils in eroded, slumped sediments	Intact (2004)
HAR-00067	Bird and small mammal remains	Intact (2004)
HAR-00170	Out of context mammoth scapula found in gravel used at Alpine that came from the Arctic Slope Regional Corporation Mine site	Removed and completely excavated (2007)

3.2.1.7 Renewable Energy

The existing and potential development areas for renewable energy generation facilities within the project study area are essentially the same as described in BLM (2014, Section 3.2.1.7)

3.2.1.8 Wildland Fire

Wildland fire in the NPR-A is discussed in BLM (2012, Section 3.3.3) and includes both wildfires and prescribed fires. Wildfires are unplanned fires that occur in wildlands and are caused by human or natural means (e.g., lightning strikes), whereas prescribed fires are naturally or manually ignited fires that occur in areas where burning is planned. Prescribed fires have not been used as a management tool within the NPR-A and are not proposed (BLM 2012, page 222). Large wildfires are rare in the tundra on the North Slope; most are small and although fires larger than 10,000 acres have occurred, the 256,000-acre Anaktuvuk River Fire in 2007 was unprecedented. Palynological (pollen) investigation of two foothills lakes shows little evidence of large, extensive fires in the past 5,000 years and analysis of deeper lake cores have revealed only a few large fires in the past 9,000 years or so. The number of recorded fires on the North Slope has increased over the past 40 years, although this may be attributed to increased detection (BLM 2012, page 222). Though wildfire is not historically common in the area of the project, in 2012 two lightning-caused wildfires occurred within a few miles of the project area. One of the two (the 2,311-acre Itkillik River Fire) required suppression action while the other (216-acre West Collville River Fire) did not.

3.2.2 Water Resources

The aquatic environment, including the project area is described in BLM (2004a, Section 3.2.2.1) and BLM (2012, Section 3.2.10.1).

Water resources in the project area consist mainly of rivers, shallow discontinuous streams, lakes, and ponds. Springs are absent, deep groundwater is saline, and shallow groundwater is limited to shallow areas below rivers and lakes. Streams in the Arctic Coastal Plain typically freeze relatively early and thaw relatively late (September and June, respectively). Wetlands are described in Section 3.3.1, “Vegetation and Wetlands.”

Hydrology in the project area is predominantly a function of climate and permafrost, which limits water availability. More than half the annual precipitation occurs as snow, and snowmelt contributes the majority of annual runoff and helps maintain a saturated layer of surface soils.

This section summarizes relevant information originally presented in the BLM reports cited above and includes supplemental information regarding hydrology in the proposed project area obtained from studies conducted in 2009 through 2013 by Michael Baker Jr., Inc. (Michael Baker Jr. Inc. 2009b, 2010, 2011, and 2013a).

3.2.2.1 Rivers, Streams and Drainage Basins

The following discussion is drawn from BLM (2012, Section 3.2.10.1). While hydrologic data for the proposed project area is limited, streams and rivers for which data are available share flow characteristics that are unique to the region (Brabets 1996). In the winter, flow is generally nonexistent or so low as to not be measurable. River flow begins during break-up in late May or early June as rapid flooding, and when combined with ice and snow, can inundate extremely large areas in a matter of days. More than half of the annual discharge for a stream can occur during a period of several days to a few weeks (Sloan 1987). Most streams continue to flow throughout the summer, but at substantially lower discharges. Rainstorms can increase stream flow, but they are seldom sufficient to cause flooding within the Arctic Coastal Plain. Stream flow rapidly declines in most streams shortly after freeze-up in September and ceases in most rivers by December. Streams on the North Slope are generally divided into three types, based on the physiographic province of their origin: those that originate: (1) on the Arctic Coastal Plain, (2) in the Arctic foothills, or (3) in the Brooks Range.

The Arctic Coastal Plain is a mosaic of tundra wetlands with extremely low relief. Because the permafrost prevents water from entering the ground and the low relief limits runoff, the Arctic Coastal Plain is covered with lakes, ponds, and generally slow-moving streams. Streams originating in the Arctic Coastal Plain generally have the latest break-up and earliest freeze-up. The Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek both originate in the Arctic Coastal Plain. There are no streams in the project area that originate in the Arctic foothills.

Streams originating in the Arctic foothills have a steeper gradient and consequently more gravel bar and cut bank features than those on the Arctic Coastal Plain. These streams tend to break up earlier, freeze-up later, and have a slightly higher average unit runoff than streams of the Arctic Coastal Plain.

The Colville River is the largest river on the North Slope originating in the Brooks Range. As the only river that includes mountainous and glacial drainage, the Colville River carries the highest sediment load and exhibits the greatest range of geomorphic features of any river in the area. Break-up and freeze-up are more complex along the Colville River because of the extreme length and range of elevation. Flow persists later in the year on the Colville River than on other North Slope rivers in the region.

Approximately half the project area is located within Tiŋmiaqsiġvik (Ublutuoch) River drainage basin. The project area also lies within the Fish Creek drainage basin, Judy Creek drainage basin, the Colville River Delta-Frontal Harrison Bay drainage basin, the Antiganu Point-Frontal Harrison Bay drainage basin, and the Kachemach River drainage basin (see Table 3.2-3). The project area is located primarily within the eastern portion of the Fish Creek drainage basin and the northern portion of the Tiŋmiaqsiġvik (Ublutuoch) River drainage basin (Michael Baker Jr. Inc. 2009a; BLM 2004a, 2012).

A summary of general hydrologic data for the major drainages located near the proposed project infrastructure is provided in Table 3.2-3 and shown on Map 3.2-2.

Table 3.2-3. Summary of drainage basins within the project area [a]

Drainage Basin	Water Body	Headwater Origin	Receiving Water	Drainage Area (square miles)	Lake Coverage (%)
Colville River	Colville River (Nigliq Channel and East Channel)	Brooks Range	Harrison Bay	20,920	3
Fish Creek	Fish Creek	Arctic Foothills and Arctic Coastal Plain	Harrison Bay	1,827	22
Judy Creek	Judy Creek	Arctic Foothills	Fish Creek	666	18
Tiŋmiaqsiġvik (Ublutuoch) River	Tiŋmiaqsiġvik (Ublutuoch) River	Arctic Coastal Plain	Fish Creek	248	15

[a] Adapted from BLM (2004a, Table 3.2.2-2; Section 3.1.1) with additional information from BLM (2012, Table 3-12). The Harrison Bay and Kachemach River drainage basins are located within the project area, but are unlikely to be directly affected by the proposed project infrastructure or activities.

Colville River and Colville River Delta

The Colville River is the longest river (370 miles) and has the largest drainage basin (20,920 square miles) on the North Slope of Alaska, extending from the Brooks Range to the Arctic Ocean (Jorgenson et al. 1997). The Colville River Delta is more than 25-miles long and covers approximately 250 square miles (Jorgenson et al. 1994). The head of the Colville River Delta is the downstream-most point where the river flows in a single channel. Information about the Colville River or Colville River Delta is described in BLM (2004a, Section 3.2.2.1) and BLM (2012, Section 3.2.10).

Fish Creek Basin Streams

The general Fish Creek drainage basin and stream information is described in BLM (2004a, Section 3.2.2.1) and BLM (2012, Section 3.2.10.1).

The Fish Creek drainage basin is relatively large (1,827 square miles) with portions of its headwaters in the Arctic foothills, as well as the Arctic Coastal Plain. The Fish Creek basin consists of three significant tributary basins: Inigok Creek drainage basin, Judy Creek drainage basin, and Tiŋmiaqsiġvik (Ublutuoch) River drainage basin (URS Corporation 2003). Only the Judy Creek drainage basin has a significant portion of its headwaters in the Arctic foothills (BLM 1998b). Supplemental information relative to the project area and more recent studies are presented below.

The Fish Creek drainage basin has two significant streams within the project area, Fish Creek and its tributary, the Tiŋmiaqsiġvik (Ublutuoch) River. Fish Creek flows northeast and enters Harrison Bay just west of the Colville River Delta. The Tiŋmiaqsiġvik (Ublutuoch) River (as well as the Nigliq Channel of the Colville River) is used by residents of Nuiqsut for access to hunting and fishing areas (BLM 2004a, Section 3.4.9.4). Judy Creek, a tributary to Fish Creek, is outside the project area.

The hydrology of the project area, including the Tiŋmiaqsiġvik (Ublutuoch) River sub-drainage has been studied from 2001 through 2013. The Tiŋmiaqsiġvik (Ublutuoch) River is a tributary of Fish Creek that flows north approximately 7 river miles from the GMT1 road crossing, connecting to Fish Creek approximately 10 river miles upstream from Harrison Bay. It is characterized by numerous meander bends, often with undercut banks (Michael Baker Jr. Inc. 2009a) which are vegetated with dense brush (Dietzmann et al. 2002).

There are two primary drainage basins crossed by the proposed route to GMT2 from GMT1, Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River. Delineation of sub-drainage basins that contribute to the flow at various points along the proposed corridor for the GMT1 Project show that water flow along the GMT1 road corridor is typically from the south to north (BLM 2014, Section 3.2.2.1). Information collected at a small drainage along the proposed route from GMT1 to GMT2 showed water flow from south to north, and supports a conclusion that the water flow along the proposed GMT2 route is typical to that of the GMT1 area (Michael Baker Jr. Inc. 2011). In general, the sub-drainage basins are relatively small (4.1 square miles or less) (Michael Baker Jr. Inc. 2009a).

There are no large or perennial streams along the GMT2 proposed road and pipeline corridor. The route crosses a small, unnamed beaded stream pool outlet draining from Lake M9925 (see Map 3.2-3). There are no additional new stream or river crossings proposed for the GMT2 Project, although smaller, seasonal flow drainages may be crossed. The small, unnamed beaded stream pool crossed by the GMT2 proposed access corridor is described as a poorly defined, shallow-beaded stream that drains a ponded area into Lake M9925. This drainage was monitored in 2010 and 2011, with visual observations continuing in 2013 (Michael Baker Jr. Inc. 2010, 2011, 2013a). The drainage at this location was shallow and poorly defined during spring break-up monitoring in 2010 and was well defined during spring break-up monitoring in 2011, although later in the season the flow ceased (Michael Baker Jr. Inc. 2011).

Flooding Regime

Flooding of North Slope rivers is influenced by the type of physiographic region drained, the size of the drainage area, and the frequency of the event. Snowmelt flooding occurs annually in all North Slope rivers. For rivers in the project area, snowmelt flooding nearly always produces the annual peak discharge. On some of the larger rivers, summer precipitation or late summer/fall snowmelt events have been observed to produce low magnitude floods. Ice jams during break-up can also influence or result in flooding as described in the following sections.

As spring break-up flooding is normally the largest annual flooding event each year on the North Slope, monitoring of this event is integral to understanding regional hydrology. The break-up cycle is the result of several factors including snow pack, sustained cold or warm temperatures, ice thickness, wind speed and direction, precipitation, and solar radiation (Michael Baker Jr. Inc. 2009a).

Colville River and Colville River Delta

The flooding regime for the Colville River and Colville River Delta remain essentially as described in BLM (2004a, Section 3.2.2.1).

Fish Creek Basin

The hydrologic conditions on Fish Creek, Judy Creek, and the Tiŋmiaqsiġvik (Ublutuoch) River were investigated during break-up in 2001, 2002, and 2003 (URS Corporation 2001, 2003; Michael Baker Jr. Inc. 2003). These studies were presented in BLM (2004a, Section 3.2.2.1) and included monitoring sites at six locations along Fish Creek, four locations along Judy Creek, and two locations along the Tiŋmiaqsiġvik (Ublutuoch) River. The hydrologic conditions on Fish Creek and Judy Creek were studied from 2005–2009 and also on the Tiŋmiaqsiġvik (Ublutuoch) River from 2007–2009 (U.S. Geological Survey 2017). The hydrologic conditions within the Fish Creek drainage basin were further studied in 2009, 2010, 2011, and 2013 to support the proposed GMT1 and GMT2 Projects (Michael Baker Jr. Inc. 2009a, 2010, 2011, 2013a).

3.2.2.2 Lakes and Ponds

The characterization of lakes and ponds within the project area remains essentially as described in BLM (2004a, Section 3.2.2.1) and BLM (2012, Section 3.2.10.1), as summarized in the following sections.

Lakes and ponds are the most common hydrologic feature on the Arctic Coastal Plain, including the project area, with most of the lakes and ponds in this region originating from the thawing of ice-rich sediments (Sellman et al. 1975). Surface water sources located in close proximity to proposed GMT2

Project facilities include several drainages, and small creeks near the proposed GMT2 pad. There are also several lakes, drainages, and small creeks along the access road to GMT1.

Unlike streams, lakes store water year-round and are the most readily available water source on the North Slope (Sloan 1987), with availability of year-round water determined by the depth of the lake. Lakes are generally classified by depth, as either shallow (less than 6 feet) or deep (greater than 6 feet).

Recharge of lakes in the project area occurs through three mechanisms: (1) melting of winter snow accumulations within the lake's drainage basin, (2) overbank flooding from nearby streams, and (3) precipitation in the form of rainfall (Michael Baker Jr. Inc. 2002). Smaller lakes may also be recharged by other lakes within the project area if they are connected by a channel.

Shallow Lakes and Ponds

Seasonally flooded wetlands, ponds, and shallow lakes dominate the Arctic Coastal Plain in the project area. The shallow lakes and ponds generally begin to freeze in September, freeze to the bottom by mid-winter, and become ice-free between mid-June and early July, about a month earlier than the deeper lakes (Walker 1983, Hobbie 1984).

While ponds and shallow lakes generally lack fish because they usually freeze to the bottom, they can provide important summer fish-rearing habitat if they are connected to a stream by a channel or intermittently flooded by a nearby stream. They also provide important habitat to emergent vegetation, invertebrates, and migratory birds due to the earlier availability of ice-free areas.

Deep Lakes

Deep lakes (greater than 6 feet deep) with relatively large areas are present in the southern and western areas of the Arctic Coastal Plain. Some deep lakes are present within the project area. Because deep lakes do not freeze to the bottom, they provide an overwintering area for fish and aquatic invertebrates and are the most readily available supply of water during the winter. Deep lakes also have a larger thermal mass, thus the deeper lakes may remain covered by ice into early July (much later than the shallow lakes) (Walker et al. 1978).

Lake Water Usage

Ongoing and future oilfield activities within the project area would utilize ice roads and pads during the winter for access and transportation. Each winter season, millions of gallons of fresh water and ice chips are withdrawn from regional lakes for the construction of ice roads and pads. Water withdrawals for construction can begin as early as December and continue through April. Ice roads are usually completed mid-winter; however, water withdrawals for ice road and pad maintenance continue throughout the season. Freshwater lakes are also used as a potable water source and as sources of make-up water for exploratory drilling operations (Michael Baker Jr. Inc. 2002).

Between 1999 and 2006, approximately 513 million gallons of water from 126 lakes were used for exploration and construction of ice roads and pads in the NPR-A (BLM 2012, Section 3.2.10.1). Generally, water withdrawals during winter occur from lakes 7-feet deep or deeper and are limited to 15 percent of the estimated free-water volume remaining below the ice.

Lake Studies

The BLM (2004a, Section 3.2.2.1) described several lake studies conducted between 2000 and 2003 located within the project area. Key findings from these studies are summarized briefly as follows.

- Over a 5-year-study-period, water withdrawals generally did not affect water chemistry, nor did they directly affect fish populations (MJM Research 2003e). Pumping did not appear to affect temperature, pH, turbidity, sulfate, or nitrate levels (Michael Baker Jr. Inc. 2002).
- Lake water quality parameters (including dissolved oxygen, specific conductance and pH) changed little as a result of pumping (for water withdrawal). Water surface elevation changes in pumped lakes were within the range of changes seen in reference lakes, and changes in water surface elevations were correlated with changes in ice thickness (Oasis 2001).
- Water withdrawal rates were typically well below the maximum allowable. The water level decreases caused by pumping did not advance the freezing rate of the study lakes, and water levels depressed by pumping returned to pre-pump levels before freeze-up (Michael Baker Jr. Inc. 2002).
- Water surface elevations in the majority of pumped lakes were lowered more than in reference lakes. The dominant mechanism for recharge of the lakes was melting winter snow accumulations. Data from 2001 and 2002 studies as well as anecdotal information at seven North Slope communities (including Nuiqsut) indicated that the magnitude of spring recharge has always been sufficient to compensate for withdrawals (Michael Baker Jr. Inc. 2002).

3.2.2.3 Subsurface Water (Groundwater)

The characterization of groundwater within the project area remains essentially as described in BLM (2004a, Section 3.2.2.1) and BLM (2012, Section 3.2.10.1), as summarized in the following sections.

In general, usable subsurface water in the project area is limited to distinct and unconnected shallow zones due to the presence of permafrost, which is almost continuous across the North Slope (BLM 2004a, Section 3.2.2.1). The frozen state of the soils combined with their fine-grained characteristics and saturated conditions form a confining layer that prevents percolation and recharge from surface water sources, and prohibits the movement of groundwater. Because percolation and recharge are restricted, the formation of usable subsurface water resources is limited to unfrozen material on top of the permafrost or taliks (thawed zones) beneath relatively deep lakes, or zones in thawed sediments below major rivers and streams. In general, while these shallow groundwater zones do exist, they are typically very small and the water is likely unsuitable for drinking and potentially harmful to vegetation due to high salinity when discharged on the tundra surface (BLM 2004a, Section 3.2.2.1).

Shallow, supra-permafrost water also occurs seasonally in the region within the active zone above the impervious permafrost; the thickness of the active layer is typically 1.5 feet, but ranges from 1 feet to 4 feet (BLM 2004a, Section 3.2.2.1).

Groundwater within permafrost or intra-permafrost water occurs in discontinuous confined locations, where often the presence of dissolved salts depresses the freezing point of the water. Like shallow groundwater, the saline quality of the intra-permafrost groundwater makes it unsuitable for drinking water and potentially harmful to vegetation if discharged to the tundra surface. The usability of this type of groundwater source is likely to be limited because of the nature of its formation.

Deep wells drilled through the permafrost have encountered highly mineralized groundwater at depths of 3,000 feet to more than 5,000 feet in the vicinity of Prudhoe Bay and at depths of 1,600 feet to 2,500 feet near Utqiagvik (formerly Barrow), but little data on deep water sources in the project area exist (BLM 2008a, Section 3.2.9.3; Kharaka and Carothers 1988). Available data suggest that deep groundwater in the NPR-A would probably be similar to that found at Utqiagvik (formerly Barrow) and Prudhoe Bay, and would be too saline for domestic use (BLM 2008a).

Recharge

Snowmelt provides the major source of water for recharge to the shallow water-bearing zones that occur below large lakes and major streams and to the annual thaw zones that occur beneath ponds and marshy areas (BLM 2004a, Section 3.2.2.1). However, deeper groundwater zones beneath the permafrost are not as readily recharged. Sub-permafrost water may be recharged from areas to the south in the Arctic foothills and the Brooks Range by infiltration of meltwater. It is also possible that the sub-permafrost water could represent stagnant and/or isolated water zones that were cut off from recharge and groundwater movement as a result of the formation of permafrost during the Pleistocene, or that were isolated by orogenic events associated with the formation of the Brooks Range.

Springs

Landsat imagery analysis was used to locate numerous groundwater springs on the North Slope by identifying the large overflow icings (aufeis) created downstream during the winter. However, none of these springs were located in the project area (BLM 2004a, Section 3.2.2.1).

3.2.2.4 Surface Water Quality

A summary of surface water chemistry by analyte in the project area is contained in the Alpine Satellite Development Plan Final EIS as cited in BLM (2004a, Section 3.2.2.2) and in BLM (2012, Section 3.2.10.2). Results for water quality that are relevant to the project area are summarized as follows.

It is important to have knowledge of existing water quality conditions in determining potential impacts of proposed actions. Surface water is used by fish and wildlife in the project area and could be a source of potable water for humans. The State of Alaska water quality standards are published in 18 AAC 70. The State of Alaska drinking water regulations prescribe treatment for potable use. Drinking water regulations for the State of Alaska are published in 18 AAC 80.

Drinking water is obtained from lakes near the Alpine development (lakes L9313 and L9312 seen on Map 3.2-3) and Nuiqsut (BLM 2014 Section 3.2.2.4). A discussion regarding drinking water for these sources is included in Section 3.4.6, "Public Health."

Most freshwaters in the project area are considered pristine as stated in BLM (2012, Section 3.2.10.2); however, fecal contamination above State of Alaska water quality standards may occur in areas with dense avian, caribou, and lemming populations. Cold water temperatures tend to prolong the viability of fecal coliform. Ponds and local streams are highly colored from dissolved organic matter and iron, and most freshwater bodies in the NPR-A have low turbidity, and dissolved oxygen near saturation. According to Alaska Department of Environmental Conservation, no freshwater in the proposed project area is impaired by pollutants (BLM 2004b, Section 3.2.2.2, page 184; Alaska Department of Environmental Conservation 2017).

Water quality data specific to the lakes in the vicinity of the proposed GMT2 Access Road corridor and pad, GMT1, CD1, and CD4 were collected in 2002, 2004, and 2009–2012 as described in MJM Research (2004), Michael Baker Jr. Inc. (2009b), North Slope Science Initiative Alaska (2009), Michael Baker Jr. Inc. (2010), and Derry et al. (2012). Surface water features, including named lakes, are included in Map 3.2-3.

These data can be used to evaluate the potential impact to water quality from roads and pads associated with CD1 and CD4 and provide background water quality data for the proposed project area. Turbidity measured was variable between lakes and during monitoring years but, in all cases, was well below the levels that affect aquatic organisms. Dissolved oxygen measured during the summer was typically near 100 percent saturation in the lakes sampled as discussed in MJM Research (2006), Michael Baker Jr. Inc. (2009b), and Michael Baker Jr. Inc. (2010). Dissolved oxygen concentrations for lakes approximately 10-

feet deep remained high during the March 2011 sampling event but concentrations were lower by 50 percent for lakes 6 feet deep as discussed in Derry et al. (2012). Winter dissolved oxygen concentrations are highly variable between individual lakes (deep and shallow) and stratified within the water column under the ice and cannot be regionalized, which makes it extremely difficult to compare lakes across a region.

In 2006 and 2008, water chemistry results from lake samples collected within the proposed project area met the water quality standards for dissolved oxygen, pH, and turbidity (North Slope Science Initiative Alaska 2009). Of those lakes sampled, lakes M0024, M9914, M9922, and M9923 are located within 0.5 mile of the proposed GMT2 pipeline route (see Map 3.2-3).

Information available for alkalinity and pH, with respect to freshwater bodies within the proposed project area, remain essentially as described in BLM (2004a, Section 3.2.2.2) and in BLM (2012, Section 3.2.10.2).

3.2.3 Atmospheric Environment

Regional air quality is influenced by factors including climate, meteorology, magnitude and location of air pollution sources, and chemical properties of air pollutants. In the lower atmosphere, regional and local air quality is also impacted by topography influencing atmospheric dispersion and pollutant transport. The following sections summarize the existing air quality and conditions within the GMT2 Project area, National Petroleum Reserve in Alaska (NPR-A), and Alaska North Slope.

3.2.3.1 Climate and Meteorology

The GMT2 Project area is located in the NPR-A as part of the Alaska North Slope in Section 32, Township 10N, Range 2E, Umiat Meridian. The area is considered an Arctic Climate Zone with cold winters spanning approximately 8 months of the year and cool summers spanning approximately 4 months of the year. Based on the data from the Nuiqsut Airport, the annual mean temperature of the GMT2 Project area averages –10 degrees Fahrenheit (°F), with temperatures below freezing from October through May. The monthly temperature, precipitation, and snowfall data for nearby monitoring locations in the GMT2 Project area are detailed in Table 3.2-4 below. Utqiagvik (formerly Barrow) Airport and Kuparuk are included in the table as they have data spanning 30 years for a more accurate view of climate norms of the area, whereas Nuiqsut is the station closest to the GMT2 Project area and has collected more recent years of data.

From data downloaded from the Nuiqsut Airport spanning 2006 through 2016 (National Climatic Data Center 2017), the average maximum monthly temperature is 11 °F with the maximum temperature occurring in July at approximately 29 °F. During that same time period, the average minimum monthly temperature is –29 °F with the minimum temperature occurring in January at –49.4 °F. The mean temperature during that 10-year period is –10 °F. In the GMT2 Project area, rainfall is highest during the months of July and August, with monthly totals averaging 1 inch and snowfall is the highest during October, averaging approximately 8.7 inches.

Wind speed and direction is monitored at the Nuiqsut Monitoring Station operated by ConocoPhillips. The wind rose shown in Figure 3.2-1 shows the characteristic east-northeast to west-southwest bimodal pattern of the Alaska North Slope and winds speed and direction from 2011 through 2015. The mean hourly wind speed average 5 meters per second (11 miles per hour [mph]), and calm winds were infrequent occurring less than 1 percent of the 2011–2015 5-year period (SLR International Corporation 2012, 2015, 2016, 2017).

Wind speed and direction are important to the dilution and transport of air pollutants. Wind direction determines where the air pollutants are transported, and based on the Nuiqsut Monitoring Station wind rose, air pollutants are most often transported in a southwest direction within and near the GMT2 Project area. Wind speed impacts the concentration of air pollutants since dispersion increases with increasing wind speeds, thereby decreasing air pollutant concentrations at individual receptors.

The degree of stability in the atmosphere is also a key factor in dispersion of emitted pollutants. During stable conditions, vertical movement in the atmosphere is limited and the dispersion of pollutants is inhibited. Conversely, during unstable conditions, upward and downward movement in the atmosphere exists, and dispersion of pollutants in the atmosphere is enhanced. Temperatures that increase with height, or temperature inversions, can result in very stable conditions with virtually no vertical air motion. The GMT2 Project area will typically have more large-scale temperature inversions in the winter rather than in the summer due to colder stable air masses settling closer to the ground. Afternoons in the GMT2 Project area typically have increasing instability due to warming.

Table 3.2-4. Monthly temperature, precipitation, and snowfall summary

Location	Weather Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Avg.
Utqiagvik (formerly Barrow) Airport[a]	Daily Max Temperature (°F)	-7.3	-8.0	-6.1	8.5	25.8	40.5	46.9	43.9	35.8	21.8	6.2	-1.8	17.2
Utqiagvik Airport[a]	Daily Min Temperature (°F)	-19.5	-20.4	-19.2	-4.9	16.5	30.8	34.8	34.1	28.5	12.6	-4.8	-13.8	6.2
Utqiagvik Airport[a]	Daily Avg Temperature (°F)	-13.4	-14.2	-12.7	1.8	21.1	35.6	40.9	39.0	32.1	17.2	0.7	-7.8	11.7
Utqiagvik Airport[a]	Avg Total Precipitation (in)	0.13	0.14	0.09	0.16	0.18	0.32	0.98	1.05	0.72	0.41	0.21	0.14	4.53
Utqiagvik Airport[a]	Avg Total Snowfall (in)	2.6	2.6	2.1	3.2	2.7	0.7	0.2	0.9	4.4	9.1	5.7	3.5	37.7
Kuparuk[a]	Daily Max Temperature (°F)	-10.0	-10.5	-7.4	9.3	28.6	47.7	56.6	51.0	39.7	21.2	3.8	-4.4	18.8
Kuparuk[a]	Daily Min Temperature (°F)	-20.8	-21.7	-19.8	-4.3	18.9	35.1	41.0	39.1	31.1	12.3	-7.4	-15.5	7.3
Kuparuk[a]	Daily Avg Temperature (°F)	-15.4	-16.1	-13.6	2.5	23.7	41.4	48.8	45.1	35.4	16.7	-1.8	-10.0	13.1
Kuparuk[a]	Avg Total Precipitation (in)	0.12	0.09	0.08	0.16	0.07	0.32	0.89	1.04	0.44	0.30	0.15	0.14	3.80
Kuparuk[a]	Avg Total Snowfall (in)	2.8	2.6	2.3	2.8	1.8	0.5	0.0	0.3	3.0	8.4	4.9	3.7	33.1
Nuiqsut[b]	Daily Max Temperature (°F)	1.1	1.7	-0.6	5.6	12.8	27.2	28.9	24.4	18.3	9.4	1.7	1.7	11.0
Nuiqsut[b]	Daily Min Temperature (°F)	-49.4	-49.0	-47.0	-39.4	-29.4	-5.0	-1.0	-2.0	-12.8	-28.3	-40	-46	-29.1
Nuiqsut[b]	Daily Avg Temperature (°F)	-26.6	-24.3	-26.7	-15.7	-4.26	4.83	8.85	6.31	1.59	-5.11	-15.9	-22.4	-9.94

[a] *Source:* NOAA (2017). Data downloaded from https://www.ncdc.noaa.gov/cdo-web/datatools/normals for Utqiagvik (formerly Barrow) Wiley Post-Will Rogers Airport, Alaska; and Kuparuk, Alaska (1981–2010).

[b] *Source:* National Climatic Data Center (2017). Data downloaded from NCEI CDO on September 15, 2017, for Nuiqsut, Alaska, from 2006 through 2016.

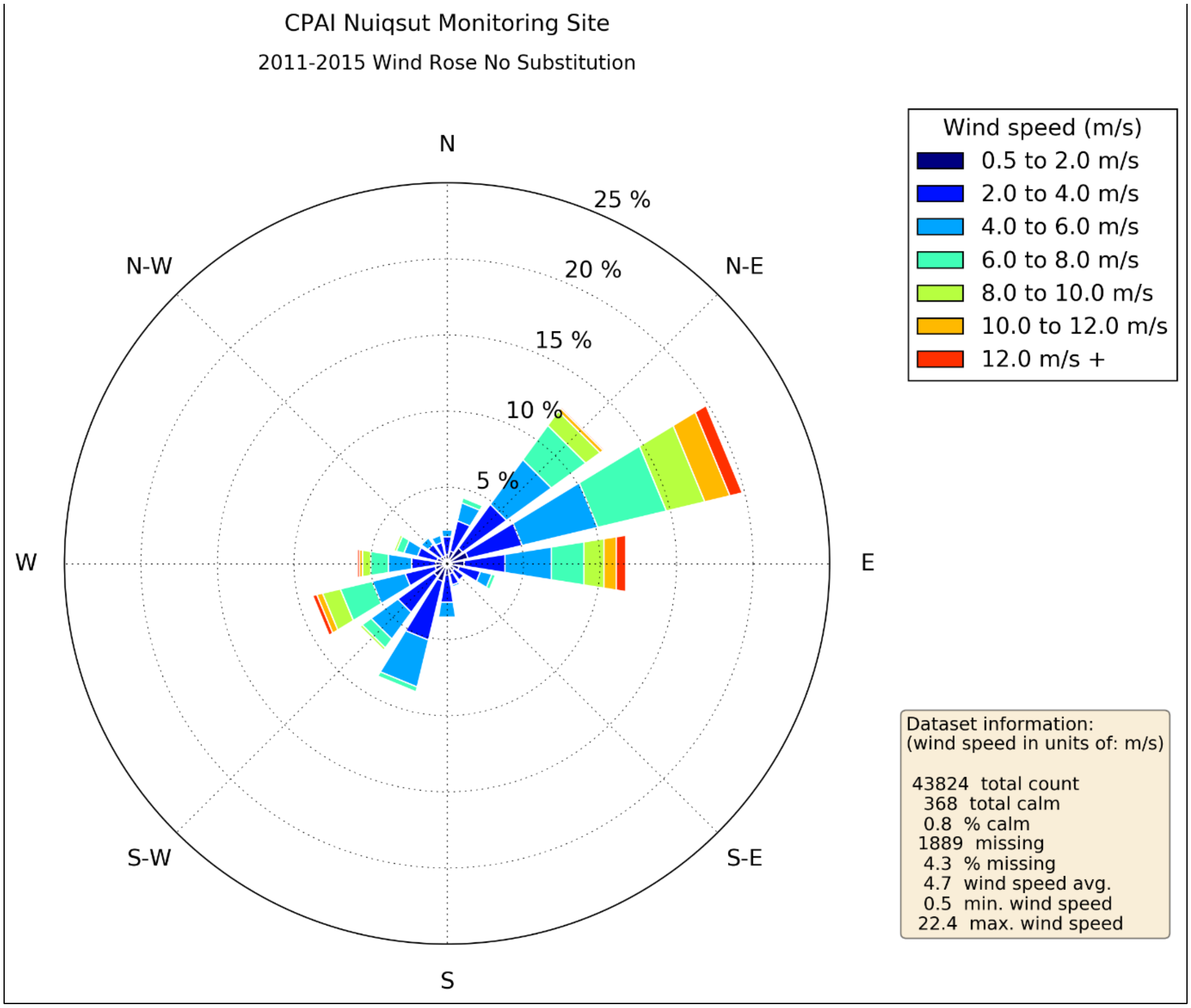

Figure 3.2-1. Nuiqsut Monitoring Station, 2011–2015 wind rose

3.2.3.2 Air Quality

Federal and state air quality regulations exist under the Clean Air Act to protect existing air quality. Alaska belongs to Region 10 Pacific Northwest of the United States Environmental Protection Agency (EPA). In Alaska, the Alaska Department of Environmental Conservation is the regulating authority to enforce the Alaska Air Quality Control Regulations under 18 Alaska Administrative Code 50 per the state implementation plan approved by the EPA.

There are a number of federal air quality regulations that are applicable to sources in the oil and gas industry segment. These include New Source Performance Standards (40 Code of Federal Regulations [CFR] Part 60), National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61), National Emission Standards for Hazardous Air Pollutants for Source Categories (40 CFR Part 63), and Mandatory Greenhouse Gas Reporting (40 CFR Part 98). Many federal regulations have been adopted by Alaska Department of Environmental Conservation and published by reference in the Alaska Air Quality Control Regulations. Federal air quality regulations should be evaluated for applicability and must be followed in addition to state permitting requirements.

Under Alaska Department of Environmental Conservation authority, for the oil and gas industry, there are different types of air quality permits that may apply. Sources that have estimated emissions of 250 tons per year or greater are required to file for a construction permit. Otherwise, the facility is required to file a minor source specific or Title I permit. Lastly, sources that have the potential to emit 10 tons per year or more of a single hazardous air pollutant, 25 tons per year or more of total hazardous air pollutants, and/or 100 tons per year or more of any criteria pollutant (nitrogen oxides [NO_x], carbon monoxide [CO], volatile organic compounds [VOC], sulfur dioxide [SO_2], or particulate matter [PM]), are required to file an operating or Title V permit. A general permit is offered for oil and gas drill rigs that meet specific requirements, such as duration of drilling activity, location and proximity to Class I or non-attainment areas, and records that must be kept.

Currently, the NPR-A is an attainment area as discussed further below. This is supported by monitoring station data collected in the Alaskan North Slope for pollutant concentrations, in addition to temperature and wind speed. The stations closest to the GMT2 Project area are the CD1 Monitoring Station, CD5 Monitoring Station, and Nuiqsut Monitoring Station. All of these stations are operated by SLR International Corporation on behalf of ConocoPhillips and in accordance with EPA prevention of significant deterioration guidance. The stations collect data for CO, NO_x, nitric oxide (NO), nitrogen dioxide (NO_2), ozone (O_3), SO_2, particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and particulate matter less than 10 microns in diameter (PM_{10}). A list of the monitoring stations, their location coordinates, and the years of data collection are included in Table 3.2-5.

Table 3.2-5. Ambient air monitoring stations near the GMT2 Project area

Name of Monitoring Station	UTM NAD83 Zone 5 Easting (meters)	UTM NAD83 Zone 5 Northing (meters)	Current 3 Years of Data
Nuiqsut	575,512	7,792,061	2014–2016
CD1 Facility	577,629	7,805,334	2013–2015
CD5 Pad	566,770	7,801,707	October 2015–December 2016

The Nuiqsut Monitoring Station is located at the north end of the town of Nuiqsut approximately 400 meters north west of the Nuiqsut Power Plant. The Nuiqsut Monitoring Station also collects wind direction, horizontal and vertical speed, temperature, differential temperature, and solar radiation data. At the CD1 Facility, the monitoring station was located on the southwest portion of the pad; data collection stopped after 2015. The monitoring data were collected primarily to show if emissions from drilling activities and rigs exceeded any National Ambient Air Quality Standards to address air quality for continued operations. Based on the wind rose from data collected at the CD1 monitoring station, as shown in the CD1 monitoring reports, the wind predominately blows from the east north-east and east directions (SLR International Corporation 2013, 2014, 2015a, 2016a). At the CD5 Drill Pad, the monitoring station is located on the east portion of the pad and data collection began in October 2015. The monitoring data are collected primarily for potential future air permitting activities and also to comply with a North Slope Borough ordinance to identify air monitoring systems prior to and after site construction (SLR International Corporation 2016b, 2017a).

Based on analysis of these monitoring stations, the data from Nuiqsut Monitoring Station is considered the most representative of the GMT2 Project area. The CD1 and CD5 facility data is more representative of the onsite operations, rather than the area at large. The measurements in Table 3.2-6 are based on data collected from 2014 through 2016 at the Nuiqsut Monitoring Station in parts per million (ppm), parts per billion (ppb), and micrograms per cubic meter ($\mu g/m^3$) (SLR International Corporation 2015, 2016, 2017). These values have been updated after the dataset review and revisions by EPA of the Nuiqsut Monitoring Station monitoring data for 2014 (EPA 2017b).

Table 3.2-6. Nuiqsut Monitoring Station background values[a]

Pollutant	Average Time	2014	2015	2016	Final Background Value
Carbon Monoxide (CO)	1-hour	1 ppm	1 ppm	1 ppm	1 ppm (1,230 $\mu g/m^3$)
Carbon Monoxide (CO)	8-hour	1 ppm	1 ppm	1 ppm	1 ppm (1,230 $\mu g/m^3$)
Nitrogen Dioxide (NO_2)	1-hour	25 ppb	24 ppb	18 ppb	22.3 ppb (41.9 $\mu g/m^3$)
Nitrogen Dioxide (NO_2)	Annual	2 ppb	2 ppb	1 ppb	2 ppb (3.8 $\mu g/m^3$)
Sulfur Dioxide (SO_2)	1-hour	1.9 ppb	1.2 ppb	3.2 ppb	2.1 ppb (5.9 $\mu g/m^3$)
Sulfur Dioxide (SO_2)	3-hour	2.2 ppb	0.0 ppb	0.0 ppb	2.2 ppb (6.2 $\mu g/m^3$)
Sulfur Dioxide (SO_2)	24-hour	1.7 ppb	0.0 ppb	0.0 ppb	1.7 ppb (4.8 $\mu g/m^3$)
Sulfur Dioxide (SO_2)	Annual	-0.1 ppb	0.0 ppb	0.001 ppb	0.001 ppb (0.003 $\mu g/m^3$)
Particulate Matter of less than 10 microns (PM_{10})	24-hour	40 $\mu g/m^3$	51.5 $\mu g/m^3$	44.0 $\mu g/m^3$	45.2 $\mu g/m^3$
Particulate Matter of less than 2.5 microns ($PM_{2.5}$)	24-hour	6 $\mu g/m^3$	10 $\mu g/m^3$	6 $\mu g/m^3$	7.3 $\mu g/m^3$
Particulate Matter of less than 2.5 microns ($PM_{2.5}$)	Annual	2.1 $\mu g/m^3$	2.8 $\mu g/m^3$	1.3 $\mu g/m^3$	2.1 $\mu g/m^3$

[a] Values are in parts per million (ppm), parts per billion (ppb), and micrograms per cubic meter ($\mu g/m^3$).

The NPR-A is an attainment area for current National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards. An attainment area indicates the existing background air quality are below the national and state of Alaska standards. The current National Ambient Air Quality Standards/Alaska Ambient Air Quality Standards are listed in Table 3.2-7 and the final backgrounds compared to the National Ambient Air Quality Standards are listed in Table 3.2-9.

Table 3.2-7. National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards values

Pollutant	Average Time	NAAQS[a]	AAAQS[b]
CO	1-hour	40,000 $\mu g/m^3$	40,000 $\mu g/m^3$
CO	8-hour	10,000 $\mu g/m^3$	10,000 $\mu g/m^3$
NO_2	1-hour	188 $\mu g/m^3$	188 $\mu g/m^3$
NO_2	Annual	100 $\mu g/m^3$	100 $\mu g/m^3$
SO_2	1-hour	196 $\mu g/m^3$	196 $\mu g/m^3$
SO_2	3-hour	1,300 $\mu g/m^3$	1,300 $\mu g/m^3$
SO_2	24-hour	NA	365 $\mu g/m^3$
SO_2	Annual	NA	80 $\mu g/m^3$
PM_{10}	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	35 $\mu g/m^3$
$PM_{2.5}$	Annual	12 $\mu g/m^3$	12 $\mu g/m^3$

[a] Referenced from 40 CFR Part 50.
[b] Referenced from 18 AAC 50.010.

Table 3.2-8. National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards

Pollutant	Average Time	Nuiqsut Monitoring Station Background	NAAQS/AAAQS	Background Percentage of NAAQS/AAQS
CO	1-hour	1,230 µg/m^3	40,000 µg/m^3	3
CO	8-hour	1,230 µg/m^3	10,000 µg/m^3	12
NO_2	1-hour	41.9 µg/m^3	188 µg/m^3	22
NO_2	Annual	3.8 µg/m^3	100 µg/m^3	4
SO_2	1-hour	5.9 µg/m^3	196 µg/m^3	3
SO_2	3-hour	6.2 µg/m^3	1,300 µg/m^3	0.5
SO_2	24-hour	4.8 µg/m^3	365 µg/m^3	1
SO_2	Annual	0.003 µg/m^3	80 µg/m^3	0.004
PM_{10}	24-hour	45.2 µg/m^3	150 µg/m^3	30
$PM_{2.5}$	24-hour	7.3 µg/m^3	35 µg/m^3	21
$PM_{2.5}$	Annual	2.1 µg/m^3	12 µg/m^3	18

There are minimal man-made and natural emission sources that negatively affect air quality in the NPR-A. Man-made emission sources in the GMT2 Project area include residential heating, snow machines, vehicle combustion and traffic, aircraft, open burning, and oil and gas production facilities. Natural emission sources in the GMT2 Project area include particulate matter emissions from wind gusts and particulate matter and combustion emissions from wildfires.

3.2.3.3 Visibility

Haze is a form of air pollution that occurs from refraction of sunlight on particles in the atmosphere (EPA, 2017c). The result of haze is impaired visibility conditions. In 1999, the EPA published the Regional Haze Rule implementing a visibility protection program for certain areas, such as national parks and wilderness areas classified as Class I areas and other federally managed public lands classified as Class II areas. Class II areas under the Regional Haze Rule have less restrictive visibility requirements compared to Class I areas. The visibility threshold is 0.5 delta deciviews (Δdv) (approximately 5 percent change in visibility) which is the level for which a source is considered to contribute to regional haze. The 0.5 Δdv is not an adverse impact threshold, but is intended as a conservative screening criterion to identify potential visibility impacts. The Interagency Monitoring of Protected Visual Environments database collects visibility and air pollutant concentration data from monitoring sites in and near Class I areas across the country (Interagency Monitoring of Protected Visual Environments 2017). Most monitors record the light extinction coefficients which quantifies the change in visibility due to changes in air pollutant concentration. The nearest current Interagency Monitoring of Protected Visual Environments monitors near the GMT2 Project area are listed below in Table 3.2-9 along with their approximate distance from the GMT2 Project area. The Ambler monitor stopped collecting data in 2004, and is therefore not included.

Table 3.2-9. Nearest interagency monitoring of protected visual environments monitors to project area

Nearest Visibility Monitors	Approximate Distance from Project Area	Clean Air Act Status (Class I or Class II)
Gates of the Arctic National Park	165 miles south-southwest	Class II
Denali National Park	500 miles south	Class I

Visibility is described by two units of measurement: haze index in units of deciviews (dv) and standard visual range in units of kilometers (km). Visibility graphs of the Gates of the Arctic and Denali National Park are shown in Figure 3.2-2 and Figure 3.2-3 in units of dv.

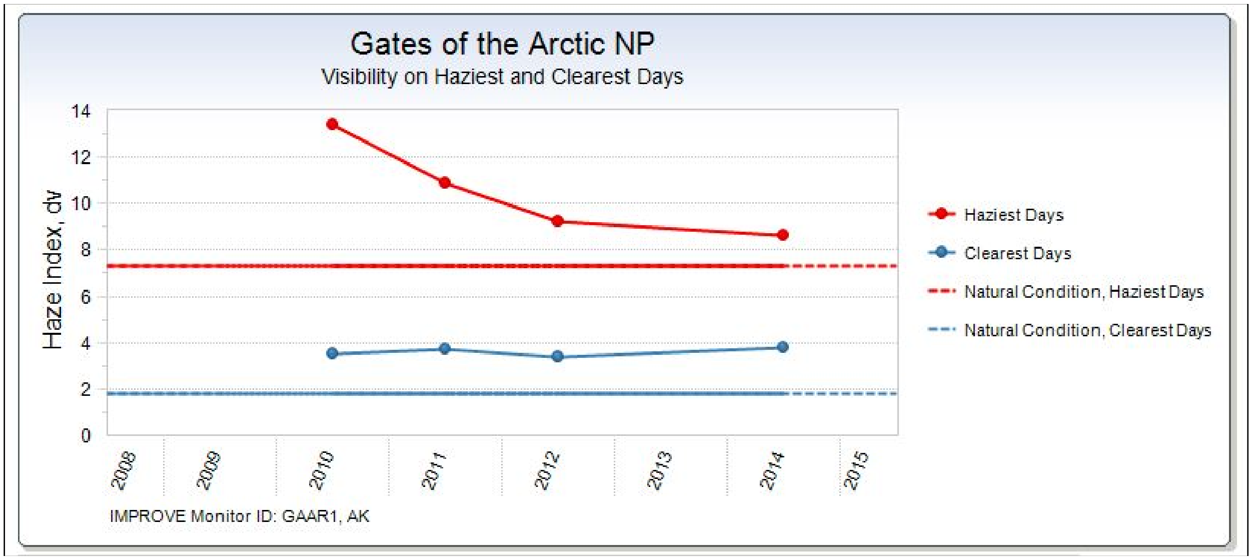

Figure 3.2-2. Visibility data for Gates of the Arctic National Park (IMPROVE Monitor ID: GAAR1)

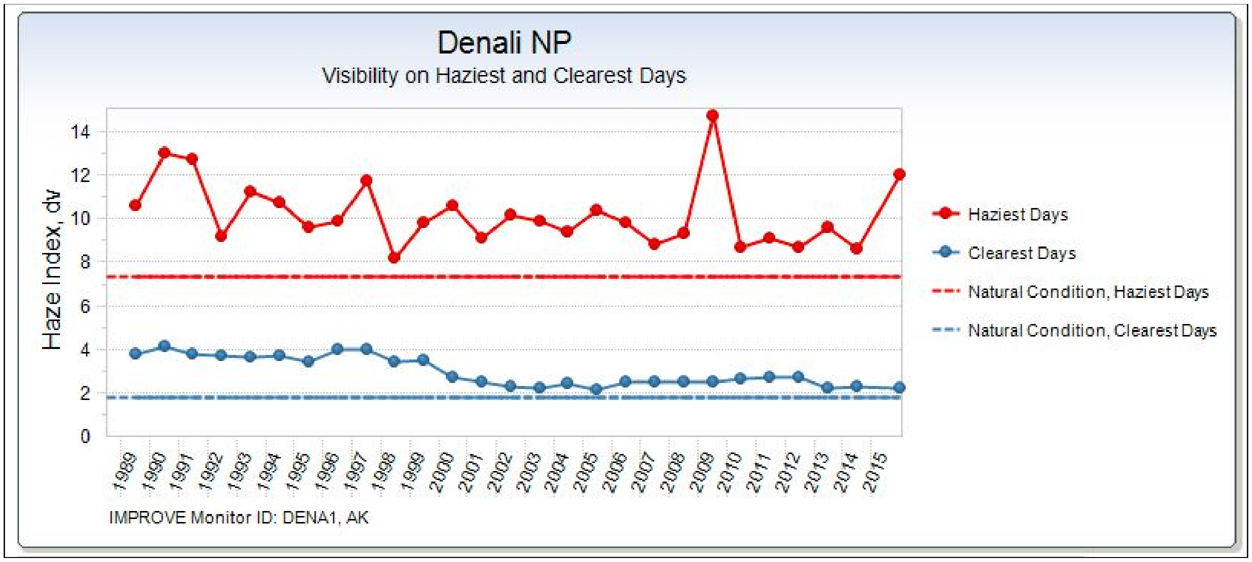

Figure 3.2-3. Visibility data for Denali National Park (IMPROVE Monitor ID: DENA1)

At both national parks, the natural condition haze index on the clearest days is just below 2 dv which equates to a visual range of approximately 350 kilometers (218 miles) and the natural condition haze index on the haziest days is about 7.5 dv which equates to a visual range of just under 200 kilometers (120 miles). Data collected at the monitors, as shown in Figure 3.2-2 and Figure 3.2-3 show haziest days on a downward trend with a recent increase in haze index at Denali National Park. However, both monitors have shown on the haziest days, a haze index peak is approximately 15 dv which equates to a visual range of approximately 100 kilometers (62 miles). The haze index on clear days is only slightly higher than the natural condition and still shows an index between 2 and 4 dv, which is just below a visual range of 350 kilometers (218 miles). Per the Nuiqsut wind rose of Figure 3.2-1, a southwest directional transport of pollutants is expected for the GMT2 Project area. Both of the Interagency Monitoring of Protected Visual Environments monitors are south-south west of the GMT2 Project area as shown in Figure 3.2-9 at the end of this section. Therefore, the transport of pollutants from the GMT2 Project may affect the visibility of these national parks.

3.2.3.4 Acid Deposition

Deposition occurs when acid-forming particles in the atmosphere such as nitrate ion (NO_3-), sulfate ion ($SO4^2$-) and ammonium ion (NH_4-) fall to the Earth's land and water. These acid-forming particles are the result of NO_x and sulfur oxides (SO_x) breaking down or chemically reacting with other compounds in the atmosphere. Deposition can occur in three forms: wet deposition where the particles fall by rain or snow, occult deposition where particles are transferred by clouds or fog, and dry deposition where particles either chemically react or physically fall to the Earth's surface. Sulfur and nitrogen depositions have a 0.005 kilogram per hectare per year (kg/ha-yr) deposition analysis threshold set forth by the Federal Land Managers for western areas (Federal Land Managers 2010). The deposition analysis threshold is not an adverse impact threshold; rather, it is an approximate value of the naturally occurring deposition where values below it are considered negligible. The National Park Service uses critical loads as an adverse impact threshold. Depending on the natural resource, minimum and maximum critical loads can vary. Table 3.2-10 lists the nearest National Park Service Units where nitrogen critical loads have been analyzed and recorded. The critical load range represents the lowest and highest critical loads based on 2010 and 2011 estimates (Linder et al. 2013) of these units nearest the GMT2 Project area. The maximum nitrogen deposition is based on recorded values from 1993 through 2016 for Poker Creek, 2008 through 2015 for Gates of the Arctic National Park, and 1980 through 2016 for Denali National Park.

Table 3.2-10. Nearest National Park Service units to project area for nitrogen critical loads

Nearest National Park Service Units	Approximate Distance from Project Area	Nitrogen Critical Load Range (kg/ha-yr)[a]	Maximum Nitrogen Deposition (kg/ha-yr)
Poker Creek	370 miles south-southwest	1–3	0.47
Gates of the Arctic National Park	165 miles south-southwest	1–3	0.94
Denali National Park	500 miles south	1–3	0.64

[a] Kilogram per hectare per year.

The National Atmospheric Deposition Program has monitoring stations across the United States to take wet deposition readings (National Atmospheric Deposition Program 2017). The National Atmospheric Deposition Program's National Trends Network collects precipitation at locations near pollution sources and analyzes the liquid for concentrations of acid-forming ions. The nearest monitoring stations to the GMT2 Project area are University of Alaska-Fairbanks and United States Forest Service Poker Creek (NTN Site AK01), National Park Service Gates of the Arctic National Park (NTN Site AK06), and National Park Service Denali National Park (Site NTN AK03) (National Atmospheric Deposition Program 2017a). The Ambler Monitoring Station (NTN Site AK99) stopped collecting acid deposition data in 2005, and is therefore not referenced. Based on data collected from each of the stations, the annual average concentrations of ammonium, nitrate, and sulfate ions have decreasing trend lines, however have shown slight increases in recent years. Figure 3.2-4, Figure 3.2-5, and Figure 3.2-6 below show the recorded concentrations at each monitoring station with the trend lines below for NH_4-, NO_3- and $SO4^2$- ions, respectively. The blue dots are concentrations for years where the weighted mean had valid samples where 75 percent of the year had valid concentration data, 90 percent of the annual precipitation had valid concentration data, and 75 percent of the precipitation data was accounted for in a year. Red dots are concentrations for years where the weighted mean did not meet the valid sample criteria. Trend lines in black are also shown on each graph where at least 3 years of valid data were available to create a trend.

Trend lines for ammonium, nitrate, and sulfate ions show that for Poker Creek and Gates of the Arctic National Park, recorded deposition at these locations are decreasing, whereas at Denali National Park, recent recordings of deposition are increasing. The acid deposition monitors are south and south-south west of the GMT2 Project area as shown in Figure 3.2-9 at the end of this section. Therefore, the transport of pollutants from the GMT2 Project may affect the acid deposition of these National Park Service units.

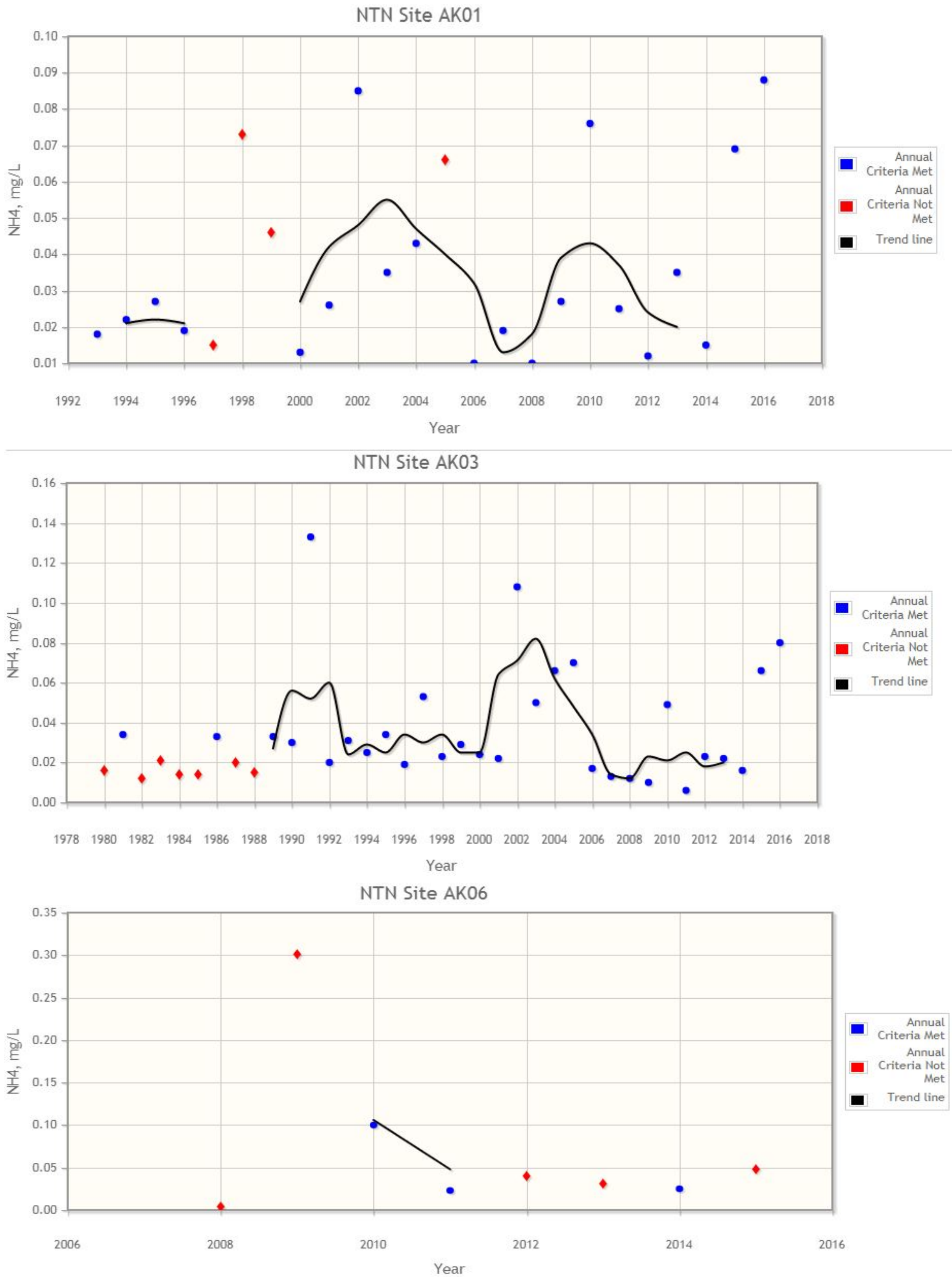

Figure 3.2-4. Ammonium ion wet deposition, Poker Creek (NTN AK01), Denali National Park (NTN AK03), and Gates of the Arctic National Park (NTN AK06)

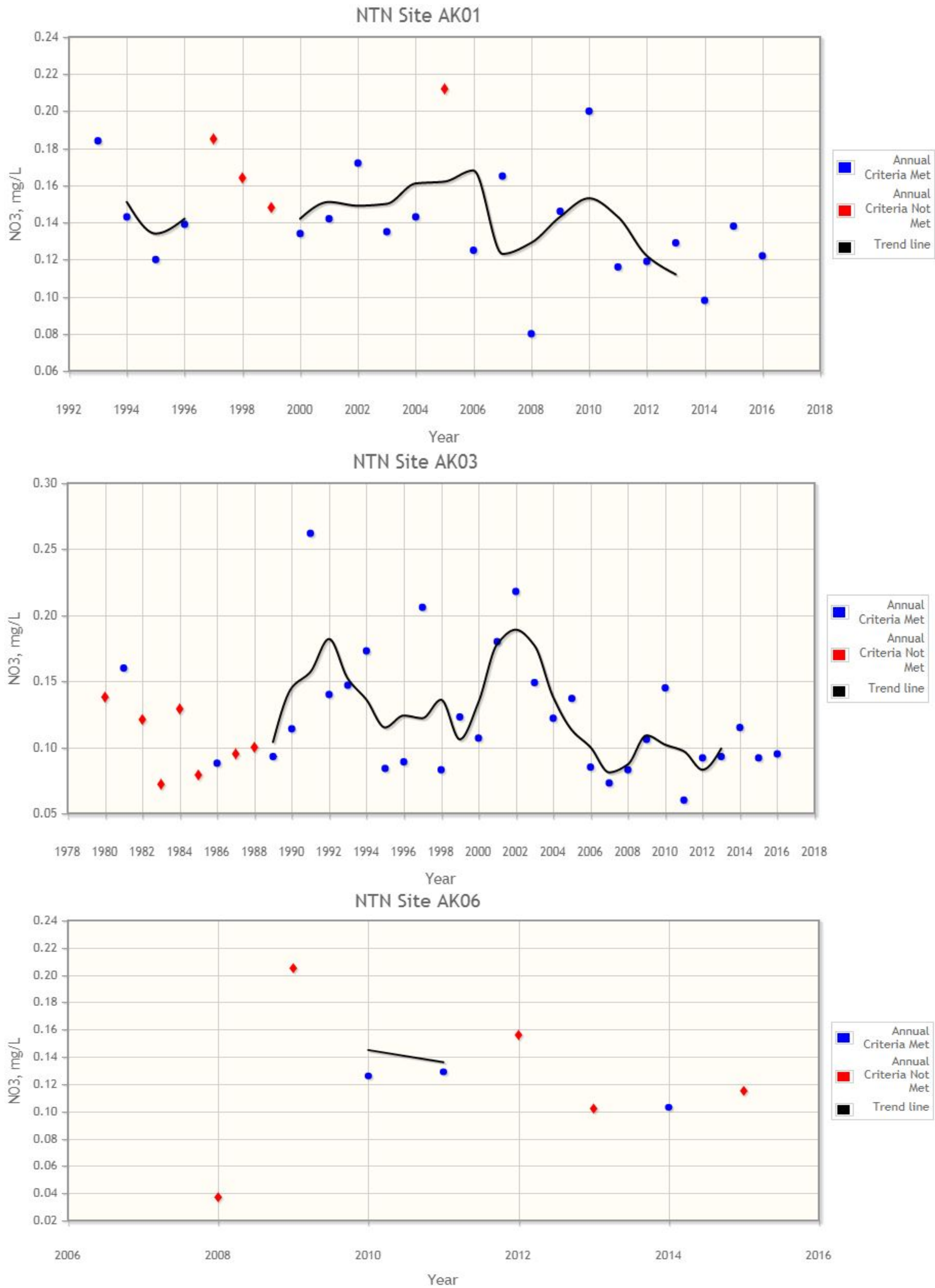

Figure 3.2-5. Nitrate ion wet deposition, Poker Creek (NTN AK01), Denali National Park (NTN AK03), and Gates of the Arctic National Park (NTN AK06)

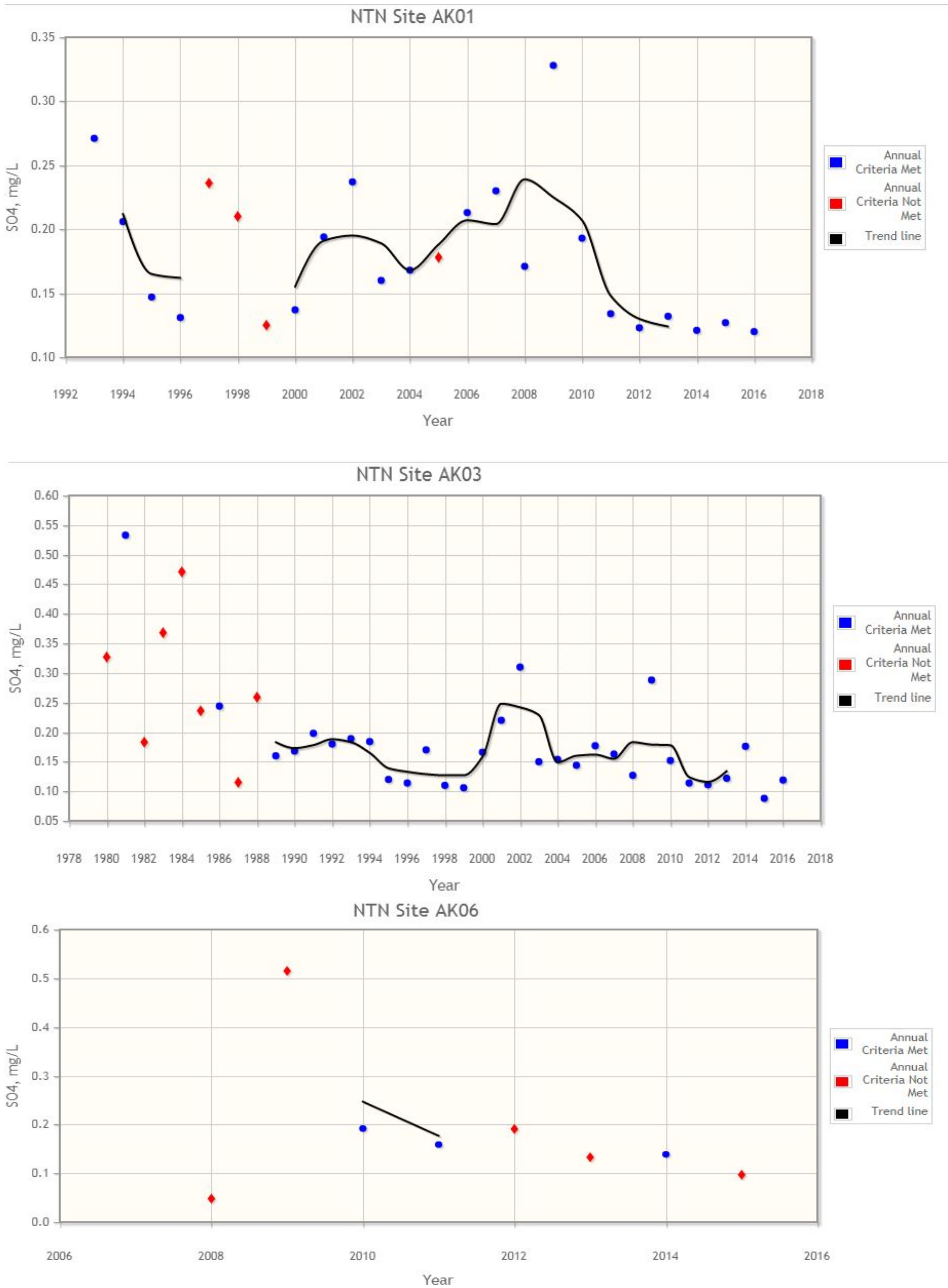

Figure 3.2-6. Sulfate ion wet deposition, Poker Creek (NTN AK01), Denali National Park (NTN AK03), and Gates of the Arctic National Park (NTN AK06)

For dry deposition, the Clear Air Status and Trends Network logs flux data from monitoring stations across the country (EPA 2017a). Flux is the rate at which dry particles reach the ground. Flux is described in units of kilograms per hectare per hour (kg/ha-hr) for dry deposition. Clean Air Status and Trends Network logs fluxes to calculate a weekly average and then an annual average.

The nearest three monitoring stations to the GMT2 Project area are at Poker Flats (Site ID POF425), Denali National Park (Site ID DEN427), and Kobuk Valley National Park (Site ID KVA428) (EPA 2017a). The Poker Flats site stopped recording dry deposition fluxes in January 2004, and Kobuk Valley National Park stopped recording dry deposition fluxes in June 2005. The most robust data are from Denali National Park from 1998 through 2016. Sulfate ion dry deposition reached its maximum at 2.5 kg/ha-hr in 2006. Nitrate ion dry deposition reached its maximum just below 2.0 kg/ha-hr in 2004, and ammonium ion dry deposition's maximum was 1.4 kg/ha-hr in 2004. For all three ion fluxes, a fairly consistent trend has been recorded for the annual average throughout the recorded history.

The Denali National Park monitor is south-south west of the GMT2 Project area as shown in Figure 3.2-9 at the end of this section. Therefore, the transport of pollutants from the GMT2 Project may affect the dry deposition of the Denali National Park dry deposition monitor.

Figure 3.2-7. Sulfate ion, nitrate ion, ammonium ion dry deposition, Denali National Park (DEN427)

3.2.3.5 Mercury Deposition

Another form of wet deposition is mercury deposition in precipitation. Mercury deposition is recorded as part of National Atmospheric Deposition Program in the Mercury Deposition Network. The nearest current station to the GMT2 Project area is the Gates of the Arctic National Park (MDN Site AK06). The station at Ambler, Alaska (MDN Site AK99), stopped collecting mercury deposition data in 2005. Most of the deposition recordings of mercury levels in the precipitation average below 50 nanograms per liter (ng/L) with random spikes in 2010, 2013, and 2015. The data recorded at MDN Site AK06 is below in Figure 3.2-8 (National Atmospheric Deposition Program 2017b). The Gates of the Arctic National Park monitor is south of the GMT2 Project area as shown in Figure 3.2-9 at the end of this section.

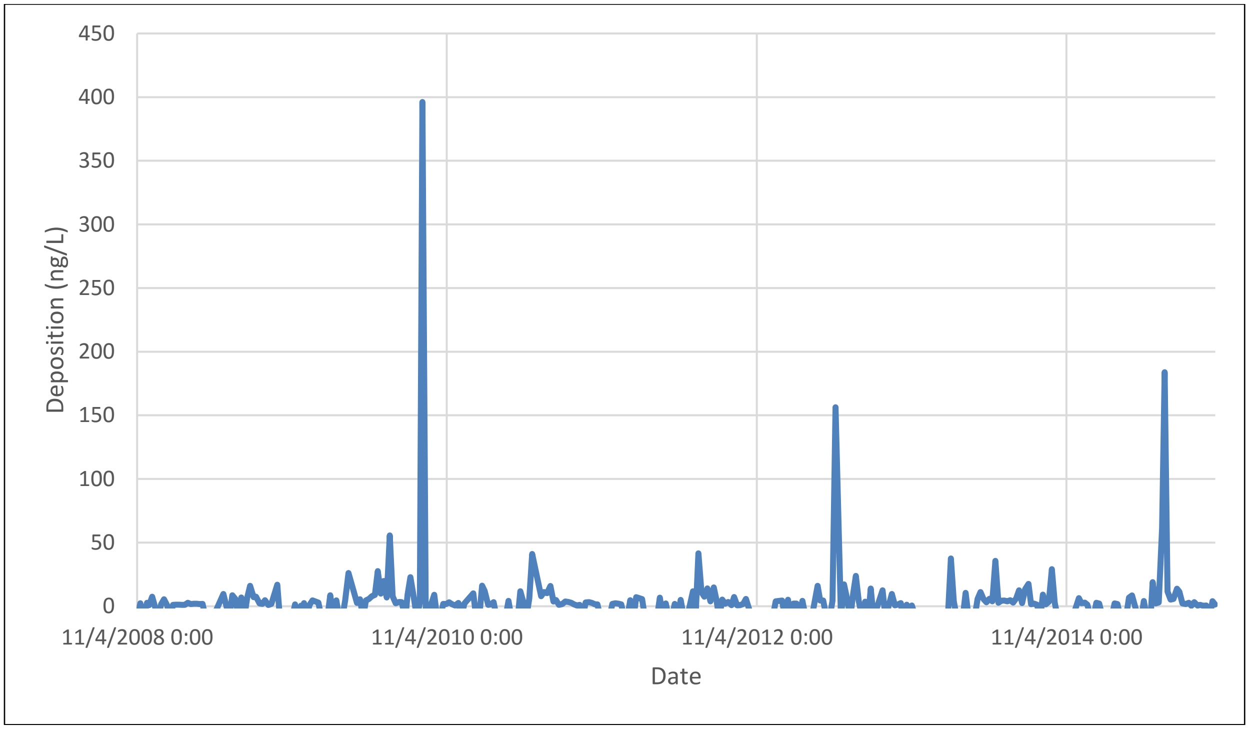

Figure 3.2-8. Mercury deposition, Gates of the Arctic National Park (MDN AK06)

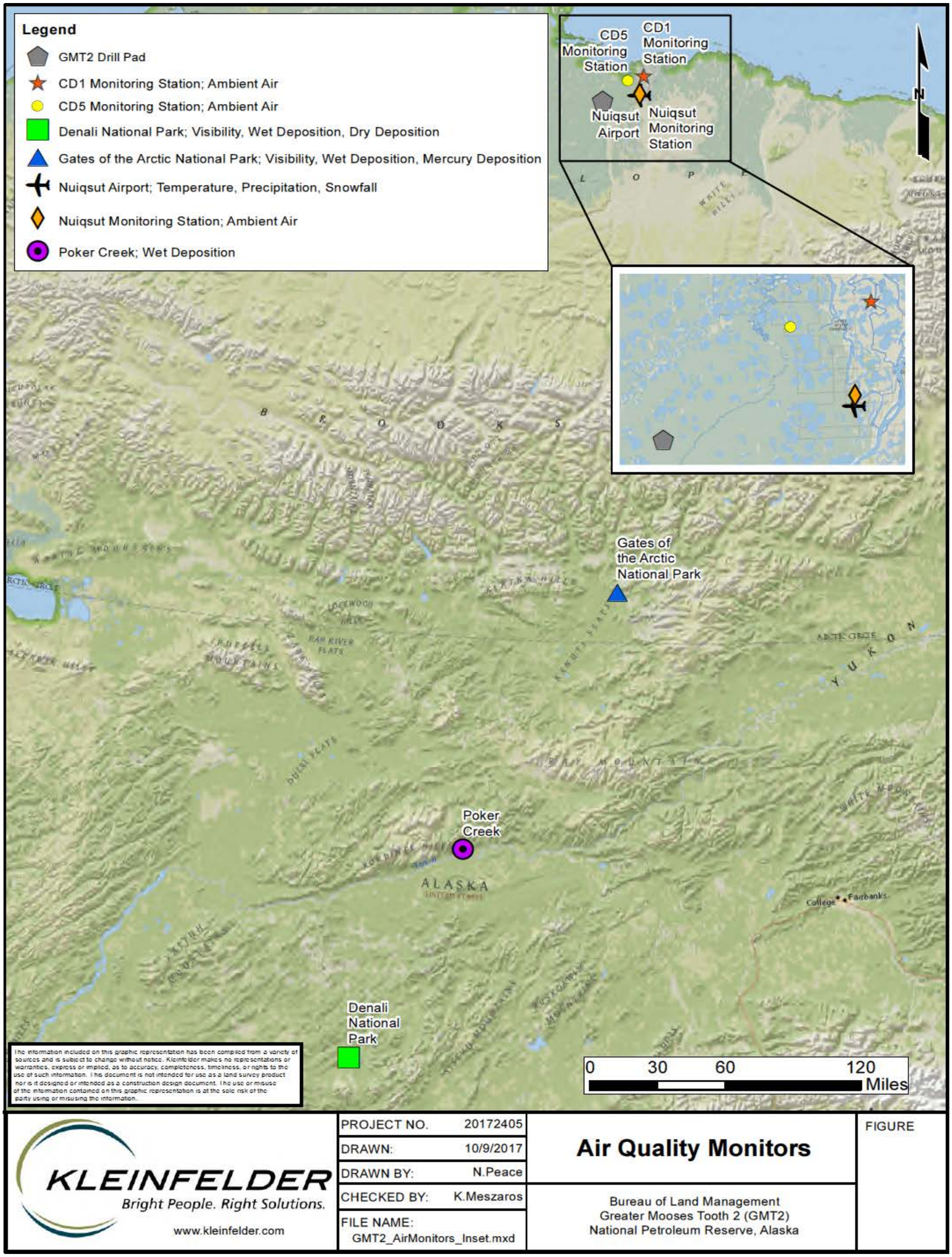

Figure 3.2-9. Monitoring data collection sites

3.2.3.6 Acoustical Environment

This section draws from and updates previous descriptions of noise conditions in the project area in BLM (2004a, Section 3.2.3.3) and BLM (2014, Section 3.2.3.3).

Overview

The acoustical environment is the combination of all sounds within a given area. These include natural sounds such as those caused by wildlife, blowing wind, and running water; as well as unwanted human-caused sounds that are considered noise because they have the potential to impact the natural acoustical environment and noise-sensitive resources and values. In the context of the proposed action, noise-sensitive resources include wildlife, as well as people engaged in subsistence pursuits, recreation, and other activities.

The degree to which noise may cause disturbances to wildlife and human receptors is dependent on many factors. For example, wildlife responses to noise are known to vary by species; acoustical factors including the frequency, intensity (loudness), and duration of noise; as well as non-acoustical factors including life-history stage, environmental or behavioral context, and degree of past exposure (Francis and Barber 2013). Noise that is abrupt and unpredictable may be perceived as a threat, potentially triggering a startle response or antipredator behavior (Frid and Dill 2002; Francis and Barber 2013). Chronic noise may impact sensory capabilities via masking of biologically important natural sounds such as those used for communication or detection of predators or prey (Francis and Barber 2013). Similarly, human responses to noise also are contingent both on acoustical and non-acoustical factors. Among the non-acoustical factors are social context and perceived ability to exert control over the noise source (Kroesen et al. 2008; Stallen 1999). Impacts on noise-sensitive resources are discussed in Chapter 4 of the supplemental EIS.

The spread (propagation) of sound in outdoor settings also is affected by many variables. These include distance from the source; weather (meteorological) conditions such as temperature, wind, and humidity; and landscape features and surface characteristics that may interfere with sound through absorption, reflection, or diffraction (Attenborough 2014). Among these, distance is the most significant factor. For a point source producing a constant sound level, sound levels expressed as decibels (dB) generally decrease (attenuate) by approximately 6 dB for each doubling of distance from the source. The same 6 dB attenuation with doubling distance holds for the maximum sound level produced by a single moving source (e.g., an aircraft in flight) when the source is at its closest point of approach to the receptor (Attenborough 2014). For a line of moving sources (e.g., vehicle traffic on a road), sound levels decrease by approximately 3 dB with doubling distance. When wind is present, sound attenuation with distance is less than expected in the downwind direction (i.e., downwind propagation is enhanced) and greater than expected in the upwind direction. Temperature inversions have the effect of reducing attenuation (enhancing propagation). In general, meteorological conditions tend to enhance sound levels to a lesser degree (e.g., 1 to 5 dB) than they attenuate sound levels (e.g., 5 to 20 dB) (Attenborough 2014).

Existing noise sources in the project area include:

- Vehicle operations (vehicles, off-road vehicles, and snowmobiles) and community noise (generators and other small equipment motors) within the village of Nuiqsut;
- Vehicles, off-road vehicles, and snowmobiles used for subsistence activities and travel among villages and between villages and subsistence camps;
- Firearms used to support subsistence activities;
- Blasting to facilitate mining of gravel deposits at the Arctic Slope Regional Corporation Colville River Consolidated Use Gravel Material Site;

- Motorized boat operations;
- Aircraft operations at Nuiqsut;
- Vehicle and equipment operations at CD1, CD2, CD4, and CD5;
- Aircraft operations into CD1;
- Incidental aircraft and boat operations into the region by recreationists and scientific researchers; and
- Incidental aircraft operations transiting the project area.

Table 3.2-11 lists measured or estimated noise levels for noise sources similar to those existing in the project area, including noise estimates reported for a standardized distance of 1,000 feet from the source. Of current noise sources in the GMT2 Project area, blasting at the Arctic Slope Regional Corporation gravel mine is likely to generate the loudest noise events. Although no noise data for the gravel mine currently are available, blast noise attributable to explosive detonations can exceed 140 dB at a distance of 1,000 feet from the source, depending on the size of charge and method of detonation (Pääkkönen 1991(Table 3.2-11). If this noise level is generated by blasts at the gravel mine, then associated peak noise levels received 4.5-miles away in the village of Nuiqsut could be as high as 110 dB, assuming 6 dB attenuation with doubling of distance from the source and not accounting for effects of meteorological conditions or the presence of noise barriers. Other sources that have the potential to generate high noise levels sufficient for long-distance (beyond 5 miles) propagation include firearms used for subsistence hunting, drill rigs, and aircraft (Table 3.2-11). Noise generated by aircraft and other forms of motor vehicles generally is greatest during acceleration, but values reported for aircraft in Table 3.2-11 are for steady level flight rather than for acceleration phases such as take-off and climb-out. Additional information concerning the extent of aircraft noise in the project area is presented below.

Table 3.2-11. Measured and estimated noise levels for noise sources similar to those existing in the GMT2 Project area [a]

Noise Source	Noise Level (dBA)	Measure-ment Distance (feet)	Estimated Noise Level at Standard 1,000-foot Distance (dBA) [a]	Estimated Attenuation Distance to Standard Noise Level of 35 dBA (miles) [a]	Measurement Details
Explosion (analog for gravel mine blasting) [b]	150 dB	328 dB	140.3	>25.0 [c]	Mean of three peak noise-level measurements for ground-surface detonations of 500-g charge of explosive hexogen (RDX)
Hunting rifle (Remington 30-06) [d]	159.4 dB	3.3 dB	109.7	>25.0 [c]	Mean of 24 peak noise-level measurements, 22-inch barrel length
Drill rig [e]	84.5	984	84.4	>25.0 [c]	Maximum 1-sec noise level measured during 44-hour period with minimal wind
Drill rig [e]	52.5	984	52.4	1.4	Median 1-second noise level measured during 44-hour period with minimal wind
C-130 [f]	88.7	315 [g]	76.7	23.0 [c, g]	Maximum 1-second noise level, estimated for level flight at 180 knots
Helicopter (B206)[h]	66.7	1,000 [g]	66.7	7.3 [c, g]	Maximum noise level, estimated for level flight at 160 knots
Single/twin-engine propeller aircraft (C207 & DHC6)[h]	65.2	1,000 [g]	65.2	6.1 [c, g]	Maximum noise level, estimated for level flight at 160 knots
Construction equipment, 5 pieces operating simultaneously [i]	88.0 [j]	50	62.0	4.2	Maximum 1-second noise level
Construction equipment, 3 pieces operating simultaneously [i]	85.8 [k]	50	59.8	3.3	Maximum 1-second noise level
Construction equipment, 1 piece [i]	81.0	50	55.0	1.9	Maximum 1-second noise level
Two-stroke snowmobile [l]	79.1	50	53.1	1.5	Median of maximum noise level measured during 12 snowmobile pass-by events during full acceleration with average speed 31.3 mph
4-wheel ORV [m]	78.5	50	52.5	1.4	Median noise level reported for eight models of off-road vehicles, with measurements conducted during four pass-by events per model with vehicles at full acceleration
Central gathering/processing facility with generator [n]	53.5	837	52.0	1.3	Maximum 1-second noise level measured during 16-hour period with minimal wind

Noise Source	Noise Level (dBA)	Measure-ment Distance (feet)	Estimated Noise Level at Standard 1,000-foot Distance (dBA) [a]	Estimated Attenuation Distance to Standard Noise Level of 35 dBA (miles) [a]	Measurement Details
Central gathering/processing facility with generator [n]	37.4	837	35.9	0.2	Median 1-second noise level measured during 16-hour period with minimal wind
Pickup truck [o]	75.0	50	49.0	0.9	Maximum 1-second noise level, one measurement
Four-stroke snowmobile [l]	72.7	50	46.7	0.7	Median of maximum noise level measured during 24 snowmobile pass-by events during full acceleration with average speed 27.4 mph

[a] Noise levels are reported in A-weighted decibels (dBA) unless otherwise noted. The table also includes estimated noise levels at a standard distance of 1,000 feet from the source and estimated distances for noise attenuation to a standard noise level of 35 dBA. These estimates assume noise attenuation of 6 dBA per doubling of distance from source and do not account for potential effects of meteorological conditions, sound barriers, and landscape characteristics. Noise sources are sorted in descending order by the estimated maximum noise level received at a standard 1,000-foot distance from the source.

[b] Pääkkönen (1991).

[c] Actual noise levels received at large distances can vary considerably due to meteorological conditions.

[d] Flamme et al. (2011).

[e] Ambrose and Florian (2014), site PAPA208.

[f] U.S. Army Corps of Engineers (2004, Appendix H); noise levels at 315 feet and 1,000 feet were estimated using the U.S. Air Force OMEGA10R noise model.

[g] Slant distance, defined as the line-of-sight distance from the noise receptor to the airborne aircraft.

[h] Miller et al. (2003), 1,000-ft noise level estimated using the Federal Aviation Administration's Integrated Noise Model.

[i] Construction noise estimates are based on the median value (81.0 dBA at 50 ft) reported for noise emissions from 49 generic types of construction equipment in USDOT (2006).

[j] Aggregate noise level resulting from simultaneous operation of 5 pieces of equipment each emitting 81.0 dBA measured at 50 feet.

[k] Aggregate noise level resulting from simultaneous operation of 3 pieces of equipment each emitting 81.0 dBA measured at 50 feet.

[l] Menge et al. (2002).

[m] Martin et al. (2005).

[n] Ambrose and Florian (2014), site PAPA206.

[o] USDOT (2006).

Results of Passive Acoustic Monitoring

During summer 2016, researchers from the University of Alaska-Fairbanks (Stinchcomb and Brinkman, *unpublished data*) collected audio recordings and sound-level data at 20 sites located near Nuiqsut and along the Fish Creek and Colville River drainages in conjunction with a passive acoustic monitoring project. Four of the 20 sites were located within the delineated GMT2 Project area. Objectives of this research were to quantify natural ambient sound levels and human-caused noise attributable to aircraft activities in the area, and to establish baseline acoustic conditions for purposes of future monitoring. Below, we use these data to further describe the existing acoustical environment in the passive acoustic monitoring study area. A description of research methods and a map showing study site locations are included in Appendix C.

Natural Acoustical Environment

Table 3.2-12 summarizes information about study sites and results of the 2016 Passive Acoustic Monitoring Project. Natural ambient sound levels, characterized as the median sound level (Median Lnat dBA) measured during periods without detectable aircraft noise, ranged from 25.3 dBA to 47.3 dBA at 16 sites where human-caused noise was attributable primarily to aircraft activities. The loudest natural ambient sound levels were recorded at a windy site (site name U.S. Geological Survey) located in the Colville River Delta near the coast. The average for these 16 sites was 35.4 dBA, which is similar to the average wind-free natural ambient sound level (32 dBA) measured near the Kuparuk Oil Field during studies conducted in 1985 and 1986 (Hampton et al. 1988), but higher than median sound levels measured in 2010 during baseline acoustical monitoring at a coastal plain location approximately 9 miles inland from the coast and 3 miles west of the Canning River where noise from human activities was generally absent (U.S. Army Corps of Engineers 2012). This baseline monitoring effort, which was conducted to support noise analysis for the Point Thomson Project (U.S. Army Corps of Engineers 2012), recorded hourly median sound levels of 23 to 28 dBA during winter conditions (27 April–8 June) and 24–26 dBA during summer conditions (12 July–12 August).

Table 3.2-12. Study site information and characteristics of aircraft noise events recorded during the 2016 Passive Acoustic Monitoring Project[a]

Site Name	Latitude (degrees N)	Longitude (degrees W)	Distance to Nuiqsut (miles)	Length of Recording Period (days)	Median Lnat[b] (dBA)	Total Aircraft Noise Events	Median Aircraft Noise Events per Day	Maximum Aircraft Noise Events per Day	Heli Events[e] (% of total events)	Prop Events[e] (% of total events)	Jet Events[e] (% of total events)	Unknown Events[e] (% of total events)
NIGLIQ1	70.242	151.000	1.6	38	35.5 [c]	565	14	35	3.4	72.9	23.5	0.2
ICERD	70.237	150.826	4.1	84	36.2 [c]	1,090	11.5	40	13.9	66.2	19.4	0.6
ITKILLIK1	70.152	150.955	4.7	84	40.3	818	8	42	5.7	54.9	39.4	0.0
NIGLIQ2	70.331	151.081	8.0	84	33.8 [c]	940	11	40	22.3	60.0	17.2	0.4
ITKILLIK2	70.106	150.837	8.5	54	25.3	408	6	37	8.3	37.3	54.4	0.0
FSHCK2	70.273	151.686	8.9	5	40.2	15	3.5	6	13.3	46.7	40.0	0.0
CLVL2	70.074	151.066	10.0	76	36.3	553	6	23	6.5	42.5	48.8	2.2
CD3	70.332	150.715	10.1	83	40.2	985	12	37	10.3	77.5	10.8	1.5
FSHCK1	70.316	151.486	12.0	23	35.0	145	7	36	11.7	53.1	35.2	0.0
FSHCK3	69.714	151.508	13.6	29	32.9	217	8	18	5.5	58.1	36.4	0.0
OCNPT	70.072	151.382	13.7	66	37.8	288	4	13	6.3	40.3	53.1	0.3
FSHCK4	69.637	151.435	17.0	15	33.1	124	7	15	4.8	47.6	47.6	0.0
USGS	70.464	150.756	17.5	80	47.4	574	7	22	7.1	70.2	22.1	0.5
CLVL4	70.000	151.593	20.8	51	31.4	114	3	8	16.7	40.4	43.0	0.0
CLVL5	69.894	151.566	26.2	84	33.9	77	1	13	23.4	62.3	14.3	0.0
UMIRUK	69.796	151.565	32.0	32	28.9	16	1	2	0.0	100.0	0.0	0.0
ROCKY	69.546	151.454	36.7	33	30.8	31	1	3	3.2	96.8	0.0	0.0
SHORTY	69.361	152.123	41.1	21	35.3	18	1	3	11.1	88.9	0.0	0.0
ANKTVK	70.360	151.292	47.3	21	37.7	21	2	6	23.8	71.4	4.8	0.0
UMIAT	70.297	151.288	65.4	41	35.6 [c]	466	9.5	62	30.7	62.4	4.7	2.1
Average	N/A	N/A	N/A		**35.4** [d]		**6.2**	**23.1**	**11.4%**	**62.5%**	**25.7%**	**0.4%**

[a] Study sites are sorted by distance to Nuiqsut; sites NIGLIQ1, ICRD, NIGLIQ2, and FSHCK2 are located in the delineated GMT2 Project area and are indicated in bold print. Data are from Stinchcomb and Brinkman (*unpublished data*).

[b] Median Lnat is the median sound level that was measured at study sites in the absence of audible aircraft noise, and is assumed to represent the natural ambient sound level.

[c] Measured sound level includes ambient noise attributable to human sources other than aircraft.

[d] Excludes four sites where measured sound levels include ambient noise attributable to human sources other than aircraft.

[e] Percentages of total aircraft noise events that were attributable to helicopters (Heli), propeller aircraft (Prop), jets (Jet), or unknown (Unk) sources.

Aircraft Noise

Aircraft noise is common in and near the GMT2 Project area. Aspects of aircraft noise are characterized as follows based on aircraft noise events measured during the 2016 Passive Acoustic Monitoring Project. For analysis purposes, an aircraft noise "event" is defined as an aircraft sound signature measured from the time it becomes audible in a sound recording to the time when the aircraft sound fades from audibility (see Appendix C). A single event does not necessarily equate to an individual aircraft, as multiple events may be caused by the same aircraft passing over the same site at different times or by the same aircraft passing over different sites.

In 2016, aircraft-related noise varied widely among study sites, especially in terms of the typical number of noise events detected on a daily basis (Table 3.2-12). For all sites combined, the median number of daily events ranged from 1 to 14, and the maximum number of daily events ranged from 2 to 62, with the lowest numbers of daily events generally occurring at sites distant from Nuiqsut (excluding Umiat) and the highest number of daily events occurring at sites relatively close to Nuiqsut and the Colville Delta area. At all sites, fewer aircraft events were attributable to helicopters (11.4 percent of total events, on average) than to propeller aircraft (62.5 percent of total events, on average) over the course of the study. Across the 20 study sites, the median duration of discrete aircraft noise events ranged from 1.9 minutes to 5.5 minutes, and the maximum duration ranged from 5.8 minutes to 30.3 minutes (Table 3.2-13).

In addition to the number and duration of discrete events per day, aircraft noise events can be characterized on the basis of maximum loudness, or Lmax, defined as the maximum 1-second sound level (dBA) measured during the noise event. On the basis of this metric, noise levels measured during helicopter events in 2016 tended to be greater than levels measured during propeller aircraft events and jet aircraft events. Across study sites, the median Lmax ranged from 44.6 dBA to 72.9 dBA for helicopter events, from 40.9 dBA to 58.8 dBA for propeller aircraft events, and from 38.0 dBA to 52.6 dBA for jet aircraft events (Table 3.2-14). The maximum Lmax measured at study sites ranged from 66.8 dBA to 94.0 dBA for helicopter events, from 59.4 dBA to 88.9 dBA for propeller aircraft events, and from 40.3 dBA to 77.3 dBA for jet aircraft events. Although maximum noise levels attributable to helicopters tended to be greater than those attributable to propeller aircraft, it is nevertheless reasonable to conclude from data currently available that propeller aircraft generated more noise and thus greater impacts on the acoustical environment in the project area during summer 2016 because of the greater frequency of propeller aircraft noise events relative to helicopter noise events.

Table 3.2-13. Duration of aircraft noise events measured at study sites during the 2016 Passive Acoustic Monitoring Project [a]

Site Name	Distance to Nuiqsut (miles)	Median Event Duration (minutes)	Maximum Event Duration (minutes)
NIGLIQ1	**1.6**	**2.5**	**15.6**
ICERD	**4.1**	**2.3**	**29.5**
ITKILLIK1	4.7	2.1	19.7
NIGLIQ2	**8.0**	**2.3**	**27.4**
ITKILLIK2	8.5	2.4	17.8
FSHCK2	**8.9**	**1.9**	**9.2**
CLVL2	10.0	2.5	22.8
CD3	10.1	2.7	23.8
FSHCK1	12.0	2.2	7.7
FSHCK3	13.6	2.4	12.9
OCNPT	13.7	2.4	20.6
FSHCK4	17.0	2.6	25.5
USGS	17.5	2.8	33.0
CLVL4	20.8	2.7	23.1
CLVL5	26.2	3.4	9.2
UMIRUK	32.0	3.9	5.8
ROCKY	36.7	5.5	12.1
SHORTY	41.1	3.6	7.6
ANKTVK	47.3	3.3	10.3
UMIAT	65.4	3.0	30.3
Average	N/A	**2.8**	**18.2**

[a] Study sites are sorted by distance to Nuiqsut; sites NIGLIQ1, ICRD, NIGLIQ2, and FSHCK2 are located in the delineated GMT2 Project area and are indicated in bold print. Data are from Stinchcomb and Brinkman (*unpublished data*).

Table 3.2-14. Maximum levels of aircraft noise recorded during the 2016 Passive Acoustic Monitoring Project [a]

Site Name	Distance to Nuiqsut (miles)	Heli Median Lmax (dBA)	Prop Median Lmax (dBA)	Jet Median Lmax (dBA)	Unk Median Lmax (dBA)	Heli Maximum Lmax (dBA)	Prop Maximum Lmax (dBA)	Jet Maximum Lmax (dBA)	Unk Maximum Lmax (dBA)
NIGLIQ1	1.6	56.3	56.3	51.7	56.6	72.8	83.6	70.2	56.6
ICERD	4.1	56.8	52.1	43.0	63.8	84.9	79.7	66.0	71.4
ITKILLIK1	4.7	61.6	51.3	52.6	--	92.0	88.9	77.3	--
NIGLIQ2	8.0	52.7	46.9	49.4	44.8	82.8	85.8	65.0	51.7
ITKILLIK2	8.5	47.4	41.6	43.5	--	68.4	63.0	62.8	--
FSHCK2	8.9	63.1	50.5	41.9	--	78.5	59.4	57.5	--
CLVL2	10.0	53.9	47.3	46.2	50.2	87.7	84.2	67.4	68.7
CD3	10.1	48.8	58.8	48.2	78.2	74.6	87.2	70.7	88.8
FSHCK1	12.0	57.4	44.4	43.4	--	77.7	63.1	58.1	--
FSHCK3	13.6	49.8	52.0	45.5	--	66.8	73.7	59.9	--
OCNPT	13.7	56.6	44.8	44.5	50.5	80.8	75.7	72.8	50.5
FSHCK4	17.0	47.8	48.1	47.7	--	68.8	62.0	61.0	--
USGS	17.5	44.6	47.5	43.8	36.1	83.4	83.5	59.7	47.9
CLVL4	20.8	56.1	47.8	40.9	--	90.6	65.6	63.9	--
CLVL5	26.2	53.4	40.9	38.0	--	94.0	63.1	54.5	--
UMIRUK	32.0	--	48.8	--	--	--	73.1	--	--
ROCKY	36.7	70.2	46.5	--	--	70.2	62.6	--	--
SHORTY	41.1	72.9	52.6	--	--	80.1	57.3	--	--
ANKTVK	47.3	61.0	47.3	40.3	--	72.5	80.8	40.3	--
UMIAT	65.4	60.4	54.5	42.3	54.1	82.3	83.7	56.5	59.4
Average	N/A	**56.4**	**49.0**	**44.9**	**54.3**	**79.4**	**73.8**	**62.6**	**61.9**

[a] Lmax is defined here as the maximum 1-second sound level measured during an aircraft noise event, and Median Lmax is the median Lmax for all helicopter (Heli) noise events, propeller (Prop) noise events, jet (Jet) noise events, and unknown-source (Unk) noise events. Maximum Lmax is the maximum Lmax that was recorded for all noise events attributable to a particular aircraft type over the course of the study. Study sites are sorted by distance to Nuiqsut; sites NIGLIQ1, ICRD, NIGLIQ2, and FSHCK2 are located in the delineated GMT2 Project area and are indicated in bold print. Data are from Stinchcomb and Brinkman (*unpublished data*).

3.2.4 Climate Change

Climate change impacts to resources in the project study area remain essentially as described in BLM (2014, Section 3.2.4). Supplemental information is taken from recent reviews of this subject including the Third National Climate Assessment-Alaska (Chapin et al. 2014) and the Arctic Report Card 2016 (Richter-Menge et al. 2016).

3.2.4.1 Climate Change in the Arctic

Climate trends in the Arctic remain essentially as described in BLM (2014, Section 3.2.4.1). The global warming trend of the past 50 years has been amplified in the Arctic. Positive feedback loops resulting from reduced overall surface reflectivity in the summer have increased the heat retention capacity of the Arctic system, which enables more melting (BLM 2014). The increased melting of snow and ice cover leads to increased thawing of permafrost and earlier greening of the tundra (Richter-Menge et al. 2016). Thawing permafrost releases carbon into the atmosphere in the form of carbon dioxide and methane, whereas increased vegetation growth pulls carbon dioxide out of the atmosphere. Overall, tundra in the Arctic is releasing net carbon into the atmosphere (Richter-Menge et al. 2016).

Arctic air temperatures have increased at double the rate of global temperature increases. The average surface air temperature for the year ending September 2016 was by far the highest since 1900, and represents a 2 ºC increase relative to the 1981–2010 baseline. Minimum sea ice extent at the end of the summer of 2016 was tied with 2007 as the second lowest sea ice cover in the satellite record. Spring snow cover extent in the North American Arctic was the lowest on the satellite record (Richter-Menge et al. 2016). These observations show a continuation of the persistent warming trend occurring in the Arctic.

3.2.4.2 Climate Change on the North Slope

The North Slope experiences the same climate trends as the Arctic as a whole, including increased average temperatures, thawing of permafrost, expanded growing season and decreases in sea ice and snow cover extent (Walsh et al. 2014). Tundra travel open season on the North Slope decreased from approximately 200 days in 1969 to approximately 120 days in 2004 as a result of regulatory changes, a warming climate and methods for measuring frost depth (North Slope Borough Oil and Gas Technical Report 2014). Tundra travel season is likely to continue to shorten in response to rising average temperatures and changes in precipitation patterns on the North Slope.

Precipitation on the North Slope is projected to increase in both summer and winter, while snow cover duration is expected to drop (BLM 2014). Projections for snowfall include a later date of first snowfall and an earlier snowmelt (BLM 2014).

3.2.4.3 Potential Climate Change Impacts in the Project Study Area

Potential climate change impacts in the project study area remain essentially as described in BLM 2014, Section 3.2.4.3, and are summarized as follows.

The project study area is located within the Arctic Coastal Plain and is dominated by features and processes driven by permafrost. The project study area is underlain by continuous permafrost, which on the North Slope ranges from depths of about 650 feet to more than 2,000 feet. During the Arctic summer, solar radiation thaws a shallow layer of soil at the surface, creating a seasonally unfrozen zone termed the active layer. Recent modeling predicted a broad range of future permafrost states due to differences in future greenhouse gas emission and climate scenarios; however, permafrost extent is predicted to decrease significantly by 2100 (Slater and Lawrence 2013). There are predictions that climate change will continue to warm and dry the NPR-A region more than historically recorded ranges; however, warmer temperatures are not likely to accelerate the soil forming processes significantly enough to measure the change during the period of construction and operations addressed in this supplemental EIS (BLM 2014, Section 3.2.4.3, page 121).

Structurally, the increase in the depth of the active layer is expected to have a negative effect on the ability of the soils to carry loads. Any traffic over the surface during non-frozen periods would be expected to create more damage than under the present conditions. This could result in deep ruts and severe channeling of water into the vehicle tracks. Such concentration of water would be likely to accelerate erosion and create new drainage channels that drain water from the surrounding areas. It also would be likely to accelerate the subsidence of the permafrost in the track areas. Similar subsidence has been observed in tracks from early exploration of the region in the 1960s in many other areas of the tundra (BLM 2012, Section 3.2.8.4, page 190). Due to the exacerbation of climate change, subsidence may occur over a broader area than solely in those areas which are directly impacted by vehicle traffic (Shiklomanov et al. 2013). Traffic is restricted on unfrozen ground in the NPR-A.

As the active layer deepens, there are more opportunities for plants to send roots deeper into the profile. This may allow plant communities to begin migrating further north within their ranges. The overall result of climate change on vegetation appears to be that growing season will be longer, and soils will be warmer and actually drier. These differences have the potential to drive significant changes in plant communities of the NPR-A, leading to significant acreages of boreal cordillera, with vegetative cover ranging from open to closed forest canopies; western tundra, which is similar but with a moist, sub-polar climate, patches of stunted trees, and a greater presence of tall shrub communities; and boreal transition with boreal forests in valleys and lowlands, and scattered pockets of permafrost. These changes in vegetation will promote soil formation through greater root development and contribution of additional organic matter to the soil profile (BLM 2014, Section 3.2.4.3, page 122).

A number of hydrologic shifts related to climate change will affect water resources, including seasonal flow patterns, ice-cover thickness and duration, and the frequency and severity of extreme flood events. The effects of these climatic and hydrologic changes will result in river systems that increasingly move or migrate over the landscape compared to a period of relatively stable climate, which may cause disruptions to infrastructure (such as roads and bridges), changes in fish and wildlife habitat, and possible hazards to shoreline communities, fish camps, and recreational users (BLM 2012, Section 3.2.10.5, page 201). Warmer temperatures will advance the spring warming period, which means that snowmelt will occur during a period of lower solar radiation, which could lead to a more protracted melt and less intense runoff. The effects of early and less intense spring melt will be most dramatic for catchments within the Arctic Coastal Plain, where snowmelt forms the major flow event of the year. Overall, the magnitude and frequency of high flows will decline while low flows will increase, thereby flattening the annual hydrograph (BLM 2014, Section 3.2.4.3, page 123).

Suspended sediment and nutrient loading of lakes and rivers will increase as thermokarsting, land subsidence, slumping, and landslides increase with permafrost degradation. With expected warming, degrading ice wedges may progressively integrate into drainage channels with a lower base elevation resulting in increased frequency of lake-tapping (sudden drainage) events. Drainage rates of lakes on the entire North Slope, in cold continuous permafrost, were found to be one to two lakes per year, but will likely increase in frequency (BLM 2014, Section 3.2.4.3, page 123).

Increasing mean air temperatures during the winter and summer will lead to increasing mean water temperatures which may affect Arctic fish species; however, the precise effect that warmer water temperatures could have on Arctic fish is complicated and difficult to predict (BLM 2014, Section 3.2.4.3, page 122).

Bird habitats worldwide are threatened by climate change, though species for which breeding is restricted to the Arctic regions may be the most vulnerable to climate change. The abundance and distribution of surface water is of crucial importance to Arctic birds as the aquatic and semi-aquatic habitats of the planning area support very large numbers of birds. Increased summer temperatures could lead to the conversion of aquatic habitats into dryer habitat types resulting in a loss of not only habitat quantity but also habitat quality in terms of potential decrease in food resources (invertebrate and plant). This loss of quantity and quality would likely lead to changes in bird distributions which might in turn lead to increased competition for limited resources and associated decreases in productivity (BLM 2012, Section 3.3.5.9, page 279).

Climate change is predicted to cause alterations to the environment and habitats of the project study area that could adversely affect paleontological resources, although the degree to which this might happen remains unclear. Mass wasting due to future climate change could result in the partial or total destruction of paleontological sites located on hillsides, bluff faces, river banks and terraces, and a warming climate may lead to more rapid decomposition of paleontological resources. On the other hand, erosion has exposed most of the known paleontological deposits in the NPR-A, an impact that is viewed as more positive than negative as it reveals the presence of sites usually with few negative results. The potential climate change impacts are not expected to be universal across the Arctic Coastal Plain as there are myriad factors that control the degree to which climate change can affect a specific location, region, habitat or ecosystem (BLM 2012, Section 3.2.7.2., page 183).

Cultural resources are susceptible to the same climate change effects related to erosion and mass wasting as discussed above for paleontological resources. As is the case for paleontological remains, organic cultural artifacts are susceptible to increased decay in a warming environment. Artifacts in the project study area were encased in permafrost long ago, preventing them from further decay. Permanently frozen ground has played a key role in preserving organic artifacts, including tools, artwork, clothing, shelters, etc., made from plant and animal materials, and animal and plant remains that can be used to identify which species were hunted and gathered and how and when they were used. In addition to increased downslope movement and erosion, thawing permafrost will incorporate whole sites into the active layer, exposing subsurface artifacts and features to cryoturbation (frost mixing). Permafrost has helped to maintain the spatial relationships between artifacts by preserving the vertical sequence in which past people left them behind; i.e., in a naturally buried deposit, older artifacts will be found deeper than younger artifacts. As more artifacts become incorporated into the active layer, they are more susceptible to disturbance, increasing the likelihood that different cultural levels will become mixed. Younger materials can move downwards via seasonal frost cracking and older artifacts can be pushed upwards by frost heaving and sorting, ice wedging, and involutions (BLM 2012, Section 3.4.2.3., page 382; French 2007; Washburn 1980; Wood and Johnson 1978).

Climate change will not affect the existence or location of the mineral material deposits within the project study area; however, it may impact the ability of industry to access those resources. Gravel mining in the project study area involves the use of ice roads, snow trails, and ice pads for transportation of equipment to and from the material source, usually during the exploration and mine development phase. Depending on the type of material and the mining method used to extract that material, a changing climate could make the excavation easier, due to the melting of the permafrost, or more difficult when attempting to develop deposits in areas with melted permafrost, which may necessitate removing water, or the need to excavate in swampy conditions (BLM, 2014, Section 3.2.4.3, page 124).

3.3 Biological Resources

The following description of biological resources of the project study area is structured and organized to match BLM (2004a) and BLM (2014). The biological environment remains essentially as described in the 2004 Alpine Satellite Development Plan EIS and the 2014 GMT1 Supplemental EIS.

3.3.1 Vegetation and Wetlands

Vegetation and wetlands are described for the entire NPR-A in BLM (2012), and for much of the GMT2 Project area in BLM (2004a) and BLM (2014). The location of the project area in the NPR-A is shown in Map 3.1-1. Additional information is also provided for the Northeast NPR-A (including the GMT2 Project area) in BLM (2008a).

A summary of the prior assessments, which focuses on the conditions within the project area and at the proposed project facilities, is presented along with new information relevant to this resource. A project area is incorporated that defines a geographic extent of all the action alternatives and allows for a defined area for detailed evaluation. The project area was selected to include all major project components of the proposed GMT2 Project and alternatives as well as where supporting activities may be located, as described in Section 3.1.1.

3.3.1.1 Summary of Vegetation and Wetland Types

A summary of vegetation and wetland types occurring within the bounds of the project area is provided in Table 3.3-1.

Table 3.3-1. Summary of vegetation and wetland types in the project area

Vegetation Type [a]	National Wetland Inventory Code [b]	Acres of Vegetation Type in Mapped Project Area [c]	% of Mapped Project Area [d]
Brackish Water	E2USH	354	0.2
Cassiope Dwarf Shrub Tundra	PSS3B, Upland	241	0.2
Closed Low Willow	PSS1B, PSS1C	2,490	1.7
Coastal Complex	E2EM1/USP	3	--
Deep Polygon Complex	PUBH, PEM2H, PEM1F, PEM1/SS1B	823	0.6
Dryas Dwarf Shrub Tundra	Upland, PSS3B	372	0.3
Elymus Meadow	Upland	23	--
Fresh Grass Marsh	PEM1H, R2AB3H, L1AB3H	525	0.4
Fresh Sedge Marsh	PEM1H	1,781	1.2
Fresh Water	PUBH, R2UBH, L1UBH, E1UBL	27,186	18.8
Halophytic Grass Wet Meadow, Brackish	PEM1R	328	0.2
Halophytic Sedge Wet Meadow, Brackish	PEM1R	240	0.2
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	150	0.1
Moist Sedge-Shrub Tundra	PEM/SS1B, PEM1/SS1E	23,682	16.4
Old (ice-rich) Basin Wetland Complex	PEM1F, PUBH, PEM1B, PEM1H	10,031	6.9
Open Low Willow	PSS1B	3,868	2.7
Open Low Willow-Sedge Shrub Tundra	PSS1B	636	0.4
Open Tall Willow	PSS1B, PSS1C	86	0.1
Partially Vegetated	PUSR, PUSC, Upland	1,407	1.0
Riverine Complex	R2UBH, R2AB3H, PEM1F	410	0.3
Salt-killed Wet Meadow	E2US4P	2	--
Seral Herbs	PSS1	54	--
Tussock Tundra	PEM/SS1B	29,899	20.6
Wet Sedge Meadow Tundra	PEM1F	32,682	22.6
Wet Sedge-Willow Tundra	PEM1F	1,893	1.3
Young (ice-poor) Basin Wetland Complex	PUBH, PEM2H, PEM1H, PEM1/SS1B,PEM1B	559	0.4
Natural Barren [e]	Us (upland), E2US3P	4,591	3.2
Human Modified Barren [f]	N/A	455	0.3
Dune Complex [e]	Upland, PEM1B, PEM1/SS1B, PSS1B	25	--
	Total Mapped in Project Area	**144,800**	**100.0**
Unmapped area	Not determined	10,636	
	Total Project Area	**155,500**	

[a] Wetland types assigned based on typical conditions expected to occur in the GMT2 Project area. Crosswalk from vegetation to National Wetlands Inventory type is based upon comparisons to vegetation type descriptions in Jorgenson et al. (2004) for the broad range of plant communities within the GMT2 Project area. *Source:* Jorgenson et al. (2004) and Wells et al. (2014).

[b] National Wetlands Inventory codes based on Cowardin et al. (1979).

[c] Acreage of each vegetation type is rounded to the nearest 1 acre.

[d] Percent of vegetation type acreage within the mapped portion of the project area. Values that are greater than 0 but less than 0.1 percent are noted with a dash (--). Note that the total project area is 155,500 acres (rounded up to the next 100 acres) and that 144,800 (rounded to nearest 100 acres) of those acres are mapped to vegetation type. The remainder, 10,636 acres (6.8 percent of the total project area) extends outside of the vegetation map coverage.

[e] Wetland status interpreted as upland based on aerial imagery.

[f] Human Modified Barrens are areas where gravel fill has been placed and have a different biological function than Natural Barrens.

Key points about vegetation and wetlands in the project area include:

- The vegetation communities of the project area are dominated by Wet Sedge Meadow Tundra, Tussock Tundra, Fresh Water (ponds and lakes), and Moist Sedge-Shrub Tundra; all of these are potential jurisdictional wetlands that are regulated under the Clean Water Act.
- The sedge species that dominate the vegetated landscape are tolerant of cold soil and high-moisture conditions. The vegetation canopy is low and individual plants are mostly less than 1-foot tall.
- A shallow active-layer (soils unfrozen only during the short growing season) in which Arctic flora can grow are underlain by permafrost in the project area. Short growing season, cold soil temperatures, and low decomposition rates influence the type of vegetation that can survive the Arctic climate of the project area.

The vegetation classification used in this analysis is the same used in BLM (2004a) and BLM (2014). Descriptions of the classifications of habitat, vegetation, and geomorphology are provided in Jorgenson et al. (2004) and Wells et al. (2014). Further information on vegetation and wetlands for the NPR-A is provided in BLM (2008a) and BLM (2012). A vegetation map of the project area is presented in Map 3.3-1. Twenty-eight vegetation types occur within the project area, as listed previously in Table 3.3-1. The vegetation types most commonly found in the project area typically meet the criteria for jurisdictional wetlands and waters based on Section 404 of the Clean Water Act. While wetlands and waters account for the majority of land cover, non-wetlands (uplands) are also present. Of the mapped area, wetlands occupy the most land area (approximately 77 percent), followed by water (approximately 19 percent), and uplands (approximately 4 percent) as shown in Table 3.3-1. When a vegetation type could be wetland or upland (based onsite-specific conditions), it is assumed to be wetland for this analysis. Thus, the listed acreages of wetlands in the study area may overestimate the total occurrence. The vegetation types, National Wetlands Inventory classifications, and descriptions are further discussed in Davis (2013).

Areas not classified as water bodies or wetlands are considered uplands or Natural Barrens. These areas occupy just over 3 percent of the project area as shown in Table 3.3-1 and include sand dunes and gravel islands in the Colville River. Gravel fill in the GMT2 Project area includes the community of Nuiqsut, the Arctic Slope Regional Corporation Mine site (initial phase only), Alpine Processing Facility/CD1, CD2, CD4, the Nuiqsut Spur Road, but does not include more recent gravel fill from CD5, Phase 3 of the Arctic Slope Regional Corporation Mine site and the CD5–GMT1 Road (not present when vegetation was mapped). These areas of Human Modified Barrens occupies 455 acres and is 0.3 percent of the mapped project area (Table 3.3-1).

Water bodies include areas of open water such as lakes, ponds, streams, and rivers. For information about water bodies in the study area, see Section 3.2.2, “Water Resources.”

The dominant vegetation types in the mapped portion of the study area include Wet Sedge Meadow Tundra (23 percent), Tussock Tundra (21 percent), and Moist Sedge-Shrub Tundra (16 percent), with Water Bodies mapped at 19 percent cover. Wet tundra is dominated by wet/moist sedges and dwarf shrubs, and occupies wet environments such as drained-lake basins and poorly drained river terraces. Sedges (e.g., *Carex* spp.) dominate this tundra type. Small intermixed patches of aquatic sedges and grasses may occur in flooded areas. Large complexes of wet and moist tundra occur, with interspersed areas of open water. Wet tundra is generally characterized under National Wetlands Inventory notation as emergent sedge or grass wetland (e.g., PEM1F), with a water regime of semi-permanently flooded. Moist tundra is characterized in the National Wetlands Inventory classification system as saturated wetland, dominated by scrub-shrub and emergent vegetation (e.g., PSS1/EM1B).

Areas of mixed moist and wet tundra occur in the drier parts of drained-lake basins and on poorly drained river terraces. Patterned ground is widespread and moist sedges and dwarf shrubs dominate areas with better drainage. Wet sedges dominate lower areas and aquatic sedges and grasses may occur in flooded areas. Mixed high and low centered polygons with extensive thermokarst troughs are interspersed with lakes and ponds. High centered polygons may be dominated by dry, dwarf shrubs and fruticose lichens. Moist/wet tundra complexes are generally characterized under National Wetlands Inventory notation as saturated or inundated emergent and scrub-shrub wetland, with water regimes ranging from seasonally saturated to permanently flooded. As mapped, just over 3 percent of the study area is upland (non-wetland), consisting of barren ground and Dryas Dwarf-Shrub Tundra (Table 3.3-1), while 0.3 percent of the study area consists of human modified areas where gravel was extracted from or placed on existing vegetation.

There are no plant species listed under the Endangered Species Act nor as BLM Sensitive Species known to occur within the GMT2 Project area as discussed in Appendix F of the 2012 Final NPR-A Integrated Activity Plan EIS.

3.3.1.2 Invasive Plant Species

Non-native, invasive plant species occurrence in the NPR-A is discussed in BLM (2012). In summary, there is evidence that non-native, invasive plant species have the potential to spread into the mid- and lower-latitude regions of the NPR-A. However, the higher-latitude regions which include the project area are considered to be invasion resistant due to the short growing season compared to that of known invasive species (Carlson et al. 2015). The common dandelion (*Taraxacum officinale*) has been found north of the Brooks Range and there has been anecdotal observation of dandelion in the NPR-A (BLM 2012). The mechanisms for spread of non-native, invasive plants include equipment and vehicles used for construction, and aircraft. Despite the documented economic consequences of non-native, invasive species, few quantitative data exist that have measured the ecological impacts of invasive plants, making the prediction of environmental impact of these species difficult (Barney et al. 2013).

Aquatic, non-native, invasive species are of particular concern throughout Alaska because of the potential for floatplanes to carry these into new areas (Alaska Department of Fish and Game 2013b). Infestations of waterweed (*Elodea* spp.) in Fairbanks and Anchorage have raised concerns that this aquatic, invasive plant is capable of persisting in lakes of southern and interior Alaska. Like many invasive species, this plant is adapted to disturbance, can grow rapidly, and can survive when lakes and rivers ice up. Infestations have practical as well as ecological implications, as boats and floatplanes may become entangled and damaged in thick growths of these weeds. No reports of waterweed infestations in the Arctic or the NPR-A have been identified (Alaska Natural Heritage Program 2015).

3.3.2 Fish

The following sections on fish species and habitat are chiefly summarized from the BLM (2012, Section 3.3.4; 2014, Section 3.3.2), where fish resources in the project area are discussed in more detail, with other relevant information incorporated. Subsistence fisheries in the project study area are described in Section 3.4.5, “Subsistence.”

3.3.2.1 Fish Species

Eighteen freshwater, anadromous, and nearshore marine fish species are documented in the GMT2 Project area and surrounding waters. Freshwater fish species largely remain within river, stream, and lake systems year-round while anadromous species spawn in freshwater, but spend at least part of the life cycle in the ocean. Fish distribution in the project study area is shown on Map 3.3-2.

Industry has conducted extensive fish surveys in the project area and surrounding waters (MJM Research 1998, 2000a, 2000b, 2000c, 2001a, 20001b, 2002a, 2002b, 2002c, 2002d, 2003a, 2003b, 2003c, 2003d, 2003e, 2004, 2005a, 2005b, 2007a, 2007b, 2007c, 2008a, 2008b, 2009, 2013). Ongoing research in the region conducted by the BLM and its cooperators has also provided further data on fish habitat use (Heim et al. 2014a, 2015, 2017; McFarland et al. 2017; Jones et al. 2017; BLM unpublished data). Ninespine stickleback are the most widely distributed fish species within the project area and are found in most waterbodies, including many isolated, poorly connected, and/or shallow lake and stream systems. Arctic grayling, broad whitefish, and least cisco are also prevalent in the GMT2 Project area, while Alaska blackfish, burbot, humpback whitefish, round whitefish, and slimy sculpin are relatively common, but to a lesser extent. Arctic cisco are captured in large numbers in the lower Colville River, but are encountered infrequently in the NPR-A Arctic Coastal Plain to the west. The remaining fish species are only occasionally observed in the area.

Studies have documented local and large-scale migrations by Arctic grayling, broad whitefish, and burbot in the project area, including use of main river channels, small tributary streams, and lakes (Morris 2003; Heim et al. 2014a, 2015, 2017). Given the variability of aquatic habitat on the Arctic Coastal Plain, it is likely that some individuals of other fish species also make movements among various habitat types to optimize seasonal life history needs, including feeding, overwintering, and spawning.

Table 3.3-2. Fish species found in the GMT2 Project area and vicinity

Species	Common Name	Scientific Name	Iñupiaq Name
Freshwater	Alaska blackfish	*Dallia pectoralis*	Iłuuqiniq
Freshwater	Arctic grayling	*Thymallus arcticus*	Sulukpaugaq
Freshwater	Burbot	*Lota*	Tittaaliq
Freshwater	Ninespine stickleback	*Pungitius*	Kakalisaauraq
Freshwater	Northern pike	*Esox lucius*	Siulik
Freshwater	Round whitefish	*Prosopium cylindraceum*	Savigunnaq
Freshwater	Slimy sculpin	*Cottus cognatus*	Kanayuq
Anadromous	Arctic cisco	*Coregonus autumnalis*	Qaataq
Anadromous	Bering cisco	*Coregonus laurettae*	Tiipuq
Anadromous	Broad whitefish	*Coregonus nasus*	Aanaaqłiq
Anadromous	Chinook salmon	*Oncorhynchus tschawytscha*	—
Anadromous	Chum salmon	*Oncorhynchus keta*	Iqalugruaq
Anadromous	Dolly Varden	*Salvelinus malma*	Iqalukpik
Anadromous	Humpback whitefish	*Coregonus pidschian*	Piquktuuq
Anadromous	Least cisco	*Coregonus sardinella*	Iqalusaaq
Anadromous	Pink salmon	*Oncorhynchus gorbuscha*	Amaqtuuq
Anadromous	Rainbow smelt	*Osmerus mordax*	Iłhauġniq
Coastal Marine	Fourhorn sculpin	*Myoxocephalus quadricornus*	Kanayuq

3.3.2.2 Fish Habitat

The majority of aquatic habitat in the NPR-A exhibits minimal or no impacts as a result of anthropogenic activities. Many of the more important attributes influencing fish habitat, such as stream banks and channels, lakeshores, substrates, water quality and quantity, floodplains, and riparian areas are largely unaltered from their natural condition.

The GMT2 Project area is predominantly located within the Coastal Plain Unit of the BLM designated Fish Habitat Units, along with a small portion of the eastern area located in the Lower Colville Unit (BLM 2012) (Map 3.3.4-4). The Coastal Plain Unit is characterized by extremely low gradient terrain that strongly influences aquatic habitat features and morphology. Rivers and streams are generally slow moving with many unstable banks, and substrates are dominated by sand and silt with relatively few isolated areas of gravel. A majority of the annual flow occurs during spring break-up when large expanses of land tend to be inundated by water. Flow is reduced significantly by mid to late summer and can even become discontinuous, depending on precipitation. Outside of the major river corridors, the predominant aquatic habitat type consists of complicated networks of lakes and small streams. Most of these small streams are described as "beaded" because deep pools that occur along thermally degraded ice-wedges are connected by narrow channels, resembling beads on a string (Arp et al. 2012, 2015).

Fish use of waterbodies is largely dependent upon connections between streams and lakes, which can vary throughout the year, and water depth, which can impact timing of ice thaw, water temperature, and presence of overwintering habitat. Annual waterbody connectivity and flow regimes play a major role in determining how much potential habitat is accessible.

The Tiŋmiaqsiġvik (Ublutuoch River) and Uvlutuuq (Fish Creek) are used by most fish species found in the area. Although the full extent of fish use in these higher-order streams is not well studied, deeper portions are known to be utilized for overwintering as shown in Map 3.3-2. While a unique reach of gravel substrate in the Ublutuoch River upstream of the GMT1 Access Road bridge may provide a productive area for fish invertebrate prey, these main channels are typically considered less productive for fish prey resources than smaller tributaries and connected lakes. Nevertheless, as the major drainage channels in the area they function as important migratory corridors that allow fish to access a variety of tributary habitats, primarily beaded streams and lakes.

Beaded streams are mainly used by fish during the ice-free season. Studies in the project area demonstrate that pockets of unfrozen water persist in deep pools (Lilly et al. 2010; Jones et al. 2013) (Map 3.3-3), but extremely low dissolved oxygen levels indicate that only fish species resistant to those conditions, such as Alaska blackfish and ninespine stickleback, may be able to survive (Arp et al. 2015). Following spring ice break-up, these streams can provide productive seasonal habitat for other fish species (MJM Research 2004, 2005a, 2007b, 2009). For example, Arctic grayling begin to enter Crea Creek as soon as passage is open in the spring and continue to utilize the stream until freeze-up (Heim et al. 2014a, 2015), with multiple size classes consuming a wide range of prey resources (McFarland et al. 2017). In addition to supporting productive feeding grounds, beaded streams also provide fish access to numerous lakes.

Fish use of lakes largely depends on depth and connectivity (Haynes et al. 2013; Laske et al. 2016; Jones et al. 2017). Lakes that do not freeze to the bottom annually and are greater than 6.0 feet (Map 3.3-3) provide the most likely potential overwintering habitat, although morphology and landscape attributes can strongly influence dissolved oxygen levels and effect fish species suitability (Leppi et al. 2015). In the GMT2 Project area, most lakes are isolated or poorly connected (Map 3.3-4) and are either fishless or only inhabited by ninespine stickleback (Map 3.3-2). However, even lakes that are not used by fish in the winter can provide valuable feeding habitat. For example, one shallow lake connected to Crea Creek is used extensively by numerous juvenile Arctic grayling throughout the summer (Heim et al. 2017). Additionally, lakes can be an important source of prey items (e.g., zooplankton and ninespine stickleback) for stream-dwelling fish lower in the drainage (McFarland et al. 2017). Lake water can also provide a substantial portion of downstream water supply (BLM unpublished data), further influencing stream habitat conditions and lake access.

Spawning habitat requirements vary for different Arctic fish species and can occur in a wide range of flowing or still waters. Some species can spawn successfully in areas of silt or sand substrate, while many others require gravel of a particular size class and relatively clear water. Except for burbot, which spawn under ice in late winter, Arctic freshwater fish spawn between late May and October. Although spawning is a critical aspect of species persistence, specific information on spawning locations in the GMT2 Project area is lacking.

Waterbodies used by anadromous fish species and documented in the State's Anadromous Waters Catalog (AWC; 5 AAC 95.011) are shown on Map 3.3-4 (Alaska Department of Fish and Game 2017). These streams and lakes are granted protection under the Anadromous Fish Act (AS 16.05.871). For this purpose, "anadromous" is defined as "breeding in fresh water but spending at least part of the life cycle in the ocean" (Craig 1989), which is consistent with Alaska Department of Fish and Game legal use. Fish species included under this definition are in Table 3.3-2.

3.3.2.3 Essential Fish Habitat

The 1996 Sustainable Fisheries Act enacted additional management measures to protect commercially harvested fish species from overfishing. Along with reauthorizing the Magnuson-Stevens Fishery Conservation and Management Act Reauthorization (16 U.S.C. 1801-1882), one of those added measures is to describe, identify, and minimize adverse effects to essential fish habitat through the National Environmental Policy Act. Arctic freshwater essential fish habitat only includes habitat utilized by Pacific salmon (Map 3.3-4). The essential fish habitat assessment for the GMT2 Project area is in Appendix E.

3.3.3 Birds

About 90 species of birds are expected to occur annually in the NPR-A and adjacent Beaufort and Chukchi Sea habitats (BLM 2012, Section 3.3.5). Approximately 80 of these species are likely to occur in the Alpine Satellite Development Plan Area (see BLM 2004, Figure 1.1.1-1, Plan Area Vicinity and Location Map) or in nearshore waters of Harrison Bay. Common, scientific, and Inupiaq names and status of avian species in the Alpine Satellite Development Plan Area are presented in Table 3.3-3. Life history and general biology of avian species in the Alpine Satellite Development Plan Area and within the NPR-A is provided in BLM (2004, Section 3.3.3) and in BLM (2012, Section 3.3.5) which are incorporated by reference.

The majority of wildlife studies available for this region cover a large geographical area. For the purposes of this supplemental EIS, a project study area (see Section 3.1.1 and Map 3.1-1) is used to delineate a defined area for analysis of the affected environment and potential impacts from the proposed GMT2 Project.

Federal and state agencies have been conducting avian studies for similar time periods in response to resource development activities and for the tracking of multiple species population trajectories. Migratory bird aerial surveys for the Arctic Coastal Plain have been conducted by USFWS Migratory Bird Management annually since 1986 resulting in a long-term dataset of the estimated onshore densities of up to 34 species. USFWS Migratory Bird Management has also estimated annual avian population size and average population growth rates using their long-term (1986–2016) aerial survey data (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*). Density classes occurring within the GMT2 Project area for the latest 4 years of data available, 2012–2015 (USFWS, *unpublished data* 2017) were determined by geographic information systems analysis and summaries are presented for species with available data.

Avian surveys in the Alpine Satellite Development Plan area have been conducted by ConocoPhillips and its predecessors since 1992 and in sections of the Colville River Delta since 1989. Data from these sources that support density, distribution, and trend estimates of species commonly found in the GMT2 Project area are summarized within this section (threatened bird species are discussed in Section 3.3.5). ConocoPhillips's contractor for avian studies, ABR, Inc. Environmental Research & Services has been conducting surveys of both the Colville River Delta, termed Colville Delta Study Area (Colville Delta Special Area) in this document, the northeastern portion of the NPR-A, termed NPR-A Study Area in this document, and the Kuparuk Study Area in this document.

The majority of infrastructure proposed for GMT2 Project is west of GMT1 and limited to a single ABR, Inc. Environmental Research & Service study subarea within the NPR-A Study Area called the Development Subarea. The entire Development Subarea extends east to include the gravel source, Arctic

Slope Regional Corporation Mine, and north to Alpine Central Processing Facility/CD1. Map 3.3-5 shows the location of the GMT2 Project area and associated study areas and subareas. BLM (2014, Appendix J) provides a summary of available data from ConocoPhillips avian surveys in the Alpine Satellite Development Plan area.

Beginning in 1992, ConocoPhillips engaged in consultation with resource agencies and local communities to select a focal group of wildlife species, including birds, to study using annual aerial surveys in the Colville Delta Special Area and NPR-A Study Area. Surveys continue to collect data on distribution, abundance, and habitat use of these focal species. Avian species were selected using the following criteria: (1) threatened or sensitive status, (2) indications of declining populations, (3) restricted breeding range, (4) importance to subsistence hunting, or (5) concern of regulatory agencies for development impacts.

Table 3.3-3. Colville Delta Special Area and NPR-A Study Area subareas in relation to the GMT2 Project study area

Area	Subarea	Description
Colville Delta Study Area (Colville Delta Special Area) [a]	CD North Subarea	A portion of this subarea crosses the project area but contains no project infrastructure
	Northeast Delta Subarea	Not contained within project area
	CD South Subarea	Includes GMT2 pipelines from CD1 on existing pipe rack within the project area
NPR-A Study Area [a]	Fish and Judy Creek Corridor Subarea	Overlaps with Development Subarea, intersects a portion of the GMT2 Project area but contains no project infrastructure; created and used for loon surveys in 2008
	GMT Corridor Subarea	Includes the proposed GMT2 pad, road to permitted GMT1 pad and road/pipeline to CD5 pad; created and used for loon surveys in 2014
	Fish Creek Delta Subarea	The southeast corner of this subarea crosses the GMT2 Project area but contains no project infrastructure
	Alpine West Subarea	Includes a portion of existing road and pipeline from CD4 to CD5 that will also be used by GMT2
	Development Subarea	Includes proposed GMT2 pad, pipeline and road to GMT1 and the previously permitted GMT1 to CD5 road and pipeline that will also be used by GMT2 Project

[a] See Map 3.3-5 for study subareas in relation to the GMT2 Project area. *Source:* Johnson et al. (2015).

The focal avian species included the following: spectacled eider (*Somateria fischeri*), king eider (*Somateria spectabilis*), tundra swan (*Cygnus columbianus*), yellow-billed loon (*Gavia adamsii*), brant (*Branta bernicla*), snow goose (*Chen caerulescents*), greater white-fronted goose (*Anser albifrons*), and cackling (or Canada) goose (*Branta canadensis*).

Data were also collected on the glaucous gull (*Larus hyperboreus*) due to their documented predation on eggs of ground nesting birds (Johnson et al. 2009). Three additional species that share similar conservation concerns and may occur in the GMT2 Project area are: red knot (*Calidris canutus roselaari*), short-eared owl (*Asio flammeus*), and golden eagle (*Aquila chysaetos*), as described in BLM (2004a) and BLM (2012). Seabirds (including gulls), passerines (notably Lapland longspur and common raven), ptarmigan (willow and rock), waterbirds (geese, swans, eiders, loons), shorebirds (plovers, sandpipers, phalarope, red knot), and raptors (golden eagle, peregrine falcon, gyrfalcon, owls) are the species groups discussed in this document. Most groups have been recorded regularly (ptarmigan, shorebirds, waterfowl, and passerines), but raptors only on an infrequent basis, during ConocoPhillips avian surveys in the Alpine Satellite Development Plan area (Johnson et al. 2015).

Common, scientific, and Iñupiaq names and special status of avian species in the Alpine Satellite Development Plan area are presented in Table 3.3-4. The status category includes species (or populations) listed as Birds of Conservation Concern by the USFWS (2008); or identified as sensitive species by the BLM (2010). Avian species listed as threatened under the Endangered Species Act (Steller's eider and spectacled eider) are discussed in Section 3.3.5. Species listed as Birds of Conservation Concern are migratory nongame birds that are likely to become candidates for listing under the Endangered Species Act in the absence of additional conservation efforts. BLM Sensitive Species include those known or predicted to undergo a decline that could threaten the viability of the species under all or a portion of its range, and those that rely on unique or specialized habitats that are threatened with alterations that could jeopardize the viability of the species. Life history and general biology of birds in the Alpine Satellite Development Plan area and within the NPR-A are provided in BLM (2004a, Section 3.3.3), BLM (2012, Section 3.3.5), and BLM (2014, Section 3.3.3) which are incorporated by reference.

Table 3.3-4. Common, scientific and Inupiaq names and status of avian species found in the Alpine Satellite Development Plan Area

Avian Category	Common Name	Scientific Name [a]	Iñupiaq Name [b]	Status [c]
Waterfowl (Tinmiagruich) and Waterbirds	greater white-fronted goose	*Anser albifrons*	niblivik	--
	snow goose	*Chen caerulescens*	kafuq	--
	cackling goose	*Branta hutchinsii*	iqsrabutilik	SS
	Canada goose	*Branta canadensis*	iqsrabutilik	--
	Brant	*Branta bernicla*	niblinbaq	--
	tundra swan	*Cygnus columbianus*	qugruk	--
	Gadwall	*Anas strepera*	--	-
	American wigeon	*Anas americana*	kurugabnaq	--
	Mallard	*Anas platyrhynchos*	ivugaq	--
	northern shoveler	*Anas clypeata*	qaqouqtuuq	--
	northern pintail	*Anas acuta*	kurugak	--
	green-winged teal	*Anas crecca*	qaiffiq	--
	canvasback	*Aythya valisineria*	--	--
	greater scaup	*Aythya marila*	qaqouqpalik	--
	lesser scaup	*Aythya affinis*	qaqouqtuuq	--
	Steller's eider	*Polysticta stelleri*	igniqauqtuq	T
	spectacled eider	*Somateria fischeri*	qavaasuk	T
	king eider	*Somateria spectabilis*	qifalik	--
	common eider	*Somateria mollissima*	amauligruaq	--
	surf scoter	*Melanitta perspicillata*	avixuktuq	--
	white-winged scoter	*Melanitta fusca*	killalik	--
	black scoter	*Melanitta nigra*	tuunbaabrupiaq	--
	long-tailed duck	*Clangula hyemalis*	aaqhaaliq	--
	red-breasted merganser	*Mergus serrator*	paisugruk	--
Loons (Malgitch) and Grebes	red-throated loon	*Gavia stellata*	qaqsrauq	BCC
	Pacific loon	*Gavia pacifica*	malbi	--
	yellow-billed loon	*Gavia adamsii*	tuullik	BCC, SS
	red-necked grebe	*Podiceps grisegena*	sublitcharuraq	--
	horned grebe	*Podiceps auritus*	subliq	--
Ptarmigan	willow ptarmigan	*Lagopus*	aqargiq	--
	rock ptarmigan	*Lagopus mutus*	niksaaktufiq	--
Cranes	sandhill crane	*Grus canadensis*	tatirgak	--

Avian Category	Common Name	Scientific Name [a]	Iñupiaq Name [b]	Status [c]
Raptors and Owls	bald eagle	*Haliaeetus leucocephalus*	tinmiaqpak	--
	northern harrier	*Circus cyaneus*	papiktuuq	--
	rough-legged hawk	*Buteo lagopus*	qixbiq	--
	golden eagle	*Aquila chrysaetos*	tingmiakpak	SS
	merlin	*Falco columbarius*	kirbaviatchauraq	--
	gyrfalcon	*Falco rusticolus*	aatqarruaq	--
	peregrine falcon	*Falco peregrinus*	kirgavik	BCC
	snowy owl	*Bubo scandiacus*	ukpik	--
	short-eared owl	*Asio flammeus*	nipaiouktaq	SS
Shorebirds	black-bellied plover	*Pluvialis squatarola*	tullisugruk	--
	American golden plover	*Pluvialis dominica*	tullik	--
	semipalmated plover	*Charadrius semipalmatus*	qurraquraq	--
	whimbrel	*Numenius phaeopus*	siituvak	BCC
	bar-tailed godwit	*Limosa lapponica*	turraaturaq	BCC
	red knot	*Calidris canutus*	--	BCC, SS
	ruddy turnstone	*Arenaria interpres*	tullignaq	--
	black turnstone	*Arenaria melanocephala*	--	--
	sanderling	*Calidris alba*	kimmitquioaq	--
	semipalmated sandpiper	*Calidris pusilla*	livalivak	--
	western sandpiper	*Calidris mauri*	--	-
	least sandpiper	*Calidris minutilla*	livalivauraq	--
	white-rumped sandpiper	*Calidris fuscicollis*	--	--
	Baird's sandpiper	*Calidris bairdii*	puviaqtuuyaaq	--
	pectoral sandpiper	*Calidris melanotos*	puvviaqtuuq	--
	dunlin	*Calidris alpina*	qayuuttavak	BCC
	stilt sandpiper	*Calidris himantopus*	--	--
	buff-breasted sandpiper	*Tryngites subruficollis*	satqagiixaq	BCC
	long-billed dowitcher	*Limnodromus scolopaceus*	kilyaktalik	--
	Wilson’s snipe	*Gallinago delicata*	kuukukiaq	--
	red-necked phalarope	*Phalaropus lobatus*	qayyiibun	--
	red phalarope	*Phalaropus fulicarius*	auksruaq	--

Avian Category	Common Name	Scientific Name [a]	Iñupiaq Name [b]	Status [c]
Seabirds	pomarine jaeger	*Stercorarius pomarinus*	isuffabluk	--
	parasitic jaeger	*Stercorarius parasiticus*	mibiaqsaayuk	--
	long-tailed jaeger	*Stercorarius longicaudus*	isuffaq	--
	herring gull	*Larus argentatus*	nauyavvaaq	--
	Thayer's gull	*Larus thayeri*	--	--
	glaucous-winged gull	*Larus glaucescens*	--	--
	glaucous gull	*Larus hyperboreus*	nauyavasugruk	--
	Sabine's gull	*Xema sabini*	iqirgagiaq	--
	black-legged kittiwake	*Rissa tridactyla*	--	--
	Arctic tern	*Sterna paradisaea*	mitqutaioaq	BCC
	black guillemot	*Cepphus grylle*	--	--
Passerines	common raven	*Corvus corax*	tulugaq	--
	Arctic warbler	*Phylloscopus borealis*	sonakpalutuniq	--
	bluethroat	*Luscinia svecica*	--	--
	yellow wagtail	*Motacilla flava*	misiqqaaqauraq	--
	American tree sparrow	*Spizella arborea*	misapsaq	--
	savannah sparrow	*Passerculus sandwichensis*	uqpiksiubayuk	--
	Lapland longspur	*Calcarius lapponicus*	qupaouk	--
	snow bunting	*Plectrophenax nivalis*	amauooigaaluk	--
	common redpoll	*Carduelis flammea*	saksakiq	--
	hoary redpoll	*Carduelis hornemanni*	saksakiq	--

Note: BCC = USFWS Birds of Conservation Concern; SS = BLM Sensitive Species; T = USFWS Threatened.

[a] Scientific names from List of the 2,031 Bird Species (with Scientific and English Names) Known from the A.O.U. Checklist Area (http://www.aou.org/checklist/north/print.php).

[b] Iñupiaq names from MacLean (2012).

[c] USFWS 2008, 2014a; BLM 2010.

[d] Steller's eider (*Polysticta stelleri*) and spectacled eider (*Somateria fischeri*) are listed as Threatened under the Endangered Species Act, and are discussed in Section 3.3.5 with other Endangered Species Act species.

(-) no corresponding Iñupiaq name found; or species has no notable status.

Wildlife survey data and habitat maps were used to determine habitat selection and preference by focal birds and mammals on the North Slope (Johnson et al. 2013). This approach, known as the ecological land survey approach, is described in BLM (2004a). Map 3.3-6 depicts the wildlife habitat types delineated within the GMT2 Project area. The wildlife habitat type classification considers vegetation type, geomorphology, and surface forms, but also factors in ecological significance such as use by wildlife. A description of habitat types is provided in Appendix D,

Generally, on the Arctic Coastal Plain of Alaska's North Slope, the following habitat characteristics are attractive to shorebirds, geese, ducks, and loons: availability of large deep lakes with ice floes, shoreline with low relief, peat or mud substrate for resting, graminoid meadows with moss, low predator and human population or disturbance, and proximity to coastal staging areas (BLM 2004). The most common vegetation types in the project study area include, in decreasing order: Wet Sedge Meadow Tundra, Tussock Tundra, Moist Sedge-Shrub Tundra, Water, and Ice-Rich Basin Wetland Complex (Map 3.3-1 and Table 3.3-1).

The following sections describe the focal avian species occurring in the project study area and the habitat used by those species. Steller's eider and spectacled eider are addressed in Section 3.3.5, "Threatened and Endangered Species."

3.3.3.1 Gulls

The summary presented below provides information from data collected on glaucous gulls throughout the Arctic Coastal Plain, as well as limited site-specific data regarding glaucous gulls in the project study area. This summary is supplemental to information provided in BLM (2012, Section 3.3.5.1), BLM (2004, Section 3.3.3.7), and BLM (2014, Section 3.3.3.1) which are incorporated by reference.

Glaucous gulls were selected as focal species for ongoing studies due to the potential for an increase in gull populations, resulting from their attraction to industrial development, and their known ability to prey on eggs and chicks. ConocoPhillips and its predecessors have been collecting data on glaucous gulls in the Colville Delta Special Area since 1995 and in the NPR-A Study Area since 1999 (Johnson et al. 2014a; BLM 2014). In some years, observations of gulls were collected opportunistically as part of studies that focused on other bird species.

Over the entire Arctic Coastal Plain, the average annual population growth rates (total bird index) from 1986 to 2016 for the glaucous gull was 1.034, indicating a positive population growth trend for these species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*).

Estimated density indices of glaucous gulls across the Arctic Coastal Plain are found on Map 3.3-7. Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, unpublished data 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data. The majority of gulls found within the project area are contained within the low and medium contours (Table 3.3-5).

Table 3.3-5. Estimated density contours of glaucous gulls within the project area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.110	14,156.0	9.1
0.111–0.263	66,424.6	42.6
0.264–0.444	64,382.9	41.3
0.445–0.707	8,575.4	5.5
0.708–1.489	2,450.1	1.6

Source: USFWS unpublished data 2017.

Estimated densities of glaucous gulls within the GMT2 Project area for the 2012–2015 aerial surveys range from 0.000−0.110 to 0.708−1.489 birds per square kilometer (Table 3.3-5) (Stehn 2014; Stehn et al. 2013; USFWS, unpublished data). The highest density contour is present in 1.6 percent of the project area while the second and third highest density contours are present in 83.9 percent of the project area.

Glaucous gulls were observed incidentally as part of aerial loon nesting and brood-rearing surveys in 2014 on selected lakes within the Colville Delta Special Area and the NPR-A Study Area. Lakes surveyed for gulls in the NPR-A Study Area were located in the Alpine West Subarea, the Fish Creek Delta Subarea, and the 2014 GMT Corridor Subarea (Johnson et al. 2015). A total of 84 glaucous gull nests were observed in the Colville Delta Special Area in 2014. Of the nest total, 96 percent were within CD North and CD South Subareas, which contain portions of the project study area (Johnson et al. 2015). Of a total 53 glaucous gull nests recorded in the NPR-A Study Area in 2014, 23 of the nests were found in the GMT Corridor Subarea, where the GMT2 Project area lies (Johnson et al. 2015). The number of glaucous gull nests in the Colville Delta Special Area are increasing based on survey results from 2002 to 2015 (Johnson et al. 2015). In the NPR-A Study Area, survey areas have varied between years, thus the trend in glaucous gull nesting is less clear.

Glaucous Gull nests and colonies were found in 12 different habitats in the Colville Delta Special Area (Johnson et al. 2015). The four most commonly used habitats also contained colonies: Deep Open Water with Islands or Polygonized Margins (36 percent of nests), Patterned Wet Meadow (24 percent), Tapped Lake with High-water Connection (15 percent), and Grass Marsh (8 percent). The largest Glaucous Gull colony (18 nests) was located on a large island classified as Patterned Wet Meadow. The remaining 14 percent of nests were found on islands or complex shorelines in eight other habitats. Glaucous Gull broods were found in aquatic and terrestrial habitats near nest locations, often in the same habitat as the nest (Johnson et al. 2015).

Glaucous Gulls nested in 10 different habitats in the NPR-A Study Area study area in 2014 (Johnson et al. 2015). Twenty-eight (53 percent) of 53 nests, including three colonies, were in Shallow Open Water with Islands or Polygonized Margins. Another 17 percent of the nests were located in Deep Open Water with Islands or Polygonized Margins. The remaining 20 percent were found on islands or complex shorelines of six other aquatic habitats and two terrestrial habitats. Glaucous gull broods observed during aerial surveys were located near nests and in the same habitats as were the nests (Johnson et al. 2015).

3.3.3.2 Passerines

A discussion of passerine species distribution, nesting habitats, foraging, and surveys on the Arctic Coastal Plain, as well as in the project study area, is included in BLM (2004, Section 3.3.3.8; 2012, Section 3.3.5.7; and BLM 2014, Section 3.3.3.2) which are incorporated by reference. Most passerines found in the NPR-A generally arrive on the North Slope from late May to early June and remain until mid- to late August (Johnson and Herter 1989). Passerines breeding in the project study area are generally tundra or shrub-nesting species. Savannah sparrow, redpoll, snow bunting, Lapland longspurs, common raven, and yellow wagtail are expected to occur in the project study area (BLM 2012). Nesting and foraging habitats used by passerines that are likely to occur in the project study area are summarized in BLM (2004). This section will address the Lapland longspur in detail because it is the most numerous nesting bird in the NPR-A and Colville River Delta, as indicated from surveys conducted since the 1970s (BLM 1978; Derksen et al. 1981; Burgess et al. 2003; Liebezeit and Zack 2006, 2007, 2008). Ravens will be addressed due to their known association with industrial development and their potential for preying on eggs and chicks (BLM 2012).

Lapland longspurs are the most common avian species nesting across the NPR-A and Colville Delta Special Area (BLM 2012). Lapland longspurs were the most frequent passerine nesting in all of the 24 breeding-bird plots (31.3 nests per square kilometer) in the NPR-A Study Area reported by Johnson et al. (2005) and 12 plots (45.8 nests per square kilometer on treatment plots, 37.5 nests per square kilometer on reference plots) on the Colville Delta Special Area (Johnson et al. 2003). Over a 3-year period, Lapland longspurs also were found to be the highest density nesting passerine species (40.0 to 42.5 nests per square kilometer) in an area near Teshekpuk Lake, which is located outside of the project study area (BLM 2012). In ground nest searches near the Alpine development and the NPR-A satellite developments, Lapland longspurs accounted for greater than 80 percent of all bird nests documented each year (BLM 2004).

Other passerine birds observed nesting in NPR-A included savannah sparrows (infrequent; 2 of 24 plots; 0.8 nests per square kilometer), eastern yellow wagtail (one nest found in 2004; Johnson et al. [2005]), American tree sparrows, and common redpolls nesting along the channels of the Colville River.

Common raven, though not abundant, is the only resident passerine in the NPR-A Study Area and Colville Delta Special Area, and is found across the Arctic Coastal Plain, but nest only where cliffs, bluffs, or artificial structures provide nesting habitat (BLM 2012). During a workshop designed to determine human influences on predators of nesting birds on the North Slope of Alaska held by the USFWS in 2003, participants agreed that ravens have increased in number on the Arctic Coastal Plain in response to human activity. However, consensus was not achieved on how much and where the increase in the raven population has taken place (USFWS 2003). Human activities may benefit ravens by increasing the over-winter survival of adults and/or young due to an increased food supply. Aerial surveys conducted by the USFWS across the Arctic Coastal Plain do not provide good estimates of raven population numbers due to the avoidance of areas of human habitation by the aircraft. Data has been collected using the Audubon Society Christmas Bird Counts at Prudhoe Bay between 1987 and 2012 with the only species detected in all years being the raven (http://netapp.audubon.org/CBCObservation/Historical/ResultsByCount.aspx#). During that period the count of ravens increased from 3 birds in 1987, to 39 birds in 1990, to 73 birds in 2000 and to 116 birds in the last year the survey was conducted (2012). Ravens may be surviving winter by eating anthropogenic foods at Prudhoe Bay and possibly enhancing their likelihood of winter survival on the North Slope (Day 1998). There are ravens nesting in the Alpine oilfield (BLM 2012) and ravens were reported to use buildings as roosting sites at CD1, with nests confirmed in 2000 and 2001 (Johnson et al. 2003a). Common ravens are successful egg predators of passerines, shorebirds, loons, and waterfowl on the Arctic Coastal Plain (BLM 2012), and thus, could have an impact on local ground nesting bird populations.

3.3.3.3 Ptarmigan

Two species of ptarmigan, the willow and rock ptarmigan, occur in the NPR-A (BLM 2012). Ptarmigan are ground-nesting birds in the grouse family that remain in the NPR-A year-round and are a species utilized for subsistence. Willow ptarmigan have been found nesting in both dense vegetation and on open tundra (Hannon et al. 1998; Johnson and Herter 1989). Specifically, ground-based nest searches in 2002 found willow ptarmigan nests in three habitat types (Patterned Wet Meadow, Moist Sedge-Shrub Meadow, and Moist Tussock Tundra) at a study site near the GMT1 pad (as permitted), with over 66 percent (4 of 6 nests) of the nests occurring in Moist Tussock Tundra (Burgess et al. 2003). Over 44 percent (12 of 21 nests) of the nests occurred in Moist Tussock Tundra (Burgess et al. 2003). Rock ptarmigan may conduct local migrations during the fall to obtain willow forage (Johnson and Herter 1989), and nest in dry rocky habitats and in hummocky areas of wet sedge meadows (Holder and Montgomerie 1993).

Although no research studies targeting these species were identified, both species of ptarmigan have been recorded at low densities in various large waterbird nest searches conducted in areas representative of the project study area. In 2002, among four different ground-based nest search sites summing 15.7 square kilometers (Clover [mine site], Alpine West [Subarea], Lookout [GMT1], and Spark [a previously proposed location for GMT2, approximately 2.1 miles north of the current GMT2 location]), 10 ptarmigan nests were reported, with only 1 nest located at Spark (Burgess et al. 2003).

3.3.3.4 Waterfowl

Waterfowl are among the most populous avian groups on the Arctic Coastal Plain and within the project study area. Waterfowl are present on the Arctic Coastal Plain from early spring until late fall when they migrate to their wintering grounds. The following section summarizes information for select species of waterfowl (tundra swan, brant, snow goose, king eider, greater white-fronted goose, and cackling goose) and is supplemental to information provided in BLM (2012, Section 3.3.5.5), BLM (2004a, Section 3.3.3.2), and BLM (2014, Section 3.3.3.4), which are incorporated by reference here.

Tundra Swan

The summary presented below provides information from data collected on tundra swans throughout the Arctic Coastal Plain and limited site-specific data in the project study area. Tundra swan was selected as a focal avian species because it is thought to be an indicator species for potential impacts from development.

ConocoPhillips and its predecessors have been conducting aerial surveys of nesting and brood-rearing tundra swans in the NPR-A Study Area beginning in 1999 and continuing 2001−2014, and in the Colville Delta Special Area since 1992. Survey areas and percentage of area surveyed differed among years. Tundra swans are common along the Arctic Coastal Plain, and are present in the project study area.

The average annual population growth rate (total bird index) from 1986 to 2016 for tundra swans was 1.046, indicating a positive population growth trend for this species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; and USFWS, *unpublished data*). The overall trend in counts of pairs, nests, and broods in the Colville Delta Special Area has been one of slow increase.

Due to variation of areas studied between years, an overall trend for pairs, nests, and broods is not available for the data collected on tundra swans in the NPR-A Study Area (Johnson et al. 2014).

Estimated density indices of tundra swans are found in Map 3.3-7 of this document. Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data. All onshore ranges of density index contours found on the Arctic Coastal Plain fall within the project study area and range from 0-0.077 to 0.522-1.231 birds per square kilometer (Table 3.3-6). Table 3.3-6 shows that 67.1 percent of the project study area contains high to moderately high densities of tundra swans when compared to the entire Arctic Coastal Plain population.

Table 3.3-6. Estimated density contours of tundra swans within project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.077	9,800.3	6.3
0.078–0.183	41,651.5	26.7
0.184–0.309	48,185.0	30.9
0.310–0.521	47,504.4	30.5
0.522–1.231	8,847.5	5.7

Source: USFWS unpublished data 2017.

Within the Colville Delta Special Area, the 21-year (1992–2014) number of and average density of tundra swan nests was reported at 23 nests (a greatly reduced number from the annual mean of 34 nests) and 0.04 nests per square kilometer (Johnson et al. 2015). In 2014 5 nests were located in the CD North subarea, 7 were in the CD South subarea, and 11 were in the Northeast Delta subarea (Johnson et al. 2015). Productivity of tundra swans on the Colville Delta Special Area was very low in 2014. During the 2014 brood-rearing survey, only 14 tundra swan broods were observed in the Colville Delta Special Area, far fewer than the 21-year mean of 24 broods (Johnson et al. 2015). The smallest number of broods counted since surveys were initiated in 1992 was 13, in 2013. Apparent nesting success was 61 percent (14 broods/23 nests), in contrast to the long-term mean of 71 percent (Johnson et al. 2015). The mean brood size in the Colville Delta Special Area of 2.1 young/brood in 2014 was less than the long-term mean of

2.5; the total of 29 young counted in 2014 was only half that of the mean of 58 young per year (Johnson et al. 2015).

Tundra swans on the Colville Delta Special Area used a wide range of habitats for nesting. In over 21 years of surveys, tundra swans nested in 20 of 24 available habitats, of which 9 habitats were preferred and 7 were avoided and 80 percent of the nests were found in the preferred habitats (Johnson et al. 2015). All of the preferred habitats are present in the project study area. Habitat selection also was evaluated for 498 tundra swan broods recorded on the Colville Delta Special Area since 1992. Nine habitats, all of which are found in the project study area, were preferred including high use of salt-affected or coastal habitats by brood-rearing swans reflecting an apparent seasonal change in distribution or habitat preference, in that approximately 34 percent of all swan broods on the Colville Delta Special Area were in salt-affected habitats, compared with only 19 percent of all nests (Johnson et al. 2015).

Within the NPR-A Study Area, 15 nests (0.02 nests per square kilometer) were observed in 2014 surveys, with 1 nest in the Alpine West Subarea, 1 nest in the Exploration Subarea, 2 nests in the Fish Creek Delta Subarea, and 11 nests in the Development Subarea (Johnson et al. 2015). Apparent nesting success was 67 percent (10 broods/15 nests) with a total of 10 broods recorded in the NPR-A Study Area (0.01 broods per square kilometer) with an average brood size of 2 with 8 of the broods occurred in the Development Subarea and 2 in the Fish Creek Delta (Johnson et al. 2015).

Tundra swans on the NPR-A Study Area used a wide range of habitats for nesting. Habitat selection was evaluated for 347 tundra swan nests recorded in the NPR-A Study Area since 2001 and it was determined that tundra swans nested in 21 of 26 available habitats, but preferred only 4 habitats in which 63 nests were located (Johnson et al. 2015). All of these four preferred nesting habitats occur in the project study area. Swan broods in NPR-A Study Area were attracted to large, deep waterbodies, similar to the habitats where swan broods were found on the Colville Delta Special Area. Habitat selection was evaluated for 220 tundra swan broods recorded in the northeastern NPR-A Study Area since 2001 and broods were found to have used 22 of 26 available habitats with 63 percent of all broods found in the 5 preferred habitats (Johnson et al. 2015). All five of these preferred habitats occur in the project study area.

Brant and Snow Goose

The summary presented below provides information from data collected on brant and snow geese throughout the Arctic Coastal Plain, and site-specific information collected in the project study area.

Ground-based nest searches documented nesting, brood-rearing, and fall staging of various bird species along a previously proposed road corridor between CD2, CD5, and the GMT1 pad area have been conducted (Johnson et al. 2005). These surveys were conducted 1 kilometer around proposed pad footprints for CD5 and CD6 (now known as GMT1 and GMT2), as well as 200 meters from the previously proposed road centerline between CD2, CD5, and the GMT1 pad area. Aerial surveys for brood-rearing and fall staging geese were also conducted in the NPR-A Study Area. In 2009, ground-based nest searches were conducted in a 400-meter buffer around the proposed GMT1 and CD5 pads as well as a 200-meter buffer surrounding the proposed road route between CD4 and GMT1 (Seiser and Johnson 2011).

Brant

The average annual population growth rate (total bird index) from 1986 to 2016 for brant was 1.055, indicating a positive population growth trend for this species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*).

Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data (Map 3.3-8). There are no high density concentrations of brant within the project study area and the majority of the birds are found in the lowest density contour. Estimated density index contours within the project study area range from 0-0.094 to 1.345– 2.397 birds per square kilometer and are represented in Table 3.3-7.

Table 3.3-7. Estimated density contours of brant within project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.094	113,112.3	72.5
0.095–0.329	28,175.93	18.1
0.330–0.714	12,386.53	7.9
0.715–1.344	2,313.8	1.5
1.345–2.397	0	0

Source: USFWS unpublished data 2017.

Nest surveys were conducted in 2004 in several subarea of the NPR-A Study Area. Within the road corridor study plots, 13 brant nests (1.3 nests per square kilometer) were observed and nesting success for all NPR-A Study Area study plots was moderate to high, with 76 percent of brant nests successful (Johnson et al. 2005). In 2009, two brant nests were recorded along road corridor searches (Seiser and Johnson 2011). Ground-based nest search data was used to determine habitat use during nesting for brant in 2004. In the NPR-A Study Area, nesting brant utilized shallow open water with islands or polygonized margins, and young basin wetland complex both habitat types that are contained within the project study area (Johnson et al. 2005).

Neither brood-rearing nor staging brant were observed within the project study area during aerial surveys in 2013 and 2014 (Johnson et al. 2015).

Snow Goose

The average annual population growth rate for snow geese from 1986 to 2016 was 1.243 (total bird index), indicating a positive population growth trend for this species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*). Snow geese represented the most rapid growth rate among all species surveyed on the Arctic Coastal Plain.

Snow geese nest in small numbers on the Colville River Delta (Johnson et al. 2005). During ground nest searches at CD3 (outside of the project study area) three successful snow goose nests (0.2 nests per square kilometer) were found around the proposed pad location in 2004; although, no brood-rearing snow geese were observed near CD3 in that year (Johnson et al. 2005).

Aerial brood-rearing and fall staging surveys in the NPR-A Study Area observed 60 brood-rearing snow geese (0.10 birds per square kilometer) and 96 staging snow geese (0.16 birds per square kilometer) in 2004 (Johnson et al. 2005).

Ground-based nest search data was used to calculate snow goose nesting habitat selection in 2004. In the NPR-A Study Area, nesting snow goose utilized shallow open water with islands or polygonized margins, and young basin wetland complex within the search areas (Johnson et al. 2005). Both of these habitats are present in a very small percent of the project study area.

King Eider

Information presented below provides available site-specific and Arctic Coastal Plain-wide information regarding pre-nesting and nesting king eiders, including on-shore densities, population growth rates, and habitat selection of king eiders relevant to the project study area and is supplemental to information provided in BLM (2012, Section 3.3.5.5), BLM (2004a, Section 3.3.3.2), and BLM (2014, Section 3.3.3.4), which are incorporated by reference here.

King eiders breed along the Arctic coast of Alaska and are present in the project study area. The average annual population growth rate (total bird index) from 1986 to 2016 was 1.026, indicating a positive population growth trend for this species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*).

Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data. Ninety-nine percent of the estimated density index contours within the project study area fall in the low to moderated density ranges and are shown in Table 3.3-8.

ConocoPhillips and its predecessors have been conducting aerial surveys of pre-nesting eiders in the Colville Delta Special Area for 21 years (1993–1998, 2000–2016) and the NPR-A Study Area for 16 years (1999–2014). The survey areas and survey coverage differed among years.

The number of king eiders recorded in the Colville Delta Special Area in 2014 was well above average with the indicated density in 2014 about 50 percent higher than the 21 year mean (Johnson et al. 2015). King eiders were seen in all three of the subareas, but they achieved their highest density in the Northeast Delta subarea in 2014 (Johnson et al. 2015).

King eiders were abundant in the NPR-A Study Area study area in 2014, occurring at almost three times the density recorded in the Colville Delta Special Area (Johnson et al. 2015). The indicated total number NPR-A Study Area was slightly below the 15-year mean. In 2014 the highest density of king eiders was seen in the Alpine West subarea (Johnson et al. 2015).

ABR, Inc. Environmental Research & Service surveys have recorded a positive growth rate (1.064) for king eiders in the NPR-A Study Area over the past 13 years (Johnson et al. 2015). However, in the Colville Delta Special Area, where king eiders have a small breeding presence, the growth rate is minimal (1.006) and not significantly different from 1.0 over the past 21 years (Johnson et al. 2015).

Table 3.3-8. Estimated density contours of king eiders within project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.092	24,637.0	15.8
0.093–0.268	90,380.9	57.9
0.269–0.515	40,426.4	25.9
0.516–0.953	544.5	0.3
0.954–1.800	0	0

Source: USFWS unpublished data 2017.

In 2009, ground-based nest searches were conducted in a 400-meter buffer around the proposed GMT1 and CD5 pads, as well as a 200-meter buffer surrounding the proposed road route between CD4 and GMT1. During these searches, five king eider nests were found (1.38 nests per square kilometer) (Seiser and Johnson 2011).

Pre-nesting king eiders used 19 of 24 available habitats in the Colville Delta study area over 21 years of aerial surveys preferring five habitats in the Colville Delta Special Area: Brackish Water, Salt Marsh, Salt-killed Tundra, River or Stream, and Deep Polygon Complex (Johnson et al. 2015). The high use of River or Stream, which includes the river channels primarily in the northeastern Delta Subarea, suggests that many birds were moving through to breeding areas farther east, because River or Stream is not a potential breeding habitat.

King eiders used 21 of 26 available habitats and preferred 11 habitats in the NPR-A Study Area in the 13 years of pre-nesting surveys that were used to evaluate habitat selection with Old Basin Wetland Complex and both types of Deep and Shallow Open Water the most frequently used habitats and also were preferred (Johnson et al. 2015). The preferences for and high use of Open Nearshore Water, River or Stream, and Tapped Lake with Low-water Connection are likely from birds in transit or not yet settled into nesting habitat, because the fluctuating water levels of these waterbodies make their shorelines poor locations for nesting. Six habitats are significantly avoided, which include the two most available habitats in NPR-A Study Area, Moist Sedge-Shrub Meadow and Moist Tussock Tundra (Johnson et al. 2015).

Greater White-Fronted Goose and Canada Goose

The greater white-fronted goose and Canada goose are common species along the Arctic Coast of Alaska and are present in the project study area. The summary presented below provides information from data collected on geese throughout the Arctic Coastal Plain and limited site-specific data in the project study area and is supplemental to information provided in BLM (2012, Section 3.3.5.5), BLM (2004a, Section 3.3.3.2), and BLM (2014, Section 3.3.3.4), which are incorporated by reference here.

As of 2004, the Canada goose was split into two species: Canada goose (*Branta canadensis*) and cackling goose (*Branta hutchinsii*) (Banks et al. 2004). The cackling goose is the common Canada goose species present in the project study area (Stehn et al. 2013). For the purpose of this section, “Canada goose” refers to both Canada goose and cackling goose.

ConocoPhillips and its predecessors have been conducting aerial surveys of nesting and brood-rearing geese in the Alpine Satellite Development Plan and Colville River Delta Areas since 1999 and 1992, respectively (Johnson et al. 2005). The greater white-fronted goose was included in the Alpine Satellite Development Plan wildlife study surveys because of their importance as a subsistence species (Johnson et al. 2005). The survey areas and survey coverage have differed among years.

Average annual greater white-fronted goose population growth rates of the greater white-fronted goose and Canada goose on the Arctic Coastal Plain from 1986 to 2016 were reported at 1.045 and 1.016 (total bird index), respectively, indicating a positive trend in population growth for both species (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*).

Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data. For greater white-fronted goose, density index contours within the project study area range from 0.574–1.348 to 3.643–7.312 birds per square kilometer (Table 3.3-9). Moderate to high densities of greater white-fronted goose encompass almost 80 percent of the project study area; similar to densities that are exhibited across the entire Arctic Coastal Plain (Map 3.3-8).

For Canada goose, density index contours within the project study area range from 0–0.083 to 0.543–1.016 birds per square kilometer (Table 3.3-10). Moderate to high densities of greater white-fronted goose encompass almost 35 percent of the project study area (Map 3.3-8).

Table 3.3-9. Estimated density contours of greater white-fronted goose within project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.573	0	0
0.574–1.348	31,851.1	20.4
1.349–2.323	28,856.6	18.5
2.324–3.642	33,484.6	21.5
3.643–7.312	61,796.7	39.6

Source: USFWS unpublished data 2017.

Table 3.3-10. Estimated density contours of Canada goose within project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.083	13,203.2	8.5
0.084–0.256	89,155.9	57.2
0.257–0.542	52,540.7	33.7
0.543–1.016	1,088.9	0.7
1.017–1.920	0	0

Source: USFWS unpublished data 2017

Three species of geese nested on the 40 10-hectare plots in the CD5 area in 2014 with greater white-fronted geese being the most abundant nesting waterfowl (28.7 nests/square kilometer), followed by Canada Geese (5.8 nests/square kilometer), and snow geese with 1 nest (Johnson et al. 2015). On the same plots in 2015 greater white-fronted geese were the most abundant nesting waterfowl (30.2 nests/square kilometer) with nesting densities that have increased annually through the period of the study (2013–2015) and Canada geese were second in abundance (5.5 nests/square kilometer) (Rozell and Johnson 2016).

In 2009, ground-based nest searches were conducted in a 400-meter buffer around the proposed GMT1 and CD5 pads as well as a 200-meter buffer surrounding the proposed road route between CD4 and GMT1. Within the CD5 nest survey area, eight greater white-fronted goose nests were reported and no Canada goose nests, while within the GMT1 nest survey area, no nests were found for either species. Along the proposed road segments, a total of 55 greater white-fronted goose nests were reported, with approximately 73 percent found along the segment of proposed road between CD4 and the NPR-A boundary (Seiser and Johnson 2011).

White-fronted geese nested in six habitats found on the nest plots in the CD5 area, though 83 percent of these nests were in just three habitats: Old Basin Wetland Complex, Patterned Wet Meadow, and Moist Sedge-Shrub Meadow and all habitats were used in proportion to availability and no habitat types were preferred or avoided (Johnson et al. 2015). Canada geese nested in four habitats, with most nests located in close proximity to waterbodies in the wetter habitats available (Johnson et al. 2015).

3.3.3.5 Shorebirds

The summary presented below provides information from data collected on shorebirds throughout the Arctic Coastal Plain and limited site-specific data regarding nesting densities, nesting success, population growth rates, and habitat selection for shorebirds that occur in the GMT2 Project area. This information supplements BLM (2012, Section 3.3.5.6), BLM (2004a, Section 3.3.3.6), and BLM (2014, Section 3.3.3.5), incorporated by reference here.

The average annual population growth rate for all shorebird species (shorebirds were not identified to the species level in this survey) was 1.039 (total bird index) from 1986 to 2016 (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*), indicating a positive population growth trend for shorebirds in general along the Arctic Coastal Plain.

A number of shorebird species were observed during ground-based nest searches conducted within breeding bird study plots and large waterbird survey corridors along a previously proposed road corridor between CD2 and the GMT1 pad area, and the GMT2 pad area proposed in BLM (2004a) (Burgess et al. 2003; Johnson et al. 2004; Johnson et al. 2005). During the period 2001 to 2004, pectoral sandpiper (24 nests, 10 nests per square kilometer) and semipalmated sandpiper (19 nests, 7.9 nests per square kilometer) were among the most common breeding shorebird species detected during the surveys (Burgess et al. 2003; Johnson et al. 2004; Johnson et al. 2005). Between 2002 and 2004, the five most abundant shorebird species within these same study plots were the pectoral sandpiper, semipalmated sandpiper, long-billed dowitcher, red- necked phalarope, and red phalarope. American golden plover, stilt sandpiper, dunlin, and bar-tailed godwit were also observed (Johnson et al. 2005). Overall shorebird nest density for all study plots in 2004 was 38.3 nests per square kilometer, with nesting success estimated at 63 percent (64 percent and 60 percent in 2002 and 2003, respectively) (Burgess et al. 2003; Johnson et al. 2004; Johnson et al. 2005).

Four shorebird species nesting in the project study are listed by USFWS as Birds of Conservation Concern: whimbrel, bar-tailed godwit, dunlin, and buff-breasted sandpiper. Ground-based nest searches conducted in a portion of the GMT2 Project area between 2001 and 2004 recorded dunlin nests each breeding season at densities ranging from 1.3 to 2.5 nests per square kilometer (Burgess et al. 2003; Johnson et al. 2004; Johnson et al. 2005). Bar-tailed godwit nests were recorded in 2001 to 2003 at densities ranging from 0.4 to 1.7 nests per square kilometer (Burgess et al. 2003; Johnson et al. 2004). A bar-tailed godwit nest was also observed in 2009 along a study corridor between CD4 and the NPR-A Study Area A boundary (Seiser and Johnson 2011). Buff-breasted sandpiper nests were recorded only in 2002 at a density of 2.5 nests per square kilometer (Burgess et al. 2003). Whimbrel nests were not observed during nest surveys, but individuals are reported to have been observed as part of various bird surveys in the NPR-A (Johnson et al. 2005).

The red knot is a medium-sized shorebird listed as a BLM Sensitive Species. The breeding range in Alaska is only generally known. Within the NPR-A the red knot is a rare migrant on both the Chukchi Sea and Bering Sea coasts, but has been recorded breeding in small numbers near Utqiagvik (formerly Barrow) (BLM 2012). Nest surveys in both the Colville River Delta and NPR-A found no evidence of this species in the area (BLM 2004). Red knots were not surveyed in 2011 studies (Johnson et al. 2012).

Habitat selection for shorebirds varies depending on species and life stage. In general, habitats used by shorebirds for breeding, nesting, and brood-rearing differ from those used for pre-migratory staging (Connors and Connors 1982). Many shorebirds nest and rear broods in tundra habitats, then migrate to coastal littoral zone habitats for pre-migratory staging (Connors and Connors 1982). Using results of bird surveys and habitat information, Saalfeld et al. (2013) developed habitat suitability models for several shorebirds that breed on the Arctic Coastal Plain. In general, the suitability of breeding habitat for most shorebirds increased at lower elevations, suggesting that many shorebirds may favor wet or moist lowland habitats. Results of these habitat suitability models were generally consistent with observations of the regional spatial distributions of breeding shorebird populations (Johnson et al. 2007). For example, most breeding shorebirds on the Arctic Coastal Plain are observed more frequently near the coast than in the foothills of the Brooks Range (Johnson et al. 2007), and the low elevation wetland habitats that are generally preferred by several shorebirds are often located near the coast (Saalfeld et al. 2013).

After breeding, but prior to their southern migration, many shorebirds stage on coastal littoral habitats where they forage and develop fat stores (Connors and Connors 1982). Species such as black-bellied plovers, red phalaropes, red-necked phalaropes, ruddy turnstones, and sanderlings tend to prefer gravel beach habitats, while dunlin and semipalmated sandpipers tend to prefer mudflats (Taylor et al. 2010). Other shorebird species tend to stage on salt marshes or the edges of ponds. Habitat preferences are likely influenced by prey availability, feeding mechanics, and foraging strategies (Connors et al. 1981).

3.3.3.6 Raptors

Raptors are birds of prey that include falcons, hawks, eagles, and owls. Raptors that occur on the Arctic Coastal Plain, and therefore may be present within the project study area, are discussed in BLM (2012, Section 3.3.5.7), BLM (2004, Section 3.3.3.5), and BLM (2014, Section 3.3.3.6), incorporated by reference here.

The gyrfalcon and the snowy owl are the only raptors known to overwinter in the NPR-A; all other raptors migrate south to overwinter (Johnson and Herter 1989). Arctic peregrine falcons, gyrfalcons, merlins, golden eagles, and rough-legged hawks nest on cliffs along the Colville River and other rivers in the Arctic foothills region of the NPR-A where suitable habitat is present (Swem et al. 1992; Ritchie et al. 2003). Although, the bluffs along the lower reaches of the Colville River and adjacent wetlands are important raptor nesting habitat, they are well outside of the GMT2 Project area; nearby bluff habitat is limited to small silt bluffs along the GMT2 Project area streams and some lakeshores. All of these species do use the general area to some extent for hunting during nesting and/or migration. The closest documented peregrine falcon nesting activity in 29 years of ground-based surveys is approximately 7 miles southeast of the proposed GMT2 pad (BLM 2012). However, because peregrine falcon numbers have increased substantially in the past 20 years and have begun to use lake bluffs and other coastal habitats, not all suitable nesting habitat for peregrine falcons has been covered by the ground or aerial surveys in the GMT2 Project area (Ritchie et al. 2003; Ritchie 2014). Residents of Nuiqsut reported nesting peregrine falcons on the lower reaches of Fish Creek (BLM 2014) and at least one small bluff site on lower Fish Creek has been used for nesting by peregrines in recent years (Ritchie 2014). This nest site is approximately 8 miles northeast of the western boundary of the GMT2 Project area.

The golden eagle occurs in NPR-A as a migratory species and is listed as a BLM Sensitive Species. The northern distribution limit of the breeding range for the golden eagle is the northern foothills of the Brooks Range. The closest documented golden eagle nesting activity in 29 years of ground-based surveys is approximately 100 miles from the GMT2 Project area boundary along the drainages of the Chandler and Sagavanirktok rivers in the Brooks Range foothills (Wildman and Ritchie 2000). Golden eagles, predominantly subadults, have been reported in the Arctic Coastal Plain during spring and summer seasons (McIntryre et al. 2008; Ritchie 2014), and local residents in the Nuiqsut area have reported occasional eagle sightings in the GMT2 Project area (BLM 2014). Golden and bald eagles have been recorded preying on yellow-billed loon nests in the NPR-A Study Area (Johnson et al. 2015).

The snowy owl, short-eared owl (a BLM Sensitive Species), and northern harrier, all ground- nesting species, are widely dispersed and nest irregularly throughout the NPR-A (BLM 2012, Section 3.3.5.7). Northern harriers are fairly common visitants on the Arctic Coastal Plain (Johnson and Herter 1989), but are thought to be rare breeders. Both owl species, however, may breed more often in the NPR-A when high numbers of their cyclic small mammal prey occur (Holt and Leasure 1993; Parmelee 1992). Observations of ground-nesting raptors have been reported during ground-nest searches for large waterbirds in the GMT2 Project area. A single northern harrier nest was found in the CD4 area in 2001 (Burgess et al. 2002). One short-eared owl nest was located in the Alpine search area in 1996 and three nests were located in the CD south search area in 2001, which were the only raptor nests found in 6 years of nest searches in those areas (1996−2001) (Johnson et al. 2003b; Burgess et al. 2002). Short-eared owls and norther harriers were reported depredating loon nests in 2013 (Johnson et al. 2015).

3.3.3.7 Yellow-billed Loon

The yellow-billed loon was selected as a focal avian species due to conservation concern. It was designated as a candidate for protection under the Endangered Species Act in March of 2009 and on October 1, 2014, the USFWS made the decision that listing the yellow-billed loon under the Endangered Species Act was not warranted (*Federal Register*, Volume 79, Number 190, page 59195). The yellow-billed loon is still recognized as a special status species by the BLM and as a species of conservation concern by the USFWS. Yellow-billed loons are discussed in BLM (2012, Section 3.3.5.5), BLM (2004, Section 3.3.3.2), and BLM (2014, Section 3.3.5.3), which are incorporated by reference here.

USFWS (2014) estimated the worldwide population of yellow-billed loons to be between 16,000 and 32,000 individuals, with approximately 3,000 to 4,000 individuals breeding in Alaska's two known breeding locations: the North Slope and the area surrounding Kotzebue Sound in northwest Alaska. The estimated population growth rate for yellow-billed loons on the Arctic Coastal Plain indicates a positive trend over both the long term (1.016 for 1986−2016) and the most recent 10-year period (1.023 for 2007−2016) (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*).

Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data. Density index contours within the project study area range from 0–0.022 to 0.196–0.501 birds per square kilometer, and encompass all five density contours present on the Arctic Coastal Plain (Map 3.3-9, and Table 3.3-11). Just over half of the project study area is contained within the lowest two density bands; and less than 2 percent of the project study area lies within the highest density contour.

Table 3.3-11. Estimated density contours for yellow-billed loons on the Arctic Coastal Plain (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.022	35,526.2	22.8
0.023–0.067	47,640.6	30.5
0.068–0.124	44,646.1	28.6
0.125–0.195	25,453.7	16.3
0.196–0.501	2,722.3	1.7

Source: USFWS unpublished data 2017.

Aerial surveys covering the project area were conducted in the initial years of avian surveys from 2001−2004. During this time, very few observations of yellow-billed loon nests or broods were recorded within 1 mile of the then proposed roads or facilities for GMT1 and GMT2 (BLM 2004; Johnson et al. 2005). During 2004−2013, surveys within the NPR-A Study Area focused on the Fish and Judy Creek Corridor Subarea, Fish Creek Subarea, and Alpine West Subarea (all subareas include portions of the GMT2 Project area as described in Table 3.3-3 and Map 3.3-9 (Johnson et al. 2014). In 2014, yellow-billed loon surveys were expanded south of the Fish and Judy Creek Corridor Subarea, to include a 3-mile buffer around the proposed GMT1 and GMT2 pads labeled GMT Corridor Subarea (Map 2.1-2) (Johnson et al. 2015). Both Colville Delta Special Area Subareas relevant to the project area (CD North and CD South Subareas) have been included in aerial surveys from 1993 to 2014, with the exception of years 1994 and 1999.

Due to variation in coverage of lakes in the Colville Delta Special Area and NPR-A Study Area during the different years that nesting surveys were conducted, counts of nests were not directly comparable. Accordingly, a surrogate comprised of territory occupancy of nests (number of nests found divided by the number of territories surveyed) was calculated in order to compare annual occupation of nests. Population trends were estimated using territory occupancy by adults and territory occupancy of nests from 1993–2014 for the Colville Delta Special Area and from 2001–2014 for the NPR-A Study Area. Based on these analyses and years, the number of adults in both regions appear to have increased and 2014 nest occupancy values for both areas are above the combined year mean (Johnson et al. 2015).

In 2014, 32 nests were found within the Colville Delta Special Area, with approximately 97 percent of the nests on lakes where yellow-billed loons have nested previously with 16 nests were recorded in the CD South Subarea and 15 in the CD North Subarea making the 2014 total nest count the third highest in 20 years of surveys (Johnson et al. 2015). In 2015, 25 nests were recorded with 13 nests located in the CD North Subarea, 10 nests in the CD South Subarea, and 2 nests in the Northeast Delta Subarea with the total number of nests nearly identical to the long-term mean (Johnson et al. 2016).

In the NPR-A Study Area, 20 nests were recorded, with a single nest located in the Alpine West Subarea, 6 nests in the Fish Creek Delta Subarea, 9 nests in the Fish and Judy Creek Corridor Subarea, and 4 nests were in the GMT Corridor Subarea (Johnson et al. 2015). Nest occupancy values recorded in the NPR-A Study Area were higher than the long-term mean (77 percent and 66.2 percent, respectively) (Johnson et al. 2015). Yellow-billed loon surveys were not conducted in the NPR-A Study Area in 2015.

During brood-rearing surveys in 2014, 4 broods were found in the Colville Delta Special Area and 11 broods were found in the NPR-A Study Area (Johnson et al. 2015). Territory occupancy by broods in the Colville Delta Special Area during 2014 was 19 percent, approximately 60 percent of the long-term average for all survey years (31.1 percent) while territory occupancy by NPR-A Study Area broods was 35 percent, higher than the mean for all years of 27.8 percent (Johnson et al. 2015). In both the Colville Delta Special Area and NPR-A Study Area surveyed during 2014, less than 10 percent of the nests found were within 3 miles of the proposed GMT2 pad and road (Johnson et al. 2015).

Nesting yellow- billed loons in the Colville Delta Special Area in 2014 utilized 11 of 24 available habitats, preferring 6 which occur in the project area, while nesting yellow-billed loons utilized 13 of 26 available habitats in the NPR-A Study Area, preferring 5 which occur in the project area (Johnson et al. 2015). Yellow-billed loons nested in 12 of 24 available habitats during nesting surveys conducted in the Colville Delta Special Area over 21 years with 7 habitats, supporting 435 of 481 total nests, were preferred for nesting (Deep Open Water with Islands or Polygonized Margins, Deep Open Water without Islands, Sedge Marsh, Grass Marsh, Deep Polygon Complex, Non-Patterned Wet Meadow, and Patterned Wet Meadow) (Johnson et al. 2016).

Cameras placed at yellow-billed loon nests in both the NPR-A Study Area and Colville Delta Special Area have documented egg predation by a variety of predators including glaucous gull, parasitic jaeger, common raven, golden eagle, bald eagle, red fox, wolverine, and grizzly bear. After camera monitoring in 2008 to 2014, 47 percent of the monitored nests had predation losses of at least one egg. The results of this study also highlight the importance of minimizing human disturbance to nests, because the majority of predation occurred at unattended nests (Johnson et al. 2015).

3.3.4 Mammals

This section presents information about terrestrial mammals that occur, or are suspected to occur, in the GMT2 Project area (Table 3.3-12 and Table 3.3-13).

The project area is entirely onshore, with all facilities and pipelines located more than 5 miles from the Beaufort Sea Coast line in Harrison Bay (see Map 3.1-1). Essentially all mammals with a potential for impact are terrestrial, with the exception of the polar bear, a marine mammal (discussed in Section 3.3.5). In the unlikely event of a very large oil spill reaching coastal open water, some individual marine mammals could be present in the affected area and may be adversely affected. A brief discussion of marine mammals is provided in Section 3.3.4.2.

3.3.4.1 Terrestrial Mammals

Terrestrial mammals and their habitats are discussed in BLM (2004a; 2012; 2014). Table 3.3-12 lists terrestrial mammal species that occur in the vicinity of the GMT2 Project.

Table 3.3-12. Terrestrial mammal species known or suspected to occur in the project area

Common Name	Scientific Name	Iñupiaq Name	Size
caribou	*Rangifer tarandus*	tuttu	Large
brown bear; grizzly bear	*Ursus arctos*	akjaq	Large
moose	*Alces alces*	tuttuvak	Large
muskox	*Ovibos moschatus*	umifmak	Large
wolf	*Canis lupus*	amabuq	Large
wolverine	*Gulo gulo*	qavvik	Large
red fox	*Vulpes vulpes*	kayuqtuq; qianbaq; qibñiqtaq	Large
barren-ground shrew	*Sorex ugyunak*	ugrugnaq; ugrufnaq	Small
tundra shrew	*Sorex tundrensis*	ugrugfnaq; ugrufnaq	Small
Arctic ground squirrel	*Spermophilus parryii*	siksrik; sigrik	Small
brown lemming	*Lemmus trimucronatus*	aviffapiaq; aviffaq; aviñfauraq	Small
collared lemming	*Dicrostonyx groenlandicus*	qixafmiutaq; qixafmiutauraq	Small
singing vole	*Microtus miurus*	aviñfaq; aviffaq	Small
tundra vole	*Microtus oeconomus*	aviñfaq; aviffaq	Small
ermine (short-tailed weasel)	*Mustela erminea*	itibiaq	Small
least weasel	*Mustela nivalis*	naulayuq	Small

Source: Modified from Table B-8 of PAI (2002), including updated scientific names from recent taxonomic revisions (MacDonald and Cook 2009; Bradley et al. 2014) and inclusion of some additional Iñupiaq names (MacLean 2012). Several species considered to be rare or accidental (at the limits of their range) are omitted.

None of the terrestrial mammals reported to occur within the proposed GMT2 Project area is currently listed under the Endangered Species Act, or is on the Federal or State of Alaska Endangered Species Act lists. The BLM has identified the Alaska hare (*Lepus othus*) and the Alaska tiny shrew (*Sorex yukonicus*) as sensitive mammal species in Alaska that may occur in the NPR-A. There have been no reports of the Alaska hare on the North Slope since 1951 and no report of the Alaska tiny shrew in the NPR-A (BLM 2012). Neither species is known to occur in or near the project area.

Caribou

Caribou are present on the North Slope year-round. Four caribou herds calve on the North Slope: the Western Arctic Herd, Teshekpuk Caribou Herd, Central Arctic Herd, and the Porcupine Caribou herd. The Alpine Satellite Development Plan Study Area, including the proposed GMT2 Project area, is located at the interface between the Teshekpuk Caribou Herd and Central Arctic Herd ranges, with the Teshekpuk Caribou Herd generally ranging west of the Colville River delta and Central Arctic Herd ranging east of the delta (Lawhead et al. 2015) (Figure 3.3-1). The GMT2 Project area is on the periphery of the Western Arctic Herd range, and is not within the range of the Porcupine Caribou Herd (BLM and Minerals Management Service 2003, Lawhead et al. 2013). Therefore, the Western Arctic Herd and Porcupine Caribou Herd are not discussed further.

Teshekpuk Caribou Herd and Central Arctic Herd caribou biology, population status, seasonal ranges and distribution, migration patterns, calving, and harvest in the NPR-A are described extensively in BLM (2012). ADF&G documented this information, as well as comprehensive inventory and management activities for the Western Arctic Herd, Teshekpuk Caribou Herd, and Central Arctic Herd in Dau (2013), Parrett (2015), and Lenart (2015). ConocoPhillips has conducted a study of caribou movements and distribution in the northeastern portion of the NPR-A since 2001 (Prichard et al. 2017). Information on caribou in the Alpine Satellite Development Plan is included in BLM (2004a; 2014). The relevant content of these documents and references is summarized herein.

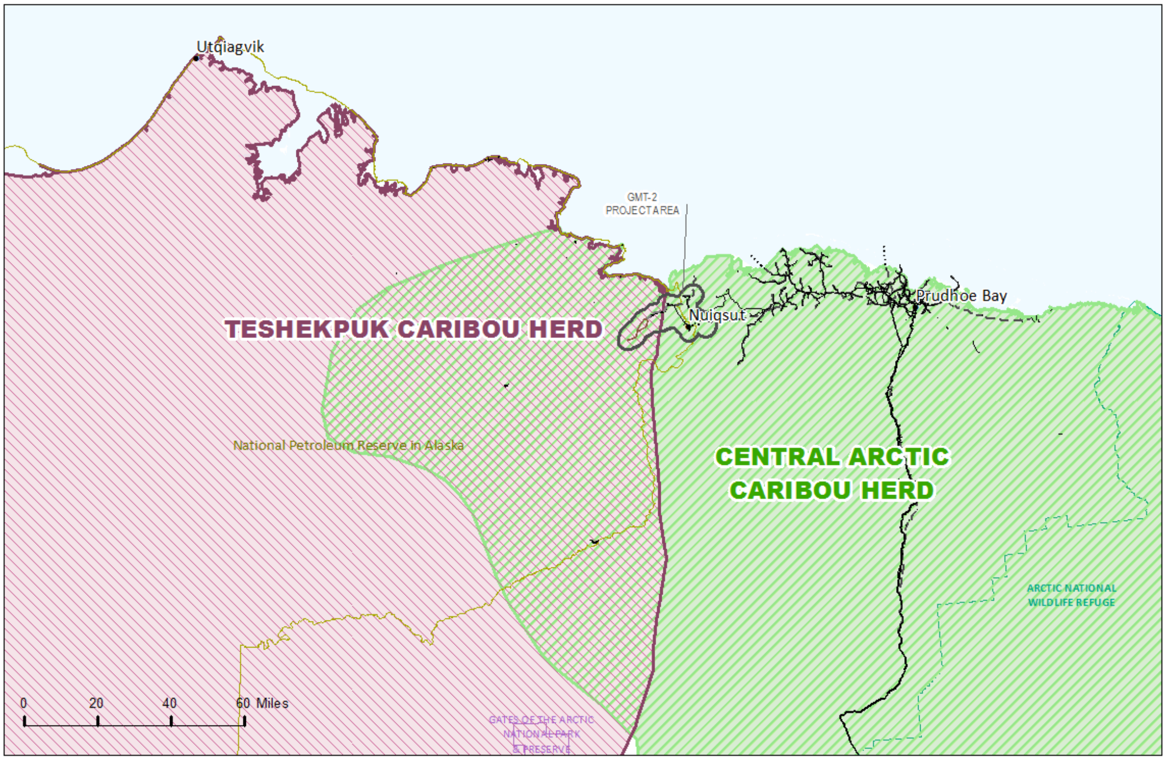

Figure 3.3-1. Teshekpuk Caribou Herd and Central Arctic Herd Total Ranges in Relation to the GMT2 Project Area.

Research Activities

Caribou calving and post-calving distribution and abundance have been surveyed between the Colville and Kuparuk rivers annually since 1993 as part of ongoing ConocoPhillips monitoring studies. In 2001, ConocoPhillips began sponsoring caribou surveys in the northeastern portion of the NPR-A in advance of the Alpine Satellite Development Project. In the construction permit for CD4 (the first Alpine Satellite Development Plan development), the North Slope Borough stipulated that a 10-year study of development impacts on caribou distribution and movements be conducted within a 30-mile radius of CD4 (referred to as the "Alpine Satellite Development Plan Study Area") (Figure 3.3-2). The study area encompasses the CD3, CD4, CD5, GMT1, and GMT2 Project areas. It also is used as both winter and summer range by the Teshekpuk Caribou Herd and as summer range for some of the Central Arctic Herd (BLM 2004a; 2012). The study began in 2005 and built on research that had been ongoing on caribou in the area since the early 1980s (Lawhead et al. 2013). The stipulation was later amended to account for additional development in the Alpine Satellite Development Plan area and, at the request of Nuiqsut residents, wording regarding the 30-mile radius was removed (Lawhead et al. 2013). The 30-mile radius is still used, however, in the monitoring study as a basis for comparing data among years.

The tenth consecutive year of the Alpine Satellite Development Plan caribou monitoring study was completed in 2014 and is summarized by Lawhead et al. (2015). ConocoPhillips has continued the study past the 10 years originally stipulated, and in 2017 published the 12th annual report encompassing the results for 2015 and 2016 (Prichard et al. 2017). The study combines results from aerial transect surveys of caribou with radio-telemetry data from collared caribou. Three areas are surveyed annually: NPR-A, Colville River Delta, and Colville East (Figure 3.3-2). The southeastern portion of the NPR-A survey area contains the proposed pipeline and road corridor to GMT2 (Lawhead et al. 2015).

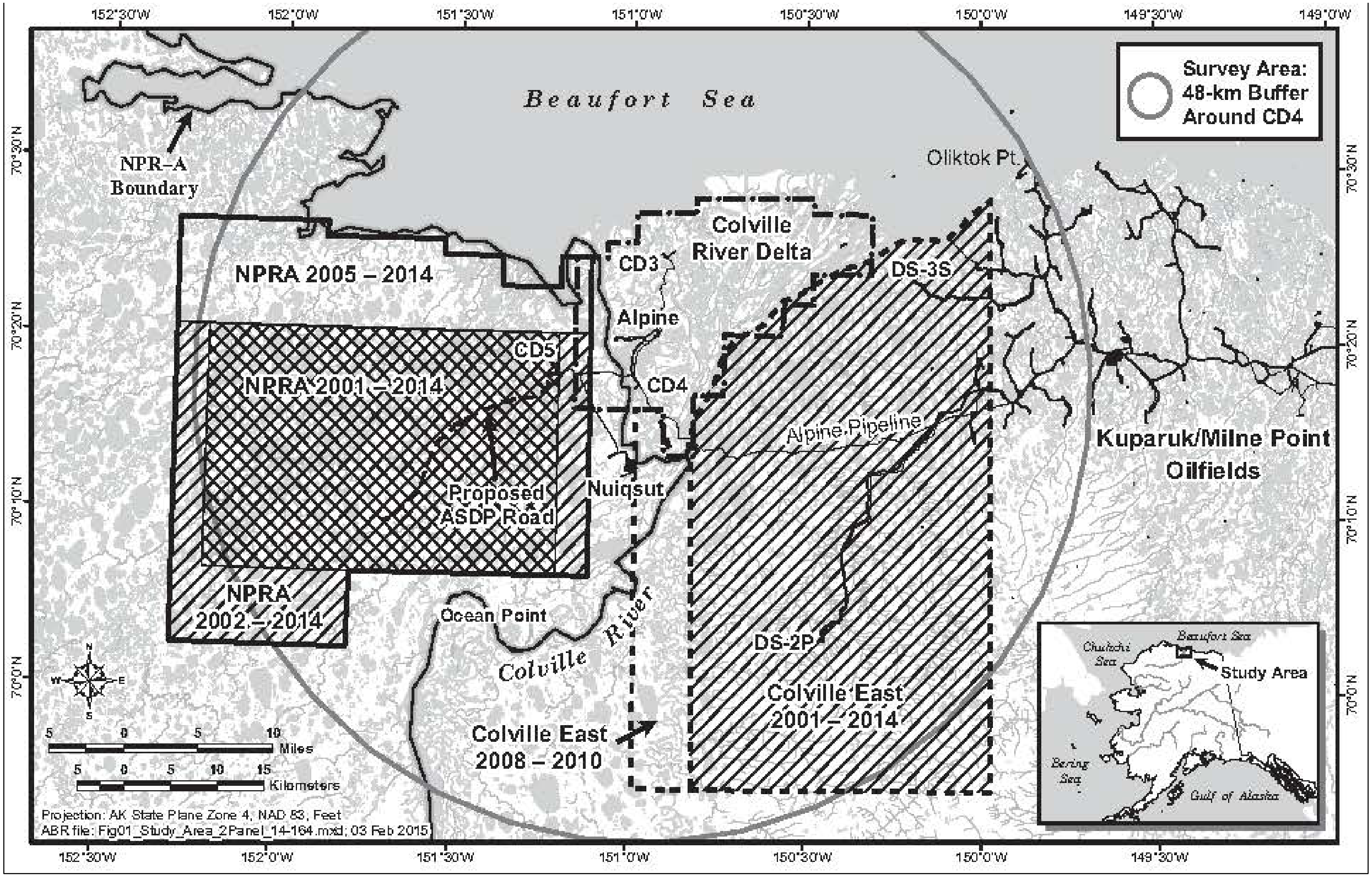

Figure 3.3-2. Location of the Alpine Satellite Development Plan Caribou Monitoring Study Area (2001−2014)

Habitat Use

Caribou use various habitats throughout their annual range during the year (Table 3.3-13). Their distribution and seasonal movements are heavily influenced by life history events (e.g. calving, migration) and environmental factors (e.g. insect harassment, plant phenology) (Lawhead et al. 2015).

During winter and early spring, the caribou diet is dominated by lichens, which are present throughout their winter range. In spring and early summer, caribou migrate north as vascular plants become available. The timing is dependent on snowmelt and temperature. Traditional calving grounds typically offer highly nutritious forage in the spring and have low densities of predators (BLM 2012). The availability of high quality and quantity of desired forage species (influenced by temperature and snow cover) probably affects specific calving locations and calving success (BLM 2012). Caribou in the NPR-A survey area generally showed selection for areas with high vegetative biomass, despite seasonal and annual variability (Lawhead et al. 2015).

Wilson et al. (2012) used telemetry data to analyze patterns of resource selection by Teshekpuk Caribou Herd caribou over the entire summer range of the herd. Patterns of selection varied from calving through post-calving and late summer, but caribou consistently avoided patches of flooded vegetation and tended to prefer areas with greater abundance of sedge-grass meadow. When insect harassment was low, Teshekpuk Caribou Herd animals primarily selected areas around Teshekpuk Lake. During the insect-harassment season (late June to early August), caribou demonstrate preference for coastal beaches, riverine sand bars and dunes (specifically along Fish Creek and Judy Creek), and coastal barrens in response to mosquito and oestrid-fly harassment (Wilson et al. 2012; Lawhead et al. 2015). Movements to these insect relief areas can be abrupt and dramatic. Although analytical methods differed, these results generally match statistical test results from aerial survey data collected in the Alpine Satellite Development Plan Study Area (Prichard et al. 2017). Prichard et al. (2017) found that from 2002-2016, caribou in the NPR-A survey area used flooded tundra significantly less than expected (based on the amount of area available) during calving, post-calving, fall, and winter. Riverine habitats were used more than expected (relative to availability) from post-calving through late summer, possibly to access areas more abundant forage and seek oestrid-fly relief and were avoided during winter.

Table 3.3-13. Caribou forage habitats within the GMT2 Project area

Caribou Life Cycle Stage	Habitat Type
Summer Forage/Calving Habitat	Moist Sedge-Shrub Meadow, Moist Tussock Tundra
Caribou Insect Relief Habitat	Barrens, Riverine
Caribou Winter Forage Habitat	Lichen-Bearing Habitats

Source: BLM (2012) and Lawhead et al. (2015).

Density and Distribution

The GMT2 Project area is located near the eastern edge of the Teshekpuk Caribou Herd range (Figure 3.3-1). Map 3.3-10 presents the seasonal utilization distribution of instrumented Teshekpuk Caribou Herd and Central Arctic Herd females using GPS and satellite tracking methods. The Teshekpuk Caribou Herd inhabits the project area throughout the year, although usually at low densities. Members of the Teshekpuk Caribou Herd demonstrate high fidelity to calving areas surrounding Teshekpuk Lake, extensive use of coastal habitat for insect relief, and broad use of the coastal plain west of the Colville River drainage in late summer (Parrett 2015). While the Teshekpuk Caribou Herd is unique in that the majority of the herd typically remains on the coastal plain through the winter, its use of winter ranges is highly variable (Parrett 2013). The only times of year when Teshekpuk Caribou Herd caribou are predictably distributed is during the insect season and late summer (Parrett 2013).

Although some Teshekpuk Caribou Herd calving occurs in the western half of the Alpine Satellite Development Plan Study Area, where the GMT2 Project area is located, it is not considered an area where concentrated calving takes place (Lawhead et al. 2015) (Map 3.3-10). Most Teshekpuk Caribou Herd females calve in the northeastern portion of the NPR-A near Teshekpuk Lake. Wilson et al. (2012) modeled land use by pregnant females during calving and found that calving was almost entirely restricted to the area surrounding Teshekpuk Lake.

Year-round Teshekpuk Caribou Herd caribou density in the NPR-A survey area is low (< 1 caribou per square kilometer), and tends to decrease from west to east (Figure 3.3-2) (Lawhead et al. 2015). From 2001-2016, the highest densities of caribou in the NPR-A survey area typically have occurred during the mosquito and oestrid-fly harassment periods in mid to late summer, and from mid-September through late October during fall migrations (Figure 3.3-3) (Prichard et al. 2017).

Teshekpuk Caribou Herd caribou density tends to be lowest in the southeastern portion of the NPR-A survey area, where the proposed GMT2 Project infrastructure would be located (Lawhead et al. 2015). The GMT2 Project area is used by the Teshekpuk Caribou Herd in winter, but the amount of use varies substantially among years (BLM 1998b, Lawhead et al. 2015). During most years, the majority of the Teshekpuk Caribou Herd winter on the Arctic Coastal Plain, sometimes including the GMT2 Project area. High densities (> 2 caribou per square kilometer) have been recorded occasionally in the NPR-A survey area during late winter (Lawhead et al. 2015).

The GMT2 Project area is located at the western edge of the Central Arctic Herd range. The majority of the Central Arctic Herd remains east of the Colville River and calves primarily in the Colville East survey area, well outside the GMT2 Project area (Map 3.3-10) (BLM 2004a; Lawhead et al. 2015). Central Arctic Herd movements into the NPR-A are uncommon; the last substantial event occurred in July 2001 when approximately 6,000 Central Arctic Herd caribou were observed moving west across the Colville River delta into the NPR-A (Lawhead et al. 2015). While overall use of the NPR-A by members of the Central Arctic Herd is low, the Alpine Satellite Development Plan Study Area does contain areas of high density utilization by the Central Arctic Herd, specifically during the mosquito and oestrid-fly seasons (Map 3.3-10).

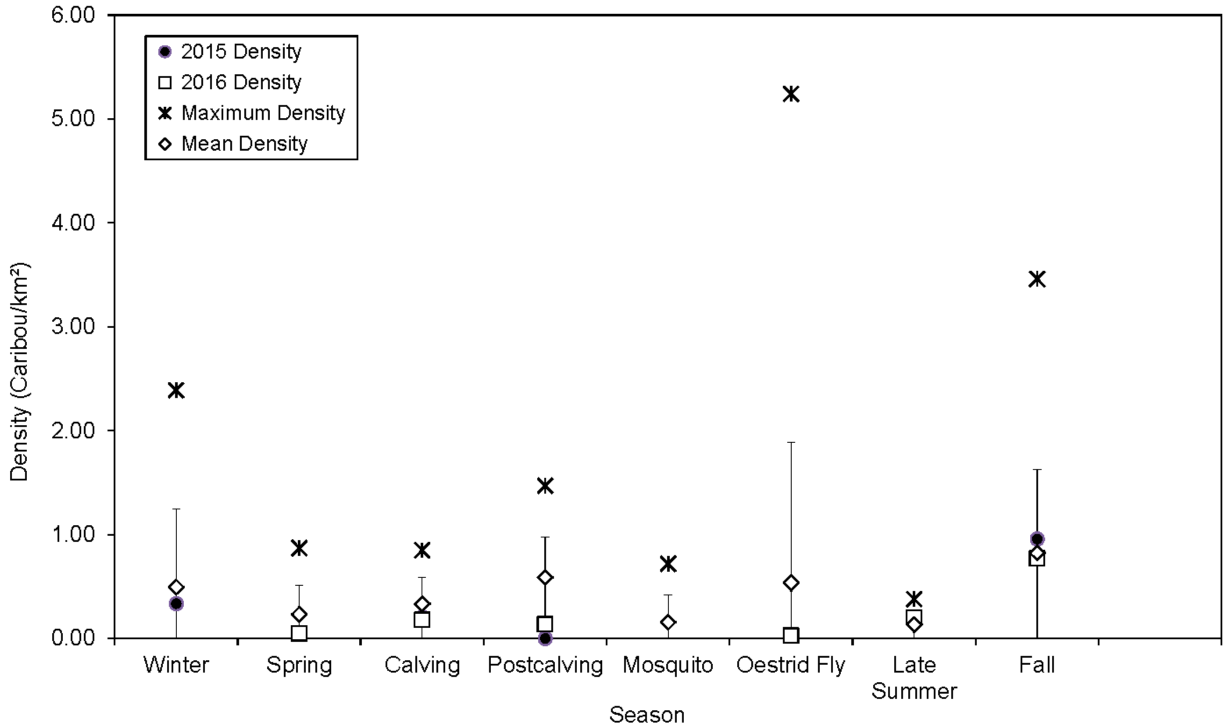

Figure 3.3-3. Caribou density observed on 100 surveys of the NPR-A Survey Area, April−October 2001−2014

Note: Error bar represents 95 percent confidence intervals.

Source: Lawhead et al. (2015), Figure 6.

Population Dynamics

Between 1984 and 2008, ADF&G estimated that the Teshekpuk Caribou Herd grew from 11,822 to a peak of more than 68,000 animals in July 2008, a rate of approximately 7% per year (Davis et al. 1979, Carroll 1992, Parrett 2011, Parrett 2015). A July 2011 photocensus estimated the herd numbered 55,704 animals (Parrett 2015), a decline of at least 19% from the 2008 estimate. A photocensus conducted in July 2013 produced an estimate of 39,172 animals (including ~7,000 animals that were mixed with the Western Arctic Herd at the time of the census; Parrett 2015), a further decrease of at least 30% since 2011. The latest photocensus in July 2015 produced a minimum count of 35,181 caribou and an accompanying estimate of 41,542 animals (Lincoln Parrett, Caribou Biologist to Peter Bente, RV Management Coordinator, "Memorandum: Summary of Teshekpuk Caribou Herd Photocensus Conducted July 6, 2015," December 31, 2015) indicating the population decline had slowed.

The Central Arctic Herd increased substantially between 1995 and 2008 at a rate of 10-13% per year, growing from 18,824 to 66,666 animals during that time (Lenart 2015). The herd size peaked in 2010, when ADF&G estimated that there were 68,442 animals. Since 2010, the herd has declined. The population size was 50,753 in 2013 and decreased by over half to 22,630 caribou in 2016 (Lenart 2015, ADF&G 2016).

Both the Teshekpuk Caribou Herd and Central Arctic Herd have undergone recent changes in size, demography, and distribution. Both populations have declined, in part due to decreased survival of adults and calves during the prolonged winter of 2012-2013 (Lawhead et al. 2015). The Teshekpuk Caribou Herd has declined in recent years due to a combination of high adult (specifically female) mortality and low calf production (Parrett 2015). The underlying mechanisms of increased mortality and decreased calf production are not totally understood, but are likely related to poor nutrition, difficult winter weather conditions, high calf predation, and nutritionally-mediated risk of predation (Parrett et al. 2014).

Overlap of the Teshekpuk Caribou Herd with the Western Arctic Herd and Central Arctic Herd can be extensive during fall and winter. Movement between the Teshekpuk Caribou Herd and Western Arctic Herd, and the Teshekpuk Caribou Herd and Central Arctic Herd has been a persistent feature of these herds (Person et al. 2007). The calving distribution of the Teshekpuk Caribou Herd has recently expanded to the west and southeast, potentially increasing the rates of emigration to other (specifically the Western Arctic Herd and Central Arctic Herd) herds (Parrett et al. 2014, Lawhead et al. 2015). While emigration and immigration between these herds have been consistently documented (Prichard et al. 2001, Yokel et al. 2009, and others), they are thought to play a minor role in contributing to changes in herd population size (Lenart 2015).

Muskox

The history, distribution, and habitat preferences of muskoxen are described previously in BLM (2012). Muskoxen historically occurred throughout northern Alaska, but no longer occur consistently in what is now the eastern NPR-A. Their population in northeastern Alaska was re-established by translocation to Barter Island and the Kavik River in 1969 and 1970. As their numbers on the Arctic Coastal Plain increased, their range expanded westward to the Colville River and eastward to the Babbage River in Yukon Territory.

Although small numbers of muskoxen have occasionally been observed west of the Colville River, they are neither regular nor abundant in the project area. Muskoxen have been noted in the Colville River Delta area since 1993. In 2012, one group moved west into the NPR-A, but the group evidently fell through thin ice and drowned in a lake (Lawhead et al. 2015). In previous years (2005−2007) a group of muskoxen were observed between the Kalikpik River and the Fish Creek Delta (Lawhead et al. 2013). Although the current North Slope population of muskoxen is reportedly stable or in slight decline (Arthur and Del Vecchio 2013), the population on the central North Slope could potentially expand into the GMT2 Project area. According to Danks (2000), suitable habitat exists in the northeastern portion of the NPR-A, although near the project area there are no ridges where winds can minimize snow depths in winter as on the western North Slope where muskoxen have been established since the 1970s (Harper 2013).

Moose

The occurrence of moose on the Arctic Coastal Plain, including the GMT2 Project area, was discussed previously by BLM (2004a; 2012). Moose occur at low densities on the Arctic Coastal Plain, which is at the northern limit of their range in Alaska (BLM 2004a). Moose are widely distributed, but generally found in areas with shrub vegetation. During the summer they range from the northern foothills of the Brooks Range to the coast of the Arctic Ocean. As snow accumulates in autumn, moose move to riparian corridors of the larger river systems, where they are relatively concentrated during winter. The largest winter concentrations of moose occur in the inland portions of the Colville River drainage (BLM 2004a). As noted by BLM (2004a), only five moose were seen at Colville Village during eight years (1992–1998 and 2001) of observations by the Helmericks family. To the southwest, moose have been recorded sporadically in the NPR-A Survey Area near Fish Creek (Lawhead et al. 2009, 2014a).

Grizzly Bear

The density of grizzly bears is lower (0.5–2.0 bears per 1,000 square kilometers) on the Arctic Coastal Plain than in the mountains and foothills of the Brooks Range. The factors that influence grizzly bear density throughout the NPR-A were discussed by BLM (2004a; 2012). A study carried out between 1999 and 2004 marked 25 grizzly bears and documented their dens in the Colville River Delta, the Fish Creek and Judy Creek Deltas, and other riparian areas in and near the GMT2 Project area (BLM 2004a).

Incidental observations of grizzly bears and their dens have been recorded during surveys for caribou and fox dens since 2001 throughout the Alpine Satellite Development Plan Study Area (Johnson square kilometer et al. 2005; Lawhead 2014b). The GMT2 Project area and adjacent areas of the northeastern portion of the NPR-A provide good habitat for grizzly bears, with suitable well-drained denning habitat and ground squirrel habitat (BLM 2004a, citing Shideler 2004, *personal communication*).

Fox

The Arctic fox is the most common furbearer in the GMT2 Project area as well as on the Colville River Delta and adjacent coastal plain. A discussion of Arctic fox population status, diet, habitat, and denning was presented by BLM (2004a). Arctic fox populations fluctuate with the availability of prey species (e.g., lemmings and voles) and the occurrence of rabies epidemics. For denning, they prefer well-drained soils (e.g., riparian or upland shrub habitat), including banks of lakes and streams, drained lake basins, and pingos. During fox den surveys conducted in 2001–2004 (BLM 2004a; Johnson et al. 2005), Arctic foxes were observed regularly in the GMT2 Project area.

Red foxes are also found in the GMT2 Project area, but generally in lower numbers than Arctic foxes. According to local knowledge, the number of red foxes has increased recently, corresponding with warmer winters (BLM 2012). A similar increase has been documented in the oilfields east of the Colville River (Stickney et al. 2014). Red foxes use denning habitats similar to those used by Arctic foxes. Red foxes are aggressive toward Arctic foxes, will displace them from feeding areas and den sites, and may even kill them if the opportunity arises (Johnson et al. 2005; Stickney et al. 2014).

Wolf

Wolves occur in the GMT2 Project area, but are uncommon (Lawhead et al. 2013; Johnson et al. 2005; BLM 2012). In general, wolves are more abundant in the Brooks Range than on the Arctic Coastal Plain, probably because of better prey availability in the foothills and mountains, limited den sites on the Arctic Coastal Plain, and rabies outbreaks and hunting pressure on the coastal plain (BLM 2004a). In 1993, the population estimate for all of Game Management Unit 26A, which is all of the North Slope west of the Itkillik River watershed, was 240 to 390 wolves in 32 to 53 packs (BLM 2012). The highest wolf densities in the NPR-A are reported along the Colville River. Surveys near Umiat showed that the wolf density increased from 2.6 wolves per 1,000 square kilometers in 1987 to 4.1 wolves per 1,000 square kilometers in 1994 (Bente 1998).

Wolverine

Wolverines may occur in the GMT2 Project area, but are uncommon (Lawhead et al. 2013, 2014b; Johnson et al. 2005; BLM 2012). BLM (2004a) summarized records of wolverines in the Alpine Satellite Development Plan Study Area. Two wolverines were seen in the NPR-A survey area in 2013 (Lawhead et al. 2014b). Wolverines occur across the Arctic Coastal Plain but are more common in the mountains and foothills of the Brooks Range (Bee and Hall 1956; BLM 1998a). In 1984, an estimated fall population of wolverines in Game Management Unit 26A (includes the NPR-A) was 821 individuals, based on a density of one wolverine per 54 square miles (BLM 2004a). Wolverines have large home ranges and use a broad variety of habitats, including tussock meadow, riparian willow, and alpine tundra (BLM 1998b). Studies in Canada and Scandinavia have shown that wolverines are more abundant in rugged areas protected from anthropogenic development and that they were less likely to occur at sites with oil and gas exploration, forest harvest, or burned areas (Fisher et al. 2013, May et al. 2006). May et al. (2006) hypothesized that wolverine distribution may be partly influenced by direct disturbance or higher risk of human-caused mortality associated with infrastructure. And that increased human development and activity in once remote areas may thus cause reduced ability of wolverines to perform their daily activities unimpeded, making the habitat less optimal or causing wolverines to avoid the disturbed area.

Small Mammals

Data on the abundance of small mammals in the GMT2 Project area are not available, but all species listed in Table 3.3-14 are likely to be present. Small terrestrial mammals are important prey for predatory birds and mammals in the region. Arctic ground squirrels hibernate during winter, whereas lemmings, voles, and shrews are active throughout the year. Many small mammal species have cyclical population fluctuations. Arctic ground squirrels, lemming, voles, and shrews use a variety of habitat types (BLM 2004a, 2012).

3.3.4.2 Marine Mammals

Marine mammals are described in BLM (2004a, 2012, 2014). Marine mammals listed under the Endangered Species Act are discussed in Section 3.3.5. Marine mammals (common name, scientific name, and Iñupiaq name) addressed in this section are listed in Table 3.3-14, below.

Table 3.3-14. Marine mammals that are reported to occur along the coast of Harrison Bay, in the Colville River Delta, or in the Beaufort Sea offshore north of the GMT2 Project area (not threatened, endangered, or candidate species)

Common Name	Scientific Name	Iñupiaq Name [a]
spotted seal	*Phoca largha pallas*	qasigiaq
bearded seal	*Erignathus barbatus*	ugruk
ribbon seal	*Phoca fasciata* or *Histriophoca fasciata* [b]	qaigullik
beluga whale	*Delphinapterus leucas*	sisuaq
gray whale	*Eschrichtius robustus*	abvibluaq
minke whale	*Balaenoptera acutorostrata*	None
narwhal	*Monodon monoceros*	None
harbor porpoise	*Phocoena*	None
killer whale	*Orcinus orca*	aabluq

[a] Source of Iñupiaq: http://www.alaskool.org/language/dictionaries/Inupiaq/dictionary.htm (Webster and Zibell 1970).

[b] *Phoca fasciata* are also referred to as *Histriophoca fasciata* due to a taxonomic debate about how closely ribbon seals are related to harbor, spotted, and ringed seals (Alaska Department of Fish and Game 2008).

The following marine mammals may be found along the coast of Harrison Bay or in the Beaufort Sea north of the project area:

- The spotted seal may be seasonally present along the coast of Harrison Bay and in the Colville River Delta (BLM 2012). Spotted seals are generally distributed along the continental shelf, where their seasonal habitats include pack ice and land-based haul outs.
- Although bearded seals may be present throughout the year in the Beaufort Sea, the population in Alaskan waters is largely migratory with most individuals overwintering in the Bering Sea (Allen and Angliss 2013).
- The Beaufort Sea stock of beluga whales may be seasonally present along the coast of Harrison Bay on rare occasions. Available evidence suggests that beluga whales show a preference for deeper waters (600 feet to 6,500 feet depth) during spring and fall migrations to and from summer grounds in the north and eastern Beaufort Sea (BLM 2008a). However, belugas do occasionally occur in coastal shallow water (brackish and marine) for periods of molting, thermal benefits for calves, or in pursuit of prey items (BLM 2012).
- Other marine mammals that occasionally occur in the Beaufort Sea include ribbon seal, gray whale, minke whale, narwhal, harbor porpoise, and killer whale. The coastline of Harrison Bay north of the GMT2 Project area is either too shallow or outside the normal range of these mammals.

The marine mammals listed above which may be found near shore in Harrison Bay were described and evaluated by BLM (2014) who determined that these species were unlikely to sustain impacts. All project facilities and the project area are entirely inland with no facilities, pipelines, or activities related to the project occurring on or immediately adjacent to the marine coastal zone. As a result, the risk of impact to marine mammals is very low and these species will not be considered further in this analysis.

3.3.5 Threatened and Endangered Species

Three species listed as threatened under the Endangered Species Act are reported to occur or have the potential to occur in the GMT2 Project area (listed in Table 3.3-15): spectacled eider; Steller's eider; and polar bear. Threatened and Endangered species are discussed in BLM (2004a, 2012, 2014), incorporated by reference here.

Bowhead whale (*Balaena mysticetus*) and ringed seal (Arctic subspecies; *Phoca hispida hispida*), which may be found near shore in Harrison Bay, were described and evaluated by BLM (2014) which determined they were unlikely to sustain impacts from the GMT1 development. Bowhead whales are listed as endangered under the Endangered Species Act and ringed seals are listed as depleted under the Marine Mammals Protection Act. All project facilities and the GMT2 Project area are entirely inland, with no facilities, pipelines, or activities related to the project occurring on or immediately adjacent to the marine coastal zone. As a result, the risk of impact to bowhead whales and ringed seals is very unlikely and these two species will not be considered further in this analysis.

The Pacific walrus (*Odobenus rosmarus divergens*) is the only subspecies of walrus occurring in Alaskan waters; its current range is the Bering, Chukchi, and Beaufort seas, but it is rare east of Point Utqiagvik (formerly Barrow) (Garlich-Miller et al. 2011). It is an Endangered Species Act candidate species considered extralimital in the southern Beaufort Sea (Marine Mammals; Incidental Take during Specified Activities: Final Rule, *Federal Register* volume 76, 47010–47054, August 3, 2011, page 47040). Furthermore, all project facilities are inland and unlikely to affect mammals in the marine environment. Accordingly, the Pacific walrus is not considered further in this analysis.

In the 2011 Programmatic Biological Opinion for Polar Bears, Polar Bear Habitat, and Conference Opinion for the Pacific Walrus on Beaufort Sea Incidental Take Regulations, which includes the GMT2 Project, the USFWS notes that the probability of a large spill to marine waters is considered to be "very unlikely to occur and cannot be said to be reasonably expected to occur" (USFWS 2011a).

The three Endangered Species Act-listed species described in this section are listed in Table 3.3-15. The following sections describe the general ecology, including occurrence or likelihood of occurrence in the proposed GMT2 Project area for those species. Additional information is provided in BLM (2004a, 2012, 2014), incorporated by reference here.

Table 3.3-15. Threatened, endangered, or candidate species documented or potentially occurring in or near the GMT2 Project area

Common Name	Scientific Name	Iñupiaq Name	Likely to Occur in GMT2 Project Area	Conservation Status
Spectacled eider	*Somateria fischeri*	qavaasuk	Yes	Threatened
Steller's eider	*Polysticta stelleri*	igniqauqtuq	No	Threatened
Polar bear	*Ursus maritimus*	nanuq	Yes	Threatened

3.3.5.1 Polar Bear

The polar bear was listed as threatened under the Endangered Species Act in May 2008 in response to sea-ice habitat loss associated with climate change (73 *Federal Register* 28211). Dependent on sea ice for survival, climate change-induced reduction in sea ice is the bear's largest overall threat. Mortality from in situ anthropogenic factors like hunting and defense of life will likely exert considerably less influence on future polar bear population outcomes, while stressors such as trans-Arctic shipping, oil and gas exploration, and point-source pollution appear to impose little risk to the long-term persistence of polar bears (Atwood et al. 2016).

In December of 2010, designation of critical habitat for the polar bear (denning and feeding) was established for more than 187,000 square miles of coastal Alaska habitat (75 *Federal Register* 76068−76137). In January 2013, the designation was vacated by the Alaska District Court (USFWS 2013), but that ruling was reversed by the U.S. Ninth Circuit Court in 2016. The three habitat units of that critical habitat include sea ice habitat extending east from the international dateline to Canada, barrier islands along Alaska's coast within the range of the polar bear, and terrestrial denning habitat extending 5 miles inland from the coast from Utqiagvik (formerly Barrow) to the Kavik River and 20 miles inland from the Kavik River to Canada. No part of the GMT2 Access Road/pad infrastructure is in any of these three units, and critical habitat will not be further considered in this analysis.

Two subpopulations of polar bears occur in Alaska, the Chukchi/Bering Seas subpopulation and the Southern Beaufort Sea subpopulation. While animals from the Southern Beaufort Sea subpopulation are more likely to occur in the GMT2 Project area, animals from the Chukchi/Bering Seas subpopulation may also occur occasionally in that area. The Chukchi/Bering Seas subpopulation was estimated at 2,000 animals in 2002 and 2006 (USFWS 2013). Recent population estimates for the Southern Beaufort Sea subpopulation have a range of values from 1,500 animals in 2006 with a 95 percent confidence interval of 1,000 to 2,000 (USFWS 2013) to approximately 900 animals in 2010 with a 90 percent confidence interval of 606 to 1212 individuals (Bromaghin et al. 2015). A combination of declining survival, recruitment, and body size (Regehr et al. 2006, 2010; Rode et al. 2010) during years of reduced sea ice (2004 and 2005), combined with an overall declining population growth rate of 0.3 percent per year from 2001 to 2005 (Hunter et al. 2007) suggest that the Southern Beaufort Sea subpopulation is in decline.

Polar bears occur in maritime and coastal zones throughout the year, with specific life cycle events dictating location and timing. Reliant on sea ice for the majority of their hunting habitat, polar bear populations are sensitive to sea ice loss in optimal habitat locations (Durner et al. 2009). Polar bears use sea ice for hunting, feeding, breeding, maternity denning, resting, and long-distance movement. Additionally, polar bears use terrestrial habitats for maternity denning, scavenging, resting, and travel between marine habitats (Regehr et al. 2010). During late autumn to early spring, polar bear range is extensive and includes pack ice, land-fast ice, and land (BLM 2004a, 2012). Denning and birthing periods occur from late October through early April. Potential terrestrial denning habitat is defined as having topographic features with greater than or equal to 8 degrees slope and greater than or equal to 1.3 meters in height, which provide conditions for drifting snow (Durner et al. 2013). The majority of maternal dens located between the Kavik River and Utqiagvik (formerly Barrow) were found to occur within 5 miles of the coast (Amstrup and Gardner 1994), thus the 5-mile width of the terrestrial denning habitat unit of critical habitat. A study by Schliebe et al. (2008) found Barter Island to have the highest on-shore concentration of polar bears, followed by Utqiagvik (formerly Barrow) and Cross Island, all located well outside of the GMT2 Project area. On-shore polar bear densities are greatly influenced by the presence of whale carcasses, as they provide an increasingly important protein source as sea ice extent diminishes (Bentzen et al. 2007).

Potential polar bear denning habitat, sightings, and den locations in relation to the proposed GMT2 Project area are shown in Map 3.3-11. The nearest den locations reported are more than 2 miles from infrastructure associated with the proposed GMT2 Project (Durner 2010) (Map 3.3-11). All proposed GMT2 facilities are outside of the area designated critical for denning or feeding. In the GMT1 Biological Opinion, USFWS noted that while polar bears may be present in the GMT1 Action Area, they are expected to occur infrequently, with the highest numbers occurring in the portion of the action area closest to the coast (USFWS 2014a). The GMT2 Action Area would be even further inland.

3.3.5.2 Spectacled Eider

The spectacled eider was listed as a threatened species under the Endangered Species Act in May 1993. The listing was prompted by declines in the western Alaska breeding population and indications of a decline on the North Slope of Alaska. There is no critical habitat designated for spectacled eiders on the North Slope; all designated critical habitat is in western Alaska and in nearshore and offshore areas in Norton Sound, Ledyard Bay and the Bering Sea between St. Lawrence and St. Matthew Islands (66 *Federal Register* 9146−9185). The status of the North Slope spectacled eider population prior to the start of the Arctic Coastal Plain aerial survey in 1992 is unknown. An estimate of 3,000 pairs was made for the pre-1993 Arctic Coastal Plain population based on data from limited migration and ground studies (Dau and Kistchinski 1977). Since 1992, aerial surveys for many waterbirds, including spectacled eider, have been conducted across the Arctic Coastal Plain each year. Aerial surveys have been conducted within the avian study series in the Colville Delta Special Area for 21 years (1993−1998, 2000−2015) and in the NPR-A Study Area for 14 years (1999−2006 and 2008−2014). Ground-based eider nest searches in the Colville River Delta (CD2, CD3, CD5, Alaska Clean Seas spill-response sites) have been conducted for 6 years (2009−2014) and in the NPR-A Study Area since 1999 (1999−2004, 2009, 2013−2014) (Seiser and Johnson 2014; Johnson et al. 2015); these studies provide recent site-specific data for the GMT2 Project area.

The following summarizes data collected throughout the Arctic Coastal Plain, and site-specific data available for on-shore densities, population growth rates, site-specific habitat selection, and nesting locations, for spectacled eiders in the GMT2 Project area. This discussion is supplemental to information provided in BLM (2012, Section 3.3.5.5), BLM (2004a, Section 3.3.3.2), and BLM (2014, Section 3.3.5.1), which are incorporated by reference.

The estimated population (total index) for spectacled eider on the Arctic Coastal Plain for the period 1992 through 2016 is 7,030 birds with a slightly negative average annual population growth rates in both the long term (0.990 for 1992 to 2016) and short term (0.996 for 2007 to 2016) (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*). The confidence interval around both of these growth rates includes positive values and as such, they do not indicate a significant decline. Spatial distribution of eiders during the 2012–2015 survey period shows the highest concentrations of birds occurring within approximately 40 miles of the coast mostly south of Utqiagvik and north and northeast of Teshekpuk Lake (Map 3.3-12).

Estimated density indices of spectacled eider across the Arctic Coastal Plain are presented in Map 3.3-12. Newly estimated density indices for the Arctic Coastal Plain using the latest 4 years of data (2012–2015) have been generated by USFWS (USFWS, *unpublished data* 2017) and these updated density indices were used to select estimated densities within the project study area by using a GIS analysis of density contour data (Table 3.3-16).

Density index contours within the project study area range from 0–0.034 to 0.035–0.101 birds per square kilometer, encompassing the lower three density contours present on the Arctic Coastal Plain (Table 3.3-16). Most of the project study area (65 percent) is contained within the lowest density band; and none of the project study area lies within the three highest density contours, suggesting that spectacled eiders are not found in high densities within the project study area.

Table 3.3-16. Estimated density contours of spectacled eider within the project study area (2012–2015)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0–0.034	101,406.3	65.0
0.035–0.101	54,582.5	35.0
0.102–0.193	0	0
0.194–0.330	0	0
0.331–0.780	0	0

Source: USFWS unpublished data 2017.

The overall population growth trends for spectacled eiders specifically surveyed within the Colville Delta Special Area (21 survey years) are slightly positive but not statistically significant at 1.01 (Johnson et al. 2015). Within the Colville Delta Special Area, the average indicated density for pre-nesting spectacled eiders over a 21-year study period (1993−1998, 2000−2014) is 0.10 birds per square kilometer (Johnson et al. 2015). Surveys conducted in 2014 indicate higher than average indicated densities at 0.14 birds per square kilometer and the CD North Subarea continued to exhibit the highest concentration of pre-nesting spectacled eiders at 0.29 birds per square kilometer (Johnson et al. 2015). Spectacled eiders were near average in abundance on the Colville Delta Special Area in 2015, with densities of both total indicated and observed spectacled eiders (0.11 indicated total birds/square kilometer and 0.12 observed birds/square kilometer) similar to mean values recorded over 22 years (Johnson et al. 2016). The CD North Subarea contained 96 percent of the spectacled eiders observed in 2015, whereas the CD South subarea contained none (Johnson et al. 2016). The density of spectacled eiders in the CD North Subarea during 2015 (0.25 indicated birds/square kilometer) was about twice the density on the much larger Colville Delta Special Area. The distribution of spectacled eiders in 2015 was typical of previous years, when densities have been highest north of Alpine and low south and northeast of Alpine (Johnson et al. 2016).

The overall population growth trends for spectacled eiders specifically surveyed within the NPR-A Study Area (13 survey years) are slightly positive but not statistically significant at 1.05 (Johnson et al. 2015). Compared with 14 previous years of pre-nesting surveys, the density of spectacled eiders in the NPR-A Study Area was near average in 2014 with the density being only 21 percent of the density on the Colville Delta Special Area (Johnson et al. 2015). Over the entire NPR-A Study Area spectacled eider densities were 0.02 observed birds/square kilometer and 0.03 indicated birds/square kilometer in 2014 (Johnson et al. 2015). Spectacled eiders were observed only in two subareas (Alpine West and Fish Creek Delta subareas) in the NPR-A Study Area in 2014, with the highest density in the Alpine West Subarea (0.14 indicated birds/square kilometer) (Johnson et al. 2015). The mean density distribution also shows high densities have occurred in the Alpine West area near the Colville River, as well as near the coast and Fish and Judy creeks in the western portions of the NPR-A Study Area (Johnson et al. 2015).

In 2014, ground-based nest searches for eiders were conducted in select areas of the Colville Delta Special Area and NPR-A Study Area (Seiser and Johnson 2014). These ground-based nest searches have been conducted for the past 6 years in preparation for planned tundra activity during nesting season (Seiser and Johnson 2014). Nest search areas included pads and road routes from CD2 to CD3, Alaska Clean Seas spill response sites in the northern Colville River Delta, and the ice road route from CD4N to CD5. The majority of the area where the ground-based work took place in 2014 lies greater than 5 miles from the proposed GMT2 pad and road (Seiser and Johnson 2014). During the 2014 nest survey, no spectacled eider nests were found within the bounds of the project study area and all observed spectacled eider nests were north along the CD3 ice road route and in search areas around the CD3 pad and airstrip (Seiser and Johnson 2014). There were no nests of spectacled eiders found along the ice road route between CD4N to CD5.

Pre-nesting spectacled eiders used 17 of 24 available habitats during 22 years of aerial surveys on the Colville Delta Special Area. Seven habitats were preferred (i.e., use significantly greater than availability,

$P \leq 0.05$) by pre-nesting spectacled eiders: three primarily coastal salt-affected habitats (Brackish Water, Salt Marsh, and Salt-killed Tundra), three aquatic habitats (Deep Open Water with Islands or Polygonized Margins, Shallow Open Water with Islands or Polygonized Margins, and Grass Marsh), and one terrestrial habitat (Deep Polygon Complex) (Johnson et al. 2016). Deep Polygon Complex, which consists of a mosaic of small, deep, polygon ponds with relatively narrow vegetated rims and sometimes with islets, is notable because of its disproportionate use; it was used by 29 percent of the spectacled eider groups yet was available on only 2.7 percent of the Colville Delta Special Area (Johnson et al. 2016). Six habitats were avoided (use significantly less than availability), including Open Nearshore Water, Tidal Flat Barrens, River or Stream, Moist Sedge-Shrub Meadow, Tall, Low, or Dwarf Shrub, and Barrens, all other habitats were used in proportion to their availabilities (Johnson et al. 2016).

Pre-nesting spectacled eiders used 13 of 26 available habitats in the NPR-A Study Area over 13 years of aerial surveys (Johnson et al. 2015) preferring five habitats in the NPR-A Study Area, four of which also were preferred in the Colville Delta study area: Brackish Water, Salt Marsh, Shallow Open Water with Islands or Polygonized Margins, and Grass Marsh (Johnson et al. 2015). Two terrestrial habitats—Moist Sedge-Shrub Meadow and Moist Tussock Tundra—were significantly avoided and were notable because they occupy the majority of the study area (Johnson et al. 2015).

3.3.5.3 Steller's Eider

The Alaska breeding population of Steller’s eider was listed as threatened under the Endangered Species Act in June 1997. There is no critical habitat designated on the North Slope for Steller’s eiders; designated critical habitat is located in western Alaska and along the Alaska Peninsula.

The size of the Steller’s eider Alaska breeding population is highly variable and nesting occurs at highest densities near Utqiagvik (formerly Barrow) (BLM 2012). Historically, Steller’s eiders have used both the Arctic Coastal Plain and the western coast of Alaska as breeding grounds, but their breeding range has contracted to the western Arctic Coastal Plain (Quakenbush et al. 1995). The Utqiagvik (formerly Barrow) vicinity supports the largest known concentration of nesting Steller’s eiders in Alaska (BLM 2012). There are only three records of Steller’s eider breeding east of Admiralty Bay, approximately 30 miles east of Utqiagvik (formerly Barrow), in the last 25 years (on the Colville River Delta in 1987, in Prudhoe Bay in 1993, and inland from Dease Inlet/Admiralty Bay area in 1997) (Seiser and Johnson 2014).

The average annual population growth rate (total bird index) from 1989 to 2016 for Steller’s eider was 0.961, indicating negative population growth for this species across the Arctic Coastal Plain (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*). Due to the very small numbers of birds detected on these aerial surveys, Stehn et al. (2013) importantly notes that although showing a decline, the trend was very imprecisely estimated and that these data do not support a definitive conclusion on population trend. The population size of Steller’s eiders on the Arctic Coastal Plain is approximately 200 birds (Stehn 2014; Stehn et al. 2013; USFWS, *unpublished data*). Since 1992, aerial and ground-based nest searches have been conducted in multiple locations within and adjacent to the project study area and over almost 2 decades, no nests or indications of breeding by Steller’s eiders have been observed (Johnson et al. 2013). The only sightings of Steller’s eider in or near the project study area have been a few single males (seen in 2001 and 2007) and one pair seen on the ground in the CD North Study Area in 2001 (Johnson et al. 2013).

3.4 Social Systems

Social systems associated with the GMT2 Project were described in BLM (2004, Section 3.4) and updated in BLM (2012, Section 3.4) and BLM (2014, Section 3.4). This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location and potential socioeconomic impacts on a narrower scale.

3.4.1 Overview of Nuiqsut

Nuiqsut is located on the Nigliq (western) Channel of the Colville River, approximately 35 miles upstream from the Beaufort Sea, in an area that provides abundant opportunities for harvests of fish, land mammals, birds, and other resources. The Nuiqsut area was formerly a place where Iñupiat and Athabascans gathered to trade and fish and was also important for maintaining connections between the Nunamiut of the inland areas and the Taremiut of the coast (Brown 1979). After the passage of the Alaska Native Claims Settlement Act, a group of Iñupiat families then living in Utqiagvik resettled at Nuiqsut to live in a more traditional manner, and many of those who moved there had a family connection to the area (Impact Assessment, Inc. 1990a). Twenty-seven families from Utqiagvik (formerly Barrow) permanently resettled Nuiqsut in 1973. Since its resettlement over 40 years ago, Nuiqsut has grown to a population of 415 residents living in 114 households in 2010 (North Slope Borough 2010).

3.4.2 Cultural Resources

This section describes cultural resources of the Arctic Coastal Plain with a focus on cultural resources near the proposed GMT2 Project area. Cultural resources include human activity, occupation, and land use locations identified and inventoried through field survey, historical documentation, or oral evidence. Cultural resources include archaeological, historic, or architectural sites, structures, or places with important public and scientific uses. These resources are concrete, material places and things and may be of traditional cultural or religious importance to specified social and/or cultural groups. Cultural resources are managed for public benefit and may be (although not necessarily) eligible for the National Register of Historic Places (BLM 2004b, page 2).

Because the Alpine Satellite Development Plan and NPR-A Integrated Activity Plan EISs (BLM 2004, 2012) have already evaluated the proposed GMT2 Project (formerly referred to as CD7) and the GMT2 study area subsumes and expands that of GMT1, this section is tiered off of the Alpine Satellite Development Plan and NPR-A Integrated Activity Plan EISs. While there is some redundancy to the GMT1 Supplemental EIS (BLM 2014), this section focuses on information that is new, updated, or not included in the previous environmental impact analyses. Information for this section relies on the Alaska Department of Natural Resources Office of History and Archaeology Alaska Heritage Resources Survey database, the North Slope Borough Iñupiat History, Language, and Culture Department’s Traditional Land Use Inventory, and relevant cultural resources literature (e.g., oral histories, reports, gray literature, academic journals, etc.).

3.4.2.1 Study Area

The study area for cultural resources includes all areas where the project may directly or indirectly impact cultural materials. This analysis is tiered off the Alpine development plan (BLM 2004) and includes areas where activities in support of GMT2 may be located, including the GMT1 footprint. The direct impact analysis area represents locations subjected to direct ground-disturbing activities, including existing, proposed, and alternative development footprints for GMT1 and GMT2 (See Map 3.1-1). Cultural resources that are not in the direct path of construction and supporting activities can still be affected by project development. For example, development can provide easier access to otherwise remote and difficult-to-access archaeological site locations, resulting in increased foot or vehicle traffic. Increased traffic can intensify erosion and/or increase the chances that cultural resources will be altered or even pilfered. The indirect impact analysis area consists of the project study area and includes lands beyond existing project facilities, and proposed GMT2 development.

3.4.2.2 Data Sources

The Alaska Heritage Resources Survey and the National Register of Historic Places are the primary sources of information for historic properties in the project area; the Traditional Land Use Inventory is the primary source of Iñupiat traditional use areas. Recent cultural resources surveys of the area provide the most current archaeological site location and condition information.

While early to mid-20th century scientific and exploration expeditions to the North Slope and Arctic Coastal Plain recorded certain aspect of cultural resources in the project area, full-scale systematic cultural resources inventories of the project area began in earnest with hydrocarbon exploration during the 1970s. The results of these archaeological surveys, including locations and descriptions of discovered sites, are housed at the Alaska Heritage Resources Survey—a statewide GIS database of archaeological sites that provides locational information and coordinates, descriptions of site characteristics, features, associated artifacts, chronology and time period, National Register of Historic Places listing or eligibility status if available, site condition, and other important site information. There are, however, certain limitations to Alaska Heritage Resources Survey data. Data reported in the Alaska Heritage Resources Survey come from a variety of sources and can be inconsistent. Many of the sites were recorded before the advent of GPS technology, so reported locations and site extents are often imprecise. While ongoing efforts are underway to update the database, many of the sites have not been updated and may have been removed or destroyed since being reported, may not resemble provided descriptions, or may not be described accurately or in detail. Despite these limitations, however, “the Alaska Heritage Resources Survey files, including the GIS and map-based data, archived documents, and reports, represent the best available information for archaeological and historic site locations and extents for the project area” (BLM 2014, page 172).

Also beginning in the 1970s, following the passage of Alaska National Interest Lands Conservation Act, and concurrent to the onset of systematic culture resources field surveys, the North Slope Borough Iñupiat History Language and Culture commissioned a series of reports as part of the NPR-A field studies, the North Slope Borough Coastal Zone Management Plan, and establishment of the Arctic National Wildlife Refuge and Gates of the Arctic National Park and Preserve. These studies documented material remains, culturally significant places, recorded history and oral history accounts of Iñupiat land use in the North Slope Borough. Culturally significant locations contained in these reports were recorded in the Traditional Land Use Inventory, which is a living database that continues to be updated. The Traditional Land Use Inventory database documents places important to the Iñupiat in an effort to preserve and protect them from disturbance or destruction from North Slope development. It contains place names, landmarks, traditional land use sites, trails, travel corridors, hunting, fishing, berry picking, and other Iñupiat resource procurement sites, and other places of Iñupiat cultural significance. The Iñupiat History Language and Culture continuously updates the Traditional Land Use Inventory to also include sites used by modern Iñupiat. There are, however, limitations to Traditional Land Use Inventory data. Most of the site information is from oral histories and informant interviews, at times with imprecise reported locations and imperfect recollections. These sites often have not been verified through ground-truthing or field surveys. The reports that formed the basis of the Traditional Land Use Inventory database covered overlapping areas causing single sites to receive different designations in each report, with different Iñupiat spellings and different locations and associations based on recollections, resulting in duplication of sites and discrepancies in location and descriptions. The Iñupiat History Language and Culture, however, is in the process of resolving many of these discrepancies and transferring information to a GIS-based system. The Traditional Land Use Inventory database currently represents the best effort at integrating North Slope history, oral history, and archaeology to understand the late prehistoric and historic period use of lands by the Iñupiat, and it is the most accurate and reliable source of information regarding Iñupiat cultural sites. This analysis relies on the most current TLUI data and numbering supplied by NSB, but at times supplemented with descriptions from the 1976 TLUI and information provided by individuals familiar with the sites and their correct locations.

Dr. Rick Reanier conducted field surveys for CPAI in preparation of this development project and provided additional input for this analysis regarding site details and confirming the TLUI site locations provided by NSB. Dr. Reanier has decades of archaeological experience working on the North Slope and specifically in this area, including many surveys in support of other resource development activities near Nuiqsut. Over the years, he has worked closely with members of the North Slope communities to refine the AHRS and TLUI and has extensive, detailed knowledge of not only the region's prehistory and history, but also many family histories and their ties to historic properties throughout northern Alaska.

Reanier surveyed the proposed GMT2 development area in the summer of 2009. He began his review of the area by revisiting AHRS and TLUI records, along with his own personal database of modern sites he has identified on the North Slope. Flying at a speed and altitude of his choice, he then conducted field reconnaissance along the prospective production pad location and two potential road and pipeline routes between GMT1 and GMT2 by helicopter to observe any terrain that might have been suitable for historic or prehistoric occupants. Reanier landed at the production pad to investigate it on foot and conduct shovel testing for buried cultural remains. Per his discretion, Reanier landed to investigate other potential site areas identified within the development corridor on foot. Terrain in which cultural resources are generally less likely to be found (e.g. flat tussock and shrub tundra and wet sedge meadows) were examined primarily by helicopter, while geographic features in the APE that more commonly contain cultural resources (e.g. pingos, riverbanks, and stream crossings) were examined on foot.

Other sources of data include recent cultural resources surveys of the area (Potteret al. 2003, 2004; Reanier 2009a, 2009b, 2014a, 2014b; Reanier and Kunz 2010; Stephen R. Braund and Associates 2013) that provide the most current, up-to-date archaeological site location and condition information in the project area. Stephen R. Braund and Associates (2013) cultural resources inventories as part of the Foothills West Transportation Access Project and the ethno-historical report Nuiqsut Paisanich (Brown 1979) provide further information related to traditional use of the area by the people of Nuiqsut.

3.4.2.3 Cultural Context

The rich cultural history of northern Alaska is described in detail in BLM (2012, Section 3.4.2). BLM (2008) also provides a summary of the Northeast NPR-A cultural resources, which is summarized below as it relates to the proposed GMT2 Project. This section provides a brief chronological overview of regional cultural history and broadly distinguishes between prehistoric and historic periods in Arctic Alaska. Prehistory occurred before history could be recorded in writing. An historic period begins with the introduction of a written record and extends to the modern period, which is defined arbitrarily at 50 years before present; Alaska's historic period begins with the arrival of European explorers and their initial written descriptions of indigenous Alaskan culture.

Prehistoric Overview

The prehistoric culture history of the NPR-A mirrors the rest of Arctic Alaska and reflects a record of complex cultural transformations occurring since the end of the last ice age, and changing patterns of what people left behind allow archaeologists to identify and explain how and why cultures changed through time. For example, change can be a matter of adaptation. Starting with the first Alaskans, new technologies and ways of living allowed people to adapt to changing resources and conditions. On the other hand, change can reflect population migrations such as those that brought foreign people with unique technologies and knowledge. A brief summary of these cultures is provided here with additional detail found in Table 3.4-1.

The earliest evidence for North Slope human occupation dates to the late Pleistocene around 13,700 years ago and belongs to the Paleoindian and Paleo-Arctic traditions[2]. These populations are among the earliest human inhabitants of North America, residing north and west of the Laurentide and Cordilleran continental ice sheets that covered the majority of modern day Canada and the northern U.S. Although a point of contention still exists about if, when, how, why, and in what direction human populations moved between Alaska and open land south of the ice sheets, archaeological data suggest that at least some early North Americans traveled across Beringia, the land bridge that once existed between Siberia and Alaska when world-wide sea levels were as much as 300 feet lower than today. These early Alaskans are thought to have been primarily big game hunters that focused on large Pleistocene mammals such as steppe bison, mammoth, and horse to name a few (Anderson 1968, 1970a, 1970b, 1988; Bever 2000; Bowers 1982, 1999; Dixon 2001, 2013; Goebelet al. 2013; Hoffecker 2011; Hoffecker and Elias 2007; Kunz 1982; Kunz et al. 2003; Kunz and Reanier 1995, 1996; Reanier 1982; Young and Gilbert-Young 1994).

The ice age conditions of the Pleistocene epoch gave way to warming trends that marked the beginning of the Holocene Epoch. Starting roughly 12,000 years ago and lasting to the present day, the Holocene has been a period of substantial climatic change that significantly altered landscapes worldwide. The Arctic environment became generally warmer and wetter during the Holocene and soils favored vegetation communities better suited for these new conditions (Edwards et al. 2000; Edwards and Barker 1994; Mason and Bigelow 2008). Most of the large Pleistocene megafauna went extinct in Arctic Alaska while others such as caribou, grizzly and polar bears, musk ox, and Dall's sheep continued to flourish. The initial appearance of the Northern Archaic tradition in Alaska occurred around 7,500 years ago throughout the Brooks Range and Arctic Coastal Plain, which then dispersed south throughout Alaska and southwest Yukon. The Northern Archaic tradition represents strategic and technological innovations that helped Arctic and subarctic people adapt to the ecological changes occurring in the middle Holocene (Anderson 1988; Clark 1992; Esdale 2009; Workman 1978). Although Northern Archaic people still primarily focused on large mammal hunting, they made use of a wider range of animals than in the past, including those found in more upland areas (Lobdell 1986; Potter 2008a, 2008b, 2008c). Evidence that will link Northern Archaic people to modern populations has yet to be found, but the general consensus among Alaskan archaeologists is that Northern Archaic people were the ancestors of modern Athabascan groups in the region (Anderson 1988; Clark 1992; Potter 2008a, 2008b, 2008c, 2010; Workman 1978).

Also referred to as Paleo-Eskimo, the Arctic Small Tool tradition (ASTt) shares ties with eastern Siberia (Dikovet al. 1963; Powers and Jordan 1990; Raghavanet al. 2014; Rasmussenet al. 2010; Tremayne 2015b) and represents a wave of highly-mobile people that migrated over the Bering Sea and eastward across the Arctic. As the name implies, Arctic Small Tool tradition is characterized by small, finely-crafted stone tools that were part of a tool kit used to exploit a broad range of resources. In addition to reflecting adept caribou hunters, these sites provide the first evidence of sea mammal hunting in Alaska (Tremayne 2015b), although this was limited to pinnipeds such as seal and walrus. Arctic Small Tool tradition people were present on Alaska's Seward Peninsula by 4,500 years ago and managed to colonize the Arctic all the way to Greenland within approximately 500 years (Andreasen 1996; Slaughter 2005; Tremayne 2015a, 2015b). This rapid movement is credited to their ability to successfully exploit both land- and marine-based resources. The earliest manifestation of the Arctic Small Tool tradition was the Denbigh Flint complex (Giddings 1964; Tremayne 2015b), which was followed by the Choris (Anderson 1984, 1988; Dumond 1987; Giddings and Anderson 1986; Tremayne 2015b), Norton (Anderson 1984; 1988; Dumond 1987; Tremayne 2015b), and Ipiutak (Anderson 1988; Campbell 1962; Gerlach 1989; Larsen and Rainey 1948) cultures. While these cultures share some material similarities, they have been characterized and distinguished by the presence/absence and styling of pottery and/or finely-crafted ivory artwork (Tremayne 2015b; Tremayne and Rasic 2016).

[2] Tradition is defined as "a (primarily) temporal continuity represented by persistent configurations in single technologies or other systems of related forms" (Willey and Phillips 1958, page 37).

Until the arrival of European explorers, the Northern Maritime tradition represents the most recent human migration into Arctic North America. The early Northern Maritime tradition is manifest north of the Bering Strait by the Birnirk culture that crossed from northeast Asia roughly 2,000 years ago (Raghavan et al. 2014). First documented at its type site at Point Utqiaġvik (formerly Barrow), the Birnirk cultural phase reflects a maritime oriented people evidently following lifeways nearly identical to those of the historic Iñupiat. Their primary food supply included seals, fish, (probably) whale, caribou, and birds hunted with a variety of hunting implements. Material used to make artifacts include ground slate, chipped stone, antler, bone, ivory, clay, wood, and baleen (Anderson 1984; Dumond 1987; Giddings and Anderson 1986; Reanier 2009a).

From Birnirk came the Thule culture, which marks the development of whaling and a lifestyle centered around it. While reliant upon whaling, other marine and terrestrial animals such as seals, caribou, birds, and fish remained important to Thule subsistence. Whale hunting requires large communal participation, so communities began to consolidate into large settlements, several of which continue to be occupied today. Thule also had well-developed transport and used dog sleds and watercraft such as umiat (large boats) and sleek, highly-maneuverable kayaks. Between 1,000 and 500 years ago the Thule culture expanded and colonized the Arctic from Alaska to Greenland, replacing Arctic Small Tool tradition populations. Modern Iñupiat, Yup'ik, and Inuit people are directly descended from the Thule (Anderson 1984, 2004; Dumond 1987; Giddings and Anderson 1986; Mason 2016).

The late prehistory and history of the Arctic Coastal Plain focuses primarily on the Iñupiat of the North Slope who continued to have settlements based on hunting and gathering seasonal rounds, although small groups of Thule began establishing long-term settlements in the interior (Jensen 2016). The Taġiuġmiut (or Taremiut, Iñupiat who lived primarily along the coast) continued to rely heavily on sea mammals and fish, as well as caribou and smaller terrestrial animals. Taġiuġmiut can be compared to the Nunamiut, Iñupiat communities that lived further inland as far as the Brooks Range and relied almost exclusively on terrestrial resources (Burch 1998; Campbell 1968; Gubser 1965). In the nineteenth century, a series of "battles" and famines took place in the Interior, which caused population shifts leading anthropologists to suggest that the current ethnic boundaries may have fluctuated considerably (Burch 2005; Burch and Mishler 1995; Gubser 1965; Hall 1969; Ingstad 1954; McKennan 1935, 1965; Raboff 2001; West 1959). While direct contact with Euro-Americans may not have occurred until the mid-19th century, the Iñupiat Eskimo established trade routes to exchange goods along the coast and into the Interior for at least 100 years prior. European and Euro-American goods found at proto-historic Eskimo sites include glass beads, metal knife blades, brass and iron artifacts, musket balls and brass fittings from muskets (Anderson 1984; Reanier 2009a).

Table 3.4-1. Ancestral cultures of the NPR-A

Cultural Tradition/Age	Environment/Subsistence	Artifacts/Tools
Paleoindian Mesa and Sluiceway Complexes, Raven Bluff Assemblage 13,700–11,800 years ago	Land bridge connects Siberia and Alaska; drier and cooler than now; grassland, steppe prairie—mammoth, bison, muskox, caribou, moose, lion, short-faced bear	Bifacial, edge-ground fluted and unfluted lanceolate projectile points; bifacial knives; multi-spurred gravers; microblades with Raven Bluff
American Paleoarctic 10,300–7,500 years ago	Climate becomes warmer and wetter; tundra replaces grass; land bridge subsides; mammoth and bison gone	Microblade technology; burins; bifacial projectile points and knives
Northern Archaic 7,500–3,000 years ago	Annual temperatures similar or a bit warmer than 20th century average; dependence on big game primarily caribou, no evidence of marine exploitation	Microblade technology; notched and stemmed bifacial projectile points and knives; large scrapers
Denbigh Flint Complex 5,000–2,400 years ago (beginning of Eskimo cultural tradition)	Climate cooled slightly, drier than preceding period; caribou is primary subsistence animal; first evidence of sea mammal hunting; orientation more toward terrestrial than marine resources	Microblade technology; burins; diminutive side and end blades; flake knives; discoids; composite tools; semi-subterranean houses
Choris 3,800–2,200 years ago	Climate same as during the Denbigh Flint Complex period; caribou is primary subsistence animal, but there is increased emphasis on the hunting of sea mammals, primarily seals; most known sites are coastal; orientation slightly more toward terrestrial than marine resources	Burins; large bifacial projectile points; pottery; ground stone; bone, antler and ivory implements; semi-subterranean houses
Norton 2,600–1,800 years ago	Climate same as during the Denbigh Flint Complex period; caribou is primary subsistence animal, although seal hunting is an important aspect of the economy; generally, more oriented toward terrestrial than marine resources	Pentagonal projectile points; end and side blades; flake knives; discoids; ground stone; pottery; composite tools; antler, bone and ivory implements; semi-subterranean houses
Ipiutak 1,800–1,200 years ago	Climate slightly warmer and wetter than preceding 3,000 years; marine and terrestrial resources equally exploited; more emphasis on sea mammal hunting than previously	End and side blades; flake knives; discoids; no pottery or ground stone; composite tools; intricate ornamental ivory carvings; burials; semi-subterranean houses
Birnirk 1,600–1,000 years ago	Climate same as during Ipiutak period; coastal resources exploited more than terrestrial; more emphasis on sea mammal hunting than previously; watercraft based open water whaling begins	End and side blades; ground slate tools; ivory and antler harpoon heads; composite tools; pottery; semi-subterranean houses
Thule 1,000–400 years ago	The climate cools about the middle of this period; almost exclusively a marine orientation; whaling technology at its prehistoric peak; caribou remains an important part of subsistence economy	End and side blades; ground slate tools; ivory and antler harpoon heads; composite tools; dragfloat; pottery, semi-subterranean houses

Cultural Tradition/Age	Environment/Subsistence	Artifacts/Tools
Interior Eskimo 700–400 years ago	During most of this period the average annual temperature is cooler than previous 1,000 years; some communities begin occupying the interior to the Brooks Range almost year-round; primarily a terrestrial subsistence economy centered around caribou; some exploitation of coastal ecosystem	End and side blades; long-stemmed projectile points; pottery, bone, antler, ivory implements; ground stone, semi-subterranean houses
Historic Eskimo 400 years ago–Historic	Warming begins about 150 years ago; trade and close social bonds between coastal and interior communities; dramatic shift in aspects of subsistence economy after Euro-American contact about 125 years ago	Bifacial stone projectile points; bone and antler projectile points; metal projectile points; firearms; sod houses; Euro-American items after 1875

Note: Modified from BLM 2012, Section 3.4.2, Table 3-24.

Historic Overview

The historic period of the northwestern Arctic begins with direct encounters between the Iñupiat with European explorers along the north and northwestern coasts of Alaska. Sir John Franklin's 1826 expedition sailed along the Arctic coast westward from the McKenzie River before turning back at Returns Island just west of Prudhoe Bay (Reanier 2009a). That same year a barge from Beechey's expedition reached Point Utqiaġvik (formerly Barrow). These expeditions were the harbingers of European and Euro-American contact with Arctic Alaska's indigenous people, and the following enculturation process that continues to this day.

Contact between the Iñupiat and outsiders dramatically increased with commercial whaling beginning in 1848. From the 1850s to the 1920s, commercial Euro-American whaling activities often included an Iñupiat labor force. Many impacts to traditional lifeways, the economy, and material culture occurred as a result of commercial whaling (Vanstone 1984). Whaling persisted until the baleen market collapsed after 1910 (Spencer 1984). Foreign diseases such as Spanish influenza decimated Native populations and caused major demographic and traditional territorial shifts. Direct contact with Euro-American missionaries, who first arrived in Utqiaġvik in 1890, also led to changes in traditional religious practices and resulted in the near universal acceptance of Christianity by the Iñupiat by 1910 (Reanier 2009a).

Other Euro-American commercial interests attracted northern Native societies into the larger Western economic sphere. The fur industry sought Arctic fox pelts, which along with reindeer herding provided a brief economic boost for some Natives for nearly a decade after World War I. With prolonged contact, Euro-American trade goods entered the Native material culture realm as local populations traded for them or earned them in exchange for monetary wages. As commercial whaling and trading expanded, contact caused the disruption and eventual demise of long established Native trade networks as the Iñupiat sought western goods. By the 1920s, mass-produced items produced in the U.S. substantially replaced items of Native manufacture, resulting in Euro-American trade goods that can still be found today among sod house ruins and tent rings along the coast and inland to the foothills and valleys of the Brooks Range (Spencer 1984). The Great Depression (1929−1939) led to the decline of trapping; the trading posts closed, and a law requiring children to attend school depopulated the land as families moved to towns and villages where schools were located. Most of the Kuukpikmiut of the Colville River abandoned their highly mobile lifestyle and established permanent residences in Utqiaġvik.

The Naval Petroleum Reserve Number Four (now NPR-A) was established in 1923 with the Colville River as its eastern boundary. Oil exploration, World War II, and the Cold War (particularly the DEW Line radar bases) introduced wage labor to the mixed cash and subsistence economy. The passage of Alaskan statehood in 1959 sparked a period of critical events in the Arctic when the new state government selected 105 million acres on the North Slope and began selling oil leases.

The Iñupiat of the North Slope had been harvesting oil-soaked sod for centuries and saw the land and oil as their own natural resources. But state land selections and lease sales in Prudhoe Bay left Iñupiat on the North Slope fearful that outsiders would seize and develop their homeland, cutting local communities out of the profits. The movement for Alaska Native land claims grew significantly when the oil industry and State of Alaska made plans for the Trans-Alaska Pipeline System. After a Department of the Interior-imposed statewide freeze on land selections, the Alaska Native Claims Settlement Act was passed in 1971. The Act established 12 regional native corporations, and the Arctic Slope Regional Corporation was established for the North Slope area. The Alaska Native Claims Settlement Act divided land ownership into regional corporations that retained subsurface rights to oil and minerals and village corporations that retained surface rights and subsistence uses of the land. The Iñupiat of the North Slope incorporated the North Slope Borough in 1972 with the same boundaries of Arctic Slope Regional Corporation. The establishment of the North Slope Borough made it feasible to re-establish outlying villages such as Nuiqsut with schools and public facilities. Table 3.4-2 provides a synopsis of the regional history.

Table 3.4-2. Regional history synopsis

Time Frame	Historic Theme	Synopsis
1820s–1880s	European/Euro-American Exploration	• Begins when Captain F.W. Beechey and Sir John Franklin attempted a rendezvous at Point Utqiaġvik (formerly Barrow) • Ship crews during this period interact with coastal Iñupiat and document landscape, Iñupiaq culture, and name geographic features • Ends with the failed second Franklin Expedition rescue missions
1840s–1900s	Commercial Whaling	• Begins when the first commercial whaling vessel passes through the Bering Strait to the Arctic • Commercial whalers slaughter Arctic whale and walrus populations, introduce venereal disease and epidemics that decimate Iñupiat population, disrupt indigenous trade networks, establish on-shore whaling stations, and provide an influx of trade goods • Ends when commodities traditionally made from whale oil and baleen lose economic viability to similar products made from petroleum products and other materials (e.g., oil, corsets)
1880s–Present	Ethnographic and Anthropological Research	• Begins with U.S. Army Signal Corps establishing a camp in Utqiaġvik to document Iñupiaq culture and other scientific pursuits as part of the first International Polar Expedition • Researchers examine Iñupiaq life and cultural objects, Iñupiaq physical and cultural adaptations for Arctic survival, effects of resource development and cash economy on Iñupiaq culture • Continues today as part of Iñupiaq cultural revival, academic research, and state and Federal permitting process
1880s–Present	Military	• Begins when the U.S. Army Signal Corps sets up a scientific station at Point Utqiaġvik (formerly Barrow) • U.S. Army and Navy personnel explore major North Slope rivers documenting ethnographic, geographic, and travel route information; the military conducts oil and gas exploration of the NPR-A; the Cold War spurs the U.S. military to establish the Distant Early Warning (DEW) line in the 1950s to detect Soviet long-range bombers; end of the Cold War leads to the demobilization and removal of DEW line sites across Alaska • Continues today with increased presence of the U.S. Coast Guard patrolling the Beaufort and Chukchi seas
1890s–Present	Christian Missionaries	• Begins with Sheldon Jackson's arrival and becoming head of education • Missionaries convert Iñupiat to Christianity, build schools and hospitals, help manage reindeer herds, pressure Iñupiat to abandon traditional cultural practices; missionaries eventually singularize efforts to spreading Christianity • Continues today as missionaries seek new converts and multiple denominations continue to establish in North Slope communities
1890s–Present	Reindeer Herding	• Begins when Sheldon Jackson introduces reindeer herding to the Arctic to provide a stable food source • Incompatibility of reindeer herding with Iñupiat subsistence practices, competition between Iñupiat and non-Natives, problem-plagued governmental regulations, the checker-boarding of land ownership, and lack of communication between government and academic research and herders contribute to steady decline of reindeer herding on the North Slope (Stern et al. 1980) • Continues today in some areas of Alaska, but in a greatly reduced form than in the first half of the 20^{th} century
1890s–1970s	Centralization of Communities	• Begins with schools, post offices, trading posts, and reindeer stations altering Iñupiat settlement patterns through centralization into permanent communities

Time Frame	Historic Theme	Synopsis
		• Kaktovik permanently settled following establishment of trading post by Tom Gordon in 1923 • Anaktuvuk Pass established in 1949 following formation of regular air service, postal office, and a school • Ends with Nuiqsut, Point Lay, and Atqasuk reestablished as permanent communities in the 1970s following passage of Alaska Native Claims Settlement Act
1900s–1930s	Trapping and Trading Posts	• Begins with decline in whaling and rising importance of furs as an economic driver • Former whalers such as Charles Brower and Tom Gordon establish trading posts at Barter Island and Demarcation Point • Trading posts, combined with dramatic decreases in the caribou and Iñupiat populations, lure the remaining inland Iñupiat to settle in coastal settlements • Ends when the Great Depression lessens the demand for furs
1900s–Present	Geologic Exploration and Oil and Gas Development	• Begins with Schrader and Peters (1904) and Leffingwell (1919) geologic surveys of the Brooks Range and Canning and Colville Rivers • Early geological exploration leads the way to the creation of the NPR-A; governmental oil and gas exploration NPR-A eventually leads to private industry investigating areas of the Arctic Coastal Plain, which leads to the discovery of Prudhoe Bay and construction of Trans-Alaska Pipeline System and the Dalton Highway • Exploration continues today with the GMT1 Project and other projects across the North Slope
1930s–Present	Tourism	• Begins with the advent of airplanes and several well-known aviators traveling to Utqiaġvik including Charles Lindbergh and Wiley Post in the early 1930s • Continues today in Utqiaġvik and other North Slope communities as well as remote areas of the North Slope for hiking, sightseeing, boating, polar bear viewing, and other tourist activities

3.4.2.4 Cultural Resources in the Project Area

As shown in Table 3.4-3, 28 total cultural sites have been identified in the project area. Of those, 13 are listed only in the AHRS database (ADNR OHA 2017), nine are listed only in the TLUI (NSB 2017b), and six are listed in both. One site (HAR-00169) is listed on the NRHP, but no other determinations of eligibility for the NRHP (DOEs) have been completed for sites in the study area. The sites primarily include historic archaeological sites consisting of graves and historic settlements or camps at which the remains of sod houses, caches, ice cellars, and historic artifacts can still be found. Many of these areas are traditional locations for hunting, fishing, and trapping, and which continue to be used by modern Nuiqsut residents. Almost all of these sites are historic in nature, although artifact types (e.g., HAR-00169 and HAR-00163) and dated materials (e.g., HAR-00059) demonstrate a prehistoric presence in the study area.

The sites listed in Table 3.4-3 reflect all those located in the study area, however, several warrant some further discussion. Sites like HAR-00054, HAR-00055, and HAR-00089 have since eroded away, demonstrating the vulnerability of the archaeological record. In conversations with Nuiqsut elders, Reanier learned that TLUI site Qayaqtuaġiaq (TLUIHAR078) is erroneously plotted near the location of Sigirauk (TLUIHAR103) when, in reality, it is located approximately 3 miles to the south (Rick Reanier, personal communication 2017). Also, while Sigirauk is listed in the 1976 TLUI as being a fishing, hunting, and camping area located approximately 4 miles east of Nuiqsut, Reanier’s attempts to gather information from Nuiqsut elders about the site revealed no knowledge of the name or information about the location. No cultural remains have been found in the vicinity of the 1976 or 2017 locations, and had an archaeological site once existed there, it is likely that would have been along the bluff overlooking the Colville River and since eroded (Rick Reanier, personal communication 2017).

Of the 28 cultural sites identified in the AHRS and TLUI as being within the project area, three historic sites have been destroyed and one TLUI site could neither be confirmed nor relocated, leaving 24 AHRS and TLUI sites that are considered in the finding of effect analysis presented below.

Table 3.4-3. Cultural sites located in the GMT2 area of potential effect

AHRS	TLUI	Site Name	Site Description
HAR-00044	NA	NA	Grave marker
HAR-00053	NA	NA	Isolated human crania Iñupiat dating between 30 and 150 years ago. Site marked with a wooden cross and remains were reburied offsite.
HAR-00054	NA	NA	Commercial lifeboat of unknown age. Missing, possibly drifted out to sea
HAR-00055	NA	NA	Caribou bone. Totally destroyed: eroded into river
HAR-00059	NA	NA	Caribou rib with stone tool cut marks dating between 340-460 years old
HAR-00068	NA	NA	Sod house remains and historic artifacts
HAR-00069	NA	NA	Sod house and hunting camp remains with dog tethers, early 20th Century iron stoves remains, and historic artifacts
HAR-00070	NA	NA	Grave
HAR-00074	NA	NA	Grave
HAR-00077	NA	Oenga House	Sod house remains
HAR-00078	NA	NA	Sod house remains and historic artifacts
HAR-00089	TLUIHAR081	Nappaun	Sod house remains and buried historic artifacts at fishing, hunting, and camping location. Eroded into river by 2014
HAR-00155	TLUIHAR080	Uyaġagvik	Wooden wall tent stakes. Located near beach where stones were collected for fishing nets, site was used for hunting, fishing, and trapping
HAR-00156	TLUIHAR082	Nanuq	Sod house remains, sod quarry, storage pits, dog tethers, and scattered historic debris used by reindeer herder families
HAR-00157	NA	Niglivik 2	Sod house remains, sod quarry, storage pit, and several scattered historic artifacts
HAR-00158	TLUIHAR079	Putu	Sod house remains, sod quarry, fish curing pits, ice cellar, whale boat stern, and scattered historic artifacts
HAR-00163	TLUIHAR074	Itqiḷippaa	Graves, and many sod house remains, sod quarries, and storage pits and racks. Historic and prehistoric artifacts were found onsite
HAR-00169	TLUIHAR084	Niġliq	Location of prehistoric and historic trade fairs. Prehistoric artifacts along with historic sod house remains and graves have been discovered onsite. An historic commercial fishing camp was also later established at the location. Site is listed on the National Register of historic places
HAR-00171	NA	Qakimak	Sod house remains
NA	TLUIHAR041	Sikulium Paaŋa	Fishing and hunting area
NA	TLUIHAR063	Iḷaaniġruaq	Fishing area, hunting and camping area.
NA	TLUIHAR075	Tuiġauraq	Fishing, hunting, and trapping location
NA	TLUIHAR077	Napasalgun	Hunting and camping area
NA	TLUIHAR078	Qayaqtuaġiaq	Fishing, hunting and camping area. 2017 TLUI location is incorrect; 1976 TLUI location is more accurate
NA	TLUIHAR083	Apqugaaluk	Fishing location
NA	TLUIHAR087	Tiŋmiaqsiuġvik	Fishing area
NA	TLUIHAR061	Nuiqsut	Village site reestablished and relocated by ANLCS in 1972
NA	TLUIHAR103	Sigirauk	Fishing, hunting, and camping area as listed in 1976 TLUI. No additional information or land use knowledge is known to exist

3.4.2.5 Nuiqsut Cultural Landscape

The concept of a Nuiqsut cultural landscape was first introduced by Brown (1979) who coined it the "Nuiqsut Paisanich Cultural Landscape" and described its significance to the Iñupiat of Nuiqsut as "an approximation of their core ideas" and representing their "geographic and spiritual homeland." The cultural resources that comprise the Nuiqsut Cultural Landscape are primarily located along river corridors (particularly the Colville and Itkillik rivers and Fish Creek), in overland areas extending west of the community to Fish Creek and beyond to Teshekpuk Lake, and in coastal locations both west and east of the community. Several important components of the Nuiqsut Cultural Landscape are located within the project study area, including those associated with ongoing multi-generational customary practices that generally occur in similar locations as past historic or traditional practices. The continuation of these customary practices into current times and at modern sites within the landscape helps maintain Iñupiaq cultural identity to the cultural landscape.

Stephen R. Braund and Associates (2013) reviewed and updated the potential Nuiqsut Paisanich Cultural Landscape as part of the Foothills West Transportation Access Project using more thorough documentation standards that post-date Brown's (1979) efforts. Their report presents the Nuiqsut Cultural Landscape squarely in terms of the National Register of Historic Places and Section 106 considerations by: (1) relying on National Register terminology and considerations in describing this resource; (2) applying the National Park Service Cultural Resource Stewardship and Partnerships definition of a cultural landscape found in Page et al. (1998); and (3) following National Register Bulletin No. 38 (Parker and King 1998), Advisory Council on Historic Preservation (2012), and Alaska State Historic Preservation Office definitions and descriptions of Traditional Cultural Landscape characteristics (Stephen R. Braund and Associates 2013). The traditional cultural landscape characteristics reviewed by Stephen R. Braund and Associates (2013) and applied to the proposed Nuiqsut Paisanich Cultural Landscape include:

Land use: Land use is defined as the principal activities that have formed, shaped, or organized the landscape as a result of human interaction (Stephen R. Braund and Associates 2013, Appendix H, page 15). This refers to both historic territories and historic use areas. Historic territories are the broad region with which a particular Native group identifies with; while historic use areas are the results of systematic individual interviews aimed at identifying where people searched for and harvested resources. In both cases, Stephen R. Braund and Associates (2013, Appendix H, page 15) states that the primary Iñupiat use of the landscape is subsistence.

Circulation: Circulation is defined as the spaces, features, and applied material finishes that constitute systems of movement in a landscape; for example, paths, roads, bridges, railroads, and navigable rivers (Stephen R. Braund and Associates 2013, Appendix H, page 22). Circulation features in the project area are said to include modern and historical Iñupiat travel and trade routes. Stephen R. Braund and Associates s (2013) discussion focuses on rivers in the area as circulation features, and presents that, in general, the Colville, Anaktuvuk, Sagavanirktok, Chandler, Itkillik, Kuparuk and Toolik rivers are important circulation features in the Nuiqsut landscape.

Archaeological sites and places associated with cultural beliefs or practices (e.g., cultural sites): Cultural sites are places associated with cultural beliefs or practices, and consist of archaeological, ancestral, historic, traditional, sacred, camp, cabin, birthplace, harvest, and subsistence locations. Stephen R. Braund and Associates (2013) does not include Alaska Heritage Resources Survey or Traditional Land Use Inventory sites in their cultural site review of the landscape, although the document does recommend including Alaska Heritage Resources Survey and Traditional Land Use Inventory sites for a more thorough analysis (Stephen R. Braund and Associates 2013, Appendix H, page 35).

Cultural traditions: Cultural traditions include "practices that have influenced the development of the landscape in terms of land use, patterns of land division, building forms, stylistic preferences, and use of materials" (Stephen R. Braund and Associates 2013, Appendix H, page 30). The report generally states that natural landscape features can be associated with stories, songs, events and places; however, it emphasizes subsistence as the primary activity contributing to cultural and community identity.

Natural systems and features: Natural systems and features provide the setting in which cultural activities occur and in this regard influence the characteristics of a cultural landscape. Stephen R. Braund and Associates (2103) provides a general description of the types of natural features important to the Iñupiat: waterways such as lakes and rivers; topographic prominences, and subsistence resources. The bluffs on the Colville River around Umiat which are related to the Iñupiaq creation myth, the Colville and Anktuvuk rivers which are important travel corridors, and Galbraith and Toolik lakes are the features specifically mentioned as being important to the proposed Nuiqsut Paisanich Cultural Landscape.

The Stephen R. Braund and Associates report states that "SRB&A is not assessing the eligibility of the Nuiqsut cultural landscape for the National Register of Historic Places" (Stephen R. Braund and Associates 2013, Appendix H, page 1), and in most cases their report remains vague on how the characteristics described above are elements that contribute to the National Register of Historic Places significance of the proposed landscape. The integrity of these elements, both physical and cultural as well as National Register of Historic Places criteria considerations, remain unevaluated.

Land use includes both historic territories and historic use areas. As described in the data sources section, the Traditional Land Use Inventory is the best source of Iñupiat ethno-historical land use sites, and the Alaska Heritage Resources Survey contains the best available information for archaeological and historic site locations and extents for the project area. In order to mitigate redundancies and discrepancies inherent to early data sources which would skew the analysis, the unrefined sources utilized by Stephen R. Braund and Associates (2103) to identify cultural sites will not be included in the current analysis. As the Iñupiat History Language and Culture has resolved these sources' discrepancies in the Traditional Land Use Inventory, the Traditional Land Use Inventory remains the best source of information for Iñupiat cultural sites related to the Nuiqsut Paisanich Landscape. Following the recommendations by Stephen R. Braund and Associates (2013, Appendix H, page 35) landscape review, to properly evaluate the impacts of the project on the contributing elements of the proposed Nuiqsut Paisanich Cultural Landscape, the environmental consequences analysis will include only the 24 surviving Alaska Heritage Resources Survey and Traditional Land Use Inventory sites in the project area that may contribute significance to the cultural landscape in the Cultural Resources analysis. It is important to note that subsistence is evaluated as a stand-alone resource, and therefore, many of the potential environmental consequences important to the Nuiqsut Cultural Landscape are evaluated in that analysis.

3.4.3 Sociocultural Systems

This section describes the affected environment for sociocultural resources potentially affected by the project. The proposed GMT2 Project has previously been evaluated and addressed within earlier NEPA documents: (BLM 2004) and (BLM 2012) and (BLM 2015). Therefore, this section is tiered to those documents and focuses on information that is new or updated since those previous EISs. This section includes a general overview of sociocultural systems on the North Slope, particularly for Nuiqsut, including history, social organization, economic organization, community institutions, community health and welfare, and population and employment. There are two distinct populations found in the general project area: local permanent residents, a majority of whom are Iñupiaq Eskimos indigenous to the area, and oil and gas industry workers who rotate on a shift schedule and are temporary residents. This discussion focuses on the sociocultural systems of the permanent residents of the North Slope with a particular focus on the Iñupiat and on the community of Nuiqsut. Nuiqsut, located on the western bank of the Nigliq Channel of the Colville River Delta, is the closest residential community to the proposed project, 16.5 miles east of the proposed GMT2 drill pad.

3.4.3.1 Population and Employment

U.S. Census data from 2010 includes socioeconomic data on Nuiqsut, but there are other sources that the North Slope Borough and Nuiqsut residents consider more reliable and are also used in the preparation of this report. In 2010, the North Slope Borough contracted with Circumpolar Research Associates to prepare a North Slope Borough 2010 Economic Profile and Census Report, which updates demographic data for Nuiqsut. In 2012, ConocoPhillips commissioned a socio-cultural study on Nuiqsut which did not involve a community-wide survey, but was based on extensive fieldwork in Nuiqsut during the years 2012, 2013, and 2015. This report, entitled The Next Horizon: A socio-cultural study of the impact of oil development on the Native community of Nuiqsut (Redmond and Thornson 2016), also includes more reliable and current data than the 2010 U.S. Census.

Based on the 2010 North Slope Borough census data, Nuiqsut had a total population of 415 residents with Inupiaq people making up 87.7 percent of the total. Individuals under the age of 18 made up 30.7 percent of the population while individuals 18 to 64 years of age made up 66.4 percent of the total. The proportion of the labor force to the total population was 55.9 percent. The number of unemployed was approximately 29.3 percent.

The median reported household income (all households) in Nuiqsut in 2010 was $70,000; Iñupiaq household incomes were $64,196, while non-Iñupiaq household incomes were $85,600.

The Nuiqsut Trapper School is a K-12 school that is part of the North Slope Borough School District. For the 2011-2012 school year, the Nuiqsut Trapper School had an enrollment of 104 students with a graduation rate of 44 percent, below the graduation rate of 57 percent for the North Slope Borough School District (Alaska Department of Education and Early Development 2013). Ilisaġvik College in Utqiagvik (formerly Barrow) provides for advanced education in the North Slope.

3.4.3.2 Social Organization

Iñupiaq social organization traditionally revolved around the bilateral family unit and their extended kin, in addition to trading partnerships and friendships (Hall 1984). Following European and American contact, the social and political organization of the Iñupiat changed. These changes were a result of various factors including compulsory education, which led to the centralization of people into permanent villages; introduction of modern technologies, which altered residents’ methods for harvesting and processing subsistence foods; the introduction of a cash economy; the introduction of Christianity; and incorporation of the Iñupiat into new systems of laws and governing systems. Alaska Natives began forming village councils, which were reorganized under the Indian Reorganization Act. The Alaska Native Claims Settlement Act was passed in 1971 and resulted in the formation of regional and village corporations, and the North Slope Borough formed in 1972.

Despite the changes in social and political organization over time, the core of Iñupiaq social organization is similar on the North Slope today, in that it encompasses not only households and families, but also wider networks of kinship and friends, and individual family groups which depend on the extended family for support. The sharing and exchange of subsistence resources strengthen these kinship ties. In addition, despite the Christianization of the Iñupiat through missionaries, the Iñupiat maintain certain aspects of traditional Iñupiaq belief systems, which revolve around a system oriented to the environment and its animals and require that hunters follow proper hunting rituals to ensure successful harvests. For these reasons, the relationship of the Iñupiat and their natural environment remains the cornerstone of their cultural identity (BLM 2004).

The 2016 socio-cultural report on Nuiqsut (Redmond 2016) notes that much of the structure and dynamics of Nuiqsut today have changed substantially over the past 40 years, but that much of this change is the result of factors unrelated to oil development. However, sociocultural systems in Nuiqsut can be impacted by nearby oil development in a number of ways, including:

- Employment opportunities
- Increased or variable income
- Tensions relating to the permitting process for development
- Devaluation of the Nuiqsut cultural landscape
- Disruptions to subsistence resources, access, and activities

3.4.3.3 Government and Community Institutions

The people of Nuiqsut call themselves “Kuukpikmuit,” or the “People of the Lower Colville River” (BLM 2004, Section 3.4.1.2; BLM 2008b). Over 400 people reside in Nuiqsut today, the majority of whom are Iñupiat (see Section 3.4.1.6). The Native Village of Nuiqsut is a federally recognized Tribe, and the Kuukpik Corporation is the local Alaska Native Claims Settlement Act village corporation. Nuiqsut was incorporated as a second class city in 1975. Several subsistence-related organizations exist in Nuiqsut. The Kuukpik Subsistence Oversight Panel, Inc. was established in 1996 in response to development of the Alpine oilfield. The purpose of panel was to provide a method of communication between Nuiqsut residents and industry and to relay concerns to industry regarding impacts on subsistence harvesting activities. The Kuukpik Subsistence Oversight Panel, Inc. has also been involved in the establishment of resource-specific panels of experts, such as the Nuiqsut Caribou Panel and the Qaaktaq (Arctic cisco) Panel. Another subsistence-related organization is the Nuiqsut Whaling Captains Association.

The proposed GMT1 Project is within the North Slope Borough. The North Slope Borough government offices are in Utqiagvik (Utqiagvik [formerly Barrow]), the seat of government. The North Slope Borough has permit authority relevant to the proposed project. Other Federal and state agencies, including BLM who is the land manager for all non-Native land with the NPR-A, have permit authority related to the project. Nuiqsut residents, along with residents from seven other North Slope communities, are members of the regional federally recognized Tribe Iñupiat Community of the Arctic Slope and many are shareholders in the Arctic Slope Regional Corporation.

3.4.4 Economy

Oil and gas exploration, development, and production activities on Alaska's North Slope contribute to the economy of the nation, the State, the North Slope Borough, and local communities. Oil and gas development in the region supports local and non-local, direct and indirect hires, and induces jobs and generates Federal, state, and local government revenues through rentals and royalties from oil and gas leases, income taxes, property taxes, sales taxes, and other payments.

The BLM (2004, Section 3.4.2.1) describes the relationship of the oil and gas industry to the North Slope economy, the economy of the State of Alaska, and the nation’s economy. BLM (2012, Section 3.4.11) provides a more recent and detailed account of the structure of the North Slope Borough economy, including the local economies affected by oil and gas development in the NPR-A, and the revenues that accrue to the Federal, state, and regional, and local governments. Because resources and activities elsewhere dilute effects to the Nation’s economy, this section does not address the U.S. economy.

The following subsections incorporate by reference economic information contained in BLM (2014, Section 3.4.3), which provided a description of the existing economic conditions in the affected environment. However, the economy of Alaska is currently different than it was when the GMT1

Supplemental EIS was produced due to oil and gas prices falling in 2015 to their lowest prices in years. Declining state revenues have resulted in cuts to public spending that have affected many Alaskans.

The information presented in the following subsections provide an update of the economic data and is the most current (using 2014, 2015, and 2016 data) regarding condition of the affected economies at the state, regional, and local level.

3.4.4.1 Economic Organization

The Iñupiat traditionally participated in an economy that relied on subsistence resources and trading to acquire goods not readily available in their immediate area. The economy of the North Slope underwent major changes beginning in the mid-19^{th} century, when commercial whaling introduced a new type of economy to the Iñupiat. The whaling industry was followed by other economic developments, including reindeer herding, fur trapping, military development, and oil and gas exploration and development.

The Iñupiat of the North Slope continue to rely on subsistence resources while also participating in the cash economy. Like other communities on the North Slope, Nuiqsut has a mixed economy of subsistence and cash, where families invest money into small-scale, efficient technologies to harvest wild foods (BLM 2008b). These investments (e.g., gill nets, motorized skiffs, all-terrain vehicles, and snowmachines) are not oriented toward sales or profits, but are used to meet the needs of families and small communities. The contribution of subsistence harvests toward the mixed subsistence-cash economy is substantial, with documented per capita harvests in Nuiqsut ranging from 399 (in 1985) and 742 (in 1993) pounds. Subsistence activities have economic, social, cultural, and nutritional value for Nuiqsut residents.

The primary sources of wage employment in Nuiqsut are the North Slope Borough (including the school district), the Kuukpik Corporation, and the City of Nuiqsut. Craft sales are also a small part of Nuiqsut's economy.

The Kuukpik Corporation, Nuiqsut's village Alaska Native Claims Settlement Act Corporation, was established in 1973 and owns the surface rights to approximately 137,880 acres of land near Nuiqsut, including portions of the Alpine oil field which is located approximately 8 miles from the community. The corporation receives royalties for the use of its land, and its subsidiaries provide oil support services. The corporation has approximately 250 enrolled shareholders who receive dividends. Some shareholders are not residents of Nuiqsut and some are not North Slope Iñupiat; they may be Alaska Natives from other regions or non-Natives who have inherited or received gifted shares. Native children born after 1971 may not be shareholders in the Kuukpik Corporation (may not have inherited or received gifted shares) or may not be full shareholders, therefore they do not receive dividends (or full dividends) (see Chapter 4, Section 4.4.2 Sociocultural Systems).

Industrial development in the vicinity of Nuiqsut consists of oil production infrastructure. ConocoPhillips operates the Alpine production facilities that include ongoing drilling and production operations, processing facilities, wells and pipelines, camp facilities, gravel roads and airstrip, communications and power generation, sanitation utilities, warehouses, and other oil field support facilities.

The North Slope Borough owns and operates a 4,300-foot airstrip in Nuiqsut. For about 4 months per year (commonly January through April), ice roads connect Alpine and Nuiqsut to the Kuparuk and Prudhoe Bay road system. This allows residents of Nuiqsut to travel by road vehicle back and forth to urban centers during ice road season. Residents commonly drive for the convenience or cost savings over air travel for health reasons, for vacations, and to buy vehicles and other goods and drive them to their community. No other Inupiaq community on the North Slope has this ability, although residents increasingly drive to and from Utqiaġvik over packed snow trails or on the sea ice. Snowmachines are also used for local transportation in the winter, and boats and four-wheelers are a source of transportation during the snow-free months. A non-industrial gravel road (the Nuiqsut Spur Road) connects with the Alpine road system, facilitates oil field training and employment opportunities for residents, and improves road access for subsistence activities.

The Kuukpik Alaska Commercial Company store provides commercial goods including groceries, general merchandise, propane, diesel, and gasoline. Except for winter access by ice road, the majority of goods are transported to Nuiqsut by air.

Colville Village is the Helmericks' family homestead on Anachlik Island, on the northeast side of the Colville River Delta. Established in the mid-1950s, primarily as a commercial fishing operation, this site consists of several homes, a lodge, an airstrip, aircraft hangers, warehouses, barn, workshops, and other outbuildings. Family members still use the homestead but the commercial fishing business is no longer operational.

3.4.4.2 Regional Economy: North Slope Borough

The North Slope Borough is the Nation's largest oil-producing county, and oil and gas exploration and development play the central role in the borough's economic profile. Oil and gas property taxes are the primary source of revenue for the North Slope Borough government. The North Slope Borough projected $370 million in oil and gas property taxes in 2016, accounting for about 99.8 percent of the total property tax collected by the North Slope Borough that year. This amount accounts for approximately 96 percent of the total general fund revenues (North Slope Borough 2016). With significant oil and gas property tax revenues, the North Slope Borough has been able to finance construction projects through its Capital Improvement Program. The North Slope Borough government also provides a wide range of public services to all of its communities; the North Slope Borough's actual operating budget in fiscal year 2016 amounted to about $384.4 million.

Oil production at Prudhoe Bay, Kuparuk, and Alpine Fields and satellite fields account for most of the oil production activities in the region. More recent oil and gas industry activities on the North Slope include ConocoPhillips' exploration at Rendezvous and Tiŋmiaq/Willow, Hilcorp's Liberty project, Caelus' Oooguruk nearshore project (development currently suspended) and exploration in Smith Bay, ENI's offshore Nikaitchuq project (development currently suspended), ExxonMobil's Point Thomson development project, Repsol's Ugruk exploration in the Colville Delta, and Armstrong/Respol's Nanushuk project. These industry projects have and will continue to contribute to the North Slope economy through taxes, oil field services contracts, and other indirect and induced effects of industry spending in the region. The indirect effects from government and industry spending have expanded the private support sector in the region. In 2014, the North Slope Borough produced 174.5 million barrels of oil on both state-owned and federally managed land (U.S. Extractive Industries Transparency Initiative 2016). Annual oil production in the borough peaked in 1988 (at 722 million barrels) and has steadily declined since (U.S. Extractive Industries Transparency Initiative 2016).

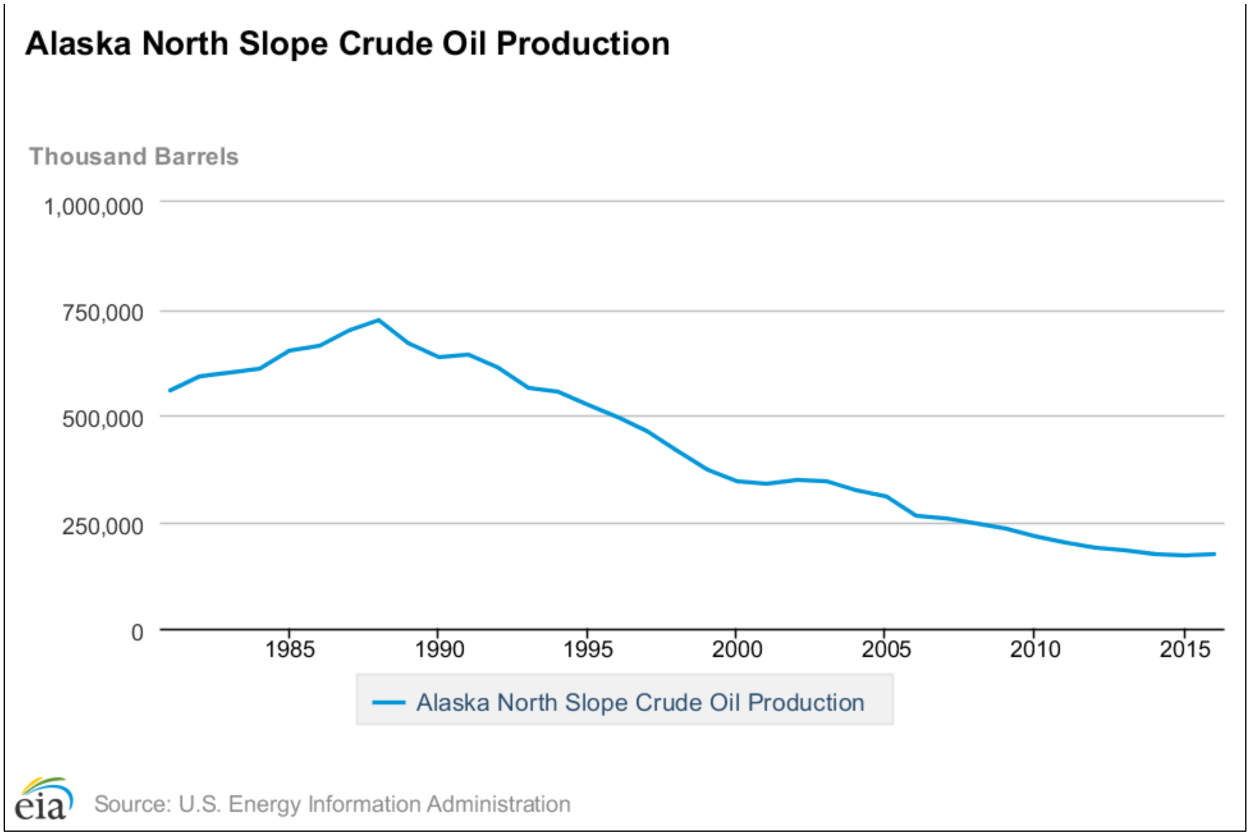

Figure 3.4-1. Alaska North Slope crude oil production

Despite the importance of oil and gas exploration and production to the North Slope Borough, extremely few residents hold jobs directly in the industry. In 2012, there were 8,459 oil industry jobs on the North Slope; residents of the North Slope filled 69 positions (Alaska Department of Labor and Workforce Development 2013). In 2015, 1.8 percent of all jobs held by North Slope residents were in the oil and gas industry and only 14 percent of people who worked in the North Slope Borough were North Slope residents (Alaska Department of Labor and Workforce Development 2016a). More than 20,000 people commuted to the North Slope in 2014 to work in jobs directly and indirectly related to oil and gas. Of those, 40 percent came from outside of Alaska, and most of the remaining 60 percent were from Anchorage or the Matanuska-Susitna Borough (Alaska Department of Labor and Workforce Development 2016a)

The local government sector (primarily the North Slope Borough government) is the largest employer of North Slope residents. In 2016, the local government sector employed 1,986 residents, accounting for 59 percent of the resident workers in the region. The next largest employment sector is trade, transportation, and utilities, accounting for about 9 percent of the resident working population (Table 3.4-4).

The Alaska Native Claims Settlement Act regional and the village corporations in the North Slope are also important economic players in the region, employing local residents, participating in the oil and gas service industry, and creating additional wealth in the region.

A portion of the Alaska Native Claims Settlement Act corporations' profits goes to shareholders in the form of dividends. Arctic Slope Regional Corporation is the regional Alaska Native Claims Settlement Act Corporation that is owned by, and represents the business interests of, the North Slope Iñupiat. For nearly two decades, Arctic Slope Regional Corporation has been the largest Alaskan-owned and operated company based on revenues. Arctic Slope Regional Corporation is also the largest private landowner in Alaska, holding title to approximately 5 million acres of land on the North Slope. Most of Arctic Slope Regional Corporation lands are rich in subsurface oil, gas, coal, and base metals. Arctic Slope Regional Corporation focuses on energy and Federal contracting, generating $2.6 billion in revenue during 2014. Its annual average dividend to shareholders hit a high of $10,000 in 2013, but declined to an average of $5,000 because the corporation is heavily invested in oil support industries and has been hit by lower prices and dwindling production (Alaska Department of Labor and Workforce Development 2016a).

Table 3.4-4. 2015 North Slope Borough resident employment by industry

Industry	Number of workers	Total Employed (%)
Local Government	1,986	59.1
Educational and Health Services	312	9.3
Trade, Transportation and Utilities	289	8.6
Professional and Business Services	288	8.6
Construction	163	4.9
Leisure and Hospitality	79	2.4
Other	78	2.3
Natural Resources and Mining	61	1.8
Financial Activities	47	1.4
State Government	27	0.8
Information	18	0.5
Manufacturing	10	0.3

Source: Alaska Department of Labor and Workforce Development (2016b).

Arctic Slope Regional Corporation Energy Services, Inc., a wholly owned subsidiary of Arctic Slope Regional Corporation, provides an array of oilfield engineering, operations, maintenance, construction, fabrication, regulatory and permitting, and other services for some of the world's largest oil and gas companies. The company has emerged as one of Alaska's largest oilfield service providers and one of Alaska's largest private-sector employers (Alaska Department of Labor and Workforce Development 2011; Arctic Slope Regional Corporation 2017). Petro Star, Inc., another subsidiary of Arctic Slope Regional Corporation, is the only Alaskan-owned refining and fuel marketing operation in the state (Arctic Slope Regional Corporation 2017).

Village Alaska Native Claims Settlement Act corporations in the North Slope Borough also are active in the oil and gas sector. The oilfield service company UMIAQ, LLC, a division of Ukpeaġvik Iñupiat Corporation (the village corporation for Utqiaġvik), and Kuukpik Corporation, the village corporation for Nuiqsut, for example, provide camp services and catering to ConocoPhillips's Alpine development and BP's offshore Northstar field.

Federal statute requires that 50 percent of the money received by the Federal government from sales, rentals, bonuses, and royalties on leases issued in the NPR-A be paid to the State of Alaska. The monies are to be used by the State of Alaska for (a) planning, (b) construction, maintenance, and operation of essential public facilities, and (c) other necessary provisions of public service. The State of Alaska is required to prioritize allocation of these funds to cities or boroughs most directly or severely impacted by development of oil and gas leases (Alaska Department of Commerce, Community, and Economic Development 2016). NPR-A impact grants are a critical component of the economy of the North Slope Borough and the individual communities that are eligible to apply for and receive the funds (Utqiaġvik, Wainwright, Atqasuk, Anaktuvuk Pass, and Nuiqsut). Since leasing in the NPR-A restarted in 1998, over $157 million has been awarded to NPR-A communities for various projects through the NPR-A Impact Mitigation Grant Program. Over $75 million has been awarded to the North Slope Borough for projects benefiting the entire NPR-A region (Alaska Department of Commerce, Community, and Economic Development 2016).

The North Slope Borough is concerned about the economic impacts of changing North Slope population dynamics. The increased school age population is a positive sign of growth for the North Slope Borough population, but it has a negative effect on the regional economy. From 2010–2015, the 0 to 15 age cohort grew 3 percent, but the 16 to 64 age cohort (the normal labor force) declined by 3.8 percent. The segment of the population over 65 grew by 0.6 percent. These shifts change dependency rations and lead the North Slope Borough to conclude that more resources will need to go toward education and senior service while the labor force and the economy are shrinking (North Slope Borough 2016).

3.4.4.3 Local Economy: Community of Nuiqsut

Nuiqsut is served by scheduled and chartered flights and residents have access to the Dalton Highway for approximately 4 months of the year. Freight arrives year-round by air cargo (Alaska Department of Commerce, Community, and Economic Development Community Profiles).

Nuiqsut's economy, like other North Slope communities, is based on a mix of cash and subsistence hunting, fishing, and whaling. More recently, Nuiqsut and its village corporation have benefited financially from close proximity to oil production activities on the North Slope, particularly development of the Alpine Field. The Kuukpik Corporation has agreements with ConocoPhillips regarding bidding for contracts for construction services for any resource development taking place on Kuukpik Corporation lands. As noted in the 2004 Alpine Satellite Development Plan (Section 2, page 294), Nuiqsut has received a number of economic benefits and employment opportunities as a result of development of the Alpine Field, including contracts to several Kuukpik Corporation joint ventures, including Nanuq (construction); Kuukpik/Arctic Services (camp and catering); Kuukpik/SAE (seismic); Kuukpik/LCMF (Umiaq) (surveying); Kuukpik/Carlisle (trucking), and Kuukpik/Nana Management Services (security). Other businesses that have benefitted include the Kuukpik Hotel, an office space leased from the City of Nuiqsut, and storage of ice road equipment.

The North Slope Borough reported that in 2015, there were 12 Nuiqsut residents working directly in the oil industry (North Slope Borough 2015). The nearby Alpine development has also provided seasonal work opportunities to Nuiqsut residents, including environmental monitoring. If past employment trends continue, direct employment of Nuiqsut residents by ConocoPhillips is expected to remain low and steady over the next 20 years. Nuiqsut residents were employed by ConocoPhillips or its contractors in the following positions: subsistence resource monitor, vehicle maintenance technician, drilling rig workers, oil spill response technicians, water treatment technicians, cooks, ice road laborers, ice road monitors, ice road drivers, security worker, and electrical/plumbing technician (North Slope Borough 2015).

The North Slope Borough government, Kuukpik Corporation (village corporation and subsidiaries), and the North Slope Borough school district, are the top employers of Nuiqsut residents (North Slope Borough 2015). In 2015, 38 percent of the Inupiaq residents of Nuiqsut were employed on a permanent full-time basis and 16 percent were unemployed (North Slope Borough 2016). Many residents receive dividends from the Alaska Permanent Fund, Arctic Slope Regional Corporation, and the Kuukpik Corporation. In March 2014, 325 people were enrolled as shareholders in the Kuukpik Corporation, which dispenses quarterly dividends. Shareholders receive a quarterly dividend of $30 to $50 per share. Most shareholders have 100 shares and could receive annual income from dividends between $12,000 and $20,000. However, children born after December 18, 1971, acquire shares by inheritance or gift only. Those shareholders may hold fewer than 100 shares and receive smaller dividends, proportionately. This has created disparity within the community (North Slope Borough 2015) (see Chapter 4, Section 4.4.2, "Sociocultural Systems").

As of 2014, Arctic Slope Regional Corporation had 261 Nuiqsut-enrolled shareholders, each with 100 shares. Dividends for 2014 were approximately $5,000 for the year (North Slope Borough 2015).

The Alaska Department of Labor and Workforce Development maintains a database of Alaskan communities that are economically distressed [3]. Approximately half of all Alaskan communities qualify as distressed by the standards used. Despite the high cost of living and economic disparity, Nuiqsut, like all North Slope Borough communities, does not qualify as economically distressed (Denali Commission 2016).

Table 3.4-5. 2010 Total employment by employer, Nuiqsut

Employer	Total	Percent
City Government	18	11
North Slope Borough Government	49	30
North Slope Borough School District	27	16
Oil Industry	14	8
Private Construction	1	1
Arctic Slope Regional Corporation/Subsidiary	3	2
Village Corporation/Subsidiary	32	19
Transportation	4	2
Other	18	11
Total	166	100

Note: The numbers include only those individuals responding to the survey and the question about employment and employer.

Source: North Slope Borough Economic Profile and Census Report: Nuiqsut Snapshot (2010).

The City of Nuiqsut's fiscal year 2017 budget is about $2.17 million. Grants, revenue sharing, and mitigation funds account for approximately 55 percent of the City's operating income. Other revenue sources include bed tax receipts, bingo income, and rents (Table 3.4-5).

Table 3.4-6. City of Nuiqsut fiscal year 2017 budget

Income	Amount	Percent
Grant Revenue	$640,000	30
State & Local Revenue	$280,000	13
Mitigation Funds	$275,000	13
Bingo	$150,000	7
USPS Nuiqsut CPU	$95,963	4
Rents	$66,670	3
Designated Funds	$27,000	1
Contributions Income	$112,000	5
Other/Hotel Bed Tax	$79,000	4
Transfer/Carry Over	$444,042	20
Total	$2,169,675	100

Source: Arnold (2017).

[3] Data available on population, employment, and earnings is used to identify those Alaska communities considered "distressed". The distressed status is determined by comparing average income of a community to full-time minimum wage earnings, the percentage of the population earning greater than full-time minimum wage earnings, and a measure of the percentage of the population engaged in year-round wage and salary employment (Denali Commission 2016; Distressed Community Criteria 2016 Update). Available online at https://www.denali.gov/images/documents/distressed_lists/2016_Distressed_Final.pdf (accessed June 2017).

The Fiscal Year 2016 NPR-A Impact Mitigation Program fund allocation for the community of Nuiqsut Local Government Operations was $514,610. This amount was less than what was initially rewarded ($680,352) because the NPR-A funding pool was smaller than expected.

The City of Nuiqsut is currently on the verge of bankruptcy, according to the City Administrator (Arnold 2017). Nuiqsut’s NPR-A Impact Mitigation funds for fiscal year 2017 ($410,000) were awarded, but are suspended by the State until the City of Nuiqsut completes audits for fiscal years 2012, 2013, and 2014. The administrator for the City of Nuiqsut contends that these audits are nearly impossible to produce due to past cuts to funding. The State has historically refused to grant funding for outside managers, administrators, or accountants of any kind, but the City of Nuiqsut has almost no capacity to manage accounts on this level. The City is currently (May 2017) waiting for the State to consider lifting the suspension once a final audit report for fiscal year 2014 is filed, which is due in June 2017. However, the Alaska Department of Commerce, Community and Economic Development has determined that the City of Nuiqsut did not expend enough federal funds in fiscal year 2015 to require an audit, while the State Finance Division Audit Compliance Officer will not lift the non-compliance claim for failure to produce an audit for that fiscal year. Until that disagreement is settled, the City of Nuiqsut will remain suspended even once the audit for fiscal year 2014 is filed.

Nuiqsut received grants for the following projects in 2016:

- **Youth Center Operations and Maintenance ($94,868).** This project is to continue operations and maintenance of the youth center. The center will continue to provide recreational opportunities and cultural experience activities for the Nuiqsut population between ages of 6 and 20. Grant funds are requested for labor, fringe benefits, supplies, freight, maintenance, repairs, utilities, communications, fuel, travel, training, equipment, cultural camps, and special events.
- **Local Government Operations and Maintenance ($514,610).** This project is to continue to fund operations so the city government may continue providing Title 29 governance (Alaska Department of Commerce 2017).

3.4.4.4 State Economy

The oil and gas industry continues to be an important contributor to the state economy. In 2016, there were 11,300 direct oil and gas jobs in the state (Alaska Department of Labor and Workforce Development 2017c). Besides the direct jobs, there are thousands of indirect jobs in security, catering, accommodations, facilities management, transportation, engineering services, and logistics, which support the oil and gas industry, but are not categorized as direct oil and gas jobs. The most recent estimate for total direct, indirect, and induced jobs associated with the oil and gas industry in Alaska, was 45,575 jobs in 2016. These jobs contributed $3.1 billion in annual payroll to Alaska residents that year (McDowell Group 2017).

Oil and gas industry jobs on the North Slope account for 66 percent of the direct oil and gas jobs in the State in 2016 (Alaska Department of Labor and Workforce Development 2017a). However, most of these workers commute to the North Slope on a rotational basis and live outside of the North Slope. Many live in Anchorage, Fairbanks, the Matanuska-Susitna Borough, and other Alaskan population centers, and therefore contribute to these regions’ economies. Many live outside of Alaska and, largely because there is no state income tax in Alaska, are not considered to contribute significantly to the Alaskan economy. A recent study on the economic benefits of the oil industry in Alaska estimated that the industry generated 5 direct jobs (oil companies), 70 indirect jobs (oil and gas support sector), and 1,925 induced jobs by residents of the North Slope Borough. In total, the industry generated 3,000 jobs held by North Slope Borough residents, with an annual payroll of $115 million (McDowell Group 2014).

The price of oil declined sharply in 2014 and 2015. The economy of Alaska faces two major hurdles related to the drop in oil prices: significant loss of jobs and the state government budget dilemma (Alaska Department of Labor and Workforce Development 2017a). After oil prices fell, job losses spread through nearly all sectors of Alaska's economy (Alaska Department of Labor and Workforce Development 2017a). Initial losses were limited to direct oil industry jobs and closely related sectors. In 2016, losses spread to unrelated sectors and the state experienced a 2.0 percent employment decline. More broad-based decline is predicted for 2017: the state is forecast to lose 2.3 percent, or about 7,500 jobs (Alaska Department of Labor and Workforce Development 2017a).

The Alaska Department of Revenue anticipates that the state government's high level of dependence on oil revenue will continue, with revenues being very sensitive to oil price and oil production. Oil-based revenue continues to dominate the state's unrestricted general fund revenue. The general fund pays for almost every state service, including the education system, transportation infrastructure, public health and safety services, and a host of other programs throughout Alaska. In fiscal year 2013, state revenues from the oil industry were $6.9 billion, which accounted for 92 percent of the total state unrestricted revenue (Alaska Department of Labor and Workforce Development 2017b). In fiscal year 2014, approximately 88 percent of the $5.4 billion in unrestricted revenue could be attributed to oil revenue (Alaska Department of Revenue 2014). In 2016, the unrestricted general fund had decreased by almost $4 billion to $1.5 billion, of which 72 percent was attributed to oil revenue. Unrestricted general fund revenue is now forecast to be $1.6 billion in fiscal year 2017 and $1.8 billion in fiscal year 2018. The revenue forecast is driven in part by an expectation for North Slope oil production to average 523,700 barrels per day in fiscal year 2017 before declining to an average of 459,900 barrels per day in fiscal year 2018 (Alaska Department of Revenue 2017).

With respect to the State of Alaska's 50 percent share of revenues from oil and gas activity in the NPR-A, the latest report indicates that the State's share of rents, royalties, and bonuses received from leases in the NPR-A in fiscal year 16 was $1.8 million. That amount was the lowest received in a decade, but the amount forecast to come to the State from NPR-A activity in 2017 and 2018 is $4.3 million each year (Alaska Department of Revenue 2017).

3.4.5 Land Use

Land use is governed by a series of laws, regulations, and authorizations that apply to the NPR-A and the proposed GMT2 Project. Both the 2013 Integrated Activity Plan and the GMT1 Supplemental EIS provide a detailed list of the key elements controlling land use as updated from the 2004 EIS. Land ownership in the project area is mixed and still changing. There are lands that have been selected by the local village and regional Native Corporations. BLM, the Kuukpik Corporation, and Arctic Slope Regional Corporation own and manage different portions of the surface land involved, while BLM and Arctic Slope Regional Corporation own and manage different portions of the subsurface mineral estate. Land ownership in the project area is shown in Map 3.1-1.

The GMT2 Project area (approximately 155,500 acres) encompasses approximately 96,600 acres of conveyed land and 9,400 acres of selected land (BLM managed). The remaining acreage of the project area consists of federally managed lands managed by BLM. The majority of the proposed GMT2 Project facilities would be located on Kuukpik Corporation-selected lands that are not conveyed. This includes approximately 14.0 acres of Kuukpik-selected lands at the drill site location, and 40.0 acres of Kuukpik-selected lands along the road and pipeline route of the proposed action. There are approximately 82 acres of Kuupik-selected land encompassed by the proposed GMT2 pipeline and access road. With approximately 15 acres of land that would be directly affected by the proposed GMT2 Project facilities still within federal ownership and are not conveyed or selected lands.

Federal oil and gas leases, permits, or rights-of-way on selected lands remain under BLM management until or if the land is conveyed. Administration of federal oil and gas leases is waived when the affected subsurface is conveyed. Lease stipulations continue to apply if the new subsurface owner choses to enforce the requirements; BLM no longer has jurisdiction over the subsurface. If the surface is not conveyed then BLM would continue to manage the surface

South of the proposed GMT2 pad location, but within the GMT2 Project area, is the Colville River Special Area (see Map 2.1-2). The Colville River Special Area was designated in 1977 to protect nesting and foraging habitat of the Arctic peregrine falcon. The Colville River Special Area Management Plan provides protections that must be followed for any activity in the area. A list of protections may be found in the Record of Decision for the Colville River Special Area (BLM 2008).

North of the GMT2 Project area, is the Teshekpuk Lake Special Area. The Teshekpuk Lake Special Area was designated in the NPR-A with acreage expanded upon the signing of the 2013 BLM record of decision. The best management practices that cover the area may be found within Appendix A of the 2013 record of decision. The outer boundary of the special area is approximately 3.1 miles northwest of the proposed GMT2 pad.

3.4.5.1 Local Transportation

Transportation facilities were described in BLM (2004a, Section 3.4.9), with information updated in BLM (2012, Section 3.4.10). This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location. Surface transportation in the project area includes local roads in Alpine and Native Village of Nuiqsut and seasonal ice and snow roads from the existing oil field gravel road system to Alpine, which is now connected by gravel road to the Native Village of Nuiqsut. BLM has issued numerous authorizations for ice roads and snow trails from Alpine and Kuparuk to exploration drilling sites in the NPR-A. BLM also issues rights-of-way for NPR-A-area-wide winter use for transport across the tundra with tundra-approved vehicles. Residents of the Native Village of Nuiqsut use snowmobile and other off-road vehicles for off-road travel. Local residents also use small boats to access subsistence resources.

Air travel is supported by an airport at the Native Village of Nuiqsut and airstrip at Alpine. Helicopter use in the area is a concern for the people of the Native Village of Nuiqsut due to the potential impacts to subsistence resources and activities. BLM permittees are required to report to BLM the number and location of take-offs and landings made in the NPR-A at the end of the summer. The date, time, and location of the take-offs and landings are collected; however, BLM does not collect data on take-offs or landings outside of the NPR-A, or for flight-tracking. The location of permits change from year to year; the locations of aircraft landings are generally clustered around research areas and oil and gas development study areas.

A summary of projected new aircraft traffic, including helicopter use, for all alternatives is presented in Chapter 2 flight tables and Appendix B.

3.4.5.2 Recreation

The recreation resources of the project area are described in BLM (2004a, Section 3.4.7) and BLM (2013, Section 3.4.6). This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location. There are little specific recreation trends in the area. Public access to the project area is limited to those who use aircraft to the Native Village of Nuiqsut Airport or small fixed-wing aircraft that can land on the tundra. There are no developed recreation facilities within the NPR-A. The project area falls within the State of Alaska Game Management Area (GMU) 26-12. BLM has two special recreation permits that cover GMU 26-12, with one permitted in the

GMT2 Project area, however generally they do not use the project area. Permitted recreation may only take place if the activity does not interfere with the purpose of the NRP-A.

Wild and Scenic Rivers

There are no designated or proposed wild and scenic rivers located within the GMT2 Project area (BLM 2012, Section 3.4.7) (Map 3.4.7-1).

Wilderness

The BLM (2012, Section 3.4.8) described the wilderness characteristics of the NPR-A. This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location. The BLM (2012, Section 3.4.8) characterized eight specific wilderness evaluation areas. The project area falls within Wilderness Evaluation Area H. This area encompasses Nuiqsut and Umiat, and contains various oil and gas leases and legacy wells. There are roads within Nuiqsut and at Umiat, and both have airstrips. The land where the GMT1–GMT2 pipeline and GMT2 pad are proposed is completely undeveloped land that possesses wilderness characteristics. There are no new data on the wilderness values associated with the proposed project area since the completion of the NPR-A Integrated Activity Plan Record of Decision (BLM 2013a). The area was inventoried as having wilderness characteristics at that time and has not changed significantly since then.

3.4.5.3 Visual Resources

This section tiers to and incorporates by reference relevant information in BLM (2012, Section 3.4.9), while placing emphasis on the proposed GMT2 Project location. The visual resources inventory of the NPR-A are described in terms of scenic quality, visual sensitivity, and distance zones (BLM 2012, Section 3.4.9). The current visual resource management class assigned to the majority of the project area is Visual Resource Management Class IV with a small portion along the Colville River assigned Class III (BLM 2013, Section 3.4.4.3). The change allowed with Visual Resource Management Class IV is high and activities may attract attention and dominate the view but are still mitigated. The change allowed with Visual Resource Management Class III is moderate and activities may attract attention but should not dominate the view. This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT2 Project location.

The visual resource management system provides a way used by the BLM to analyze potential visual impacts and an opportunity to apply visual design techniques to ensure that any surface-disturbing activities are compatible with the surroundings. The classification system applies only to federally managed land managed by the BLM and to lands selected, but not yet transferred from federal ownership.

The BLM (2012 Section 3.4.9) and BLM (2014 Section 3.4.4.3) describes the visual modifications in the project area. In the years since, a spur road connecting Native Village of Nuiqsut to the existing road system in the Alpine Field has been constructed; however, this was not on BLM-managed land. The construction of GMT1 is ongoing and has changed the landscape, but not changed the associated visual resource management class.

The BLM (2004b) authorized the approval of the proposed GMT2 Project, and GMT2 will be developed under the stipulations, required operating procedures, and best management practices described in Section 4.7, “Mitigation Measures and Monitoring.” There has been little change in the existing or prospective use of the project area for oil and gas or other uses that could impact visual resources of federally managed land in the project area that were not considered in BLM (2004a, 2004b) and the subsequent authorizations for construction and operation of production facilities in the Alpine Field that were contemplated in 2004. The BLM (2012, 2013a) considered the visual resources associated with the development facilities constructed since 2004, and assumed the GMT Unit would be developed by both the GMT1 Project and the GMT2 Project. The proposed GMT1 and GMT2 Projects have only been slightly modified since 2004 (see Section 2.1, "GMT2 Project Changes Over Time").

3.4.6 Subsistence

This section describes the affected environment for subsistence resources and traditional land use by the community of Nuiqsut whose residents harvest and/or rely on resources in the vicinity of the GMT2 Project. Because the proposed GMT2 Project has already been evaluated within earlier NEPA documents, namely BLM (2004, 2012), this section is tiered off of those documents and focuses on information that is new or updated since those previous EISs. This section includes a general overview of subsistence use patterns for Nuiqsut, including the importance of subsistence, the seasonal round, harvest estimates, and subsistence use areas. Additional detail regarding Nuiqsut subsistence uses, including additional figures and tables, is provided in Appendix F.

3.4.6.1 Study Area

The study area for subsistence includes all areas used by the community of Nuiqsut for subsistence activities because these areas could potentially be directly or indirectly affected by the proposed project. The project study area is defined as a 2.5-mile buffer surrounding the GMT2 Project Footprint and is the area where direct impacts may occur, particularly in overland areas where project components are proposed. Indirect impacts may occur in the project study area, but may also extend to the study area for impacts related to resource availability or hunter avoidance. Additional North Slope communities including Anaktuvuk Pass, Atqasuk, and Utqiagvik (formerly Barrow) also have subsistence use areas within or near the project study area; however, these use areas are located on the periphery of those communities' overall subsistence use areas. The affected environment and environmental consequences for those communities related to broader development are discussed and analyzed in BLM (2004, Section 3.4.3 and 4.4.3) and BLM (2012, Section 3.4.3, 4.3.13, 4.4.13, 4.5.13, 4.6.13, and 4.7.13).

3.4.6.2 Subsistence Definition and Relevant Legislation

Both BLM (2004, Section 3.4.3.1) and BLM (2012, Section 3.4.3.1) provide an overview of the importance of subsistence, definition of subsistence, and relevant legislation governing the regulatory environment in which subsistence activities are permitted under state and federal regulations. In summary, subsistence is recognized as a central aspect of North Slope culture and life and is the cornerstone of the traditional relationship of the Iñupiaq people with their environment. Residents of the North Slope of Alaska rely on subsistence harvests of plant and animal resources for nutritional sustenance and cultural and social well-being. Subsistence is not only a source of food for North Slope residents, but the activities associated with subsistence strengthen community and family social ties; reinforce community and individual cultural identity; and provide a link between contemporary Iñupiat and their ancestors. Subsistence customs and traditions encompass processing, sharing, redistribution networks, and cooperative and individual hunting, fishing, gathering, and ceremonial activities. These activities are guided by traditional knowledge based on a long-standing relationship with the environment. 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 (Alaska National Interest Lands Conservation Act, Title VIII, Section 803, and AS 16.05.940[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 2012). A recent U.S. Army Corps of Engineers study conducted a literature review of existing subsistence definitions and provided a proposed definition of subsistence, which addressed the economic, social, cultural, and nutritional elements and components of subsistence that have not been emphasized in previous definitions. In part, this definition reads as follows:

> Subsistence refers to a way of life in which wild renewable resources are obtained, processed, and distributed for household and communal consumption according to prescribed social and cultural systems and values….
>
> …. The subsistence way of life satisfies to various degrees and in various contexts, the economic, social, cultural, and nutritional needs of subsistence-based communities (ResourceEcon et al. 2011).

The proposed project is located primarily on federally managed lands within the northeast NPR-A. The pipeline and road components also cross federal, Kuukpik Corporation lands, Kuukpik Corporation selected lands (managed by BLM), and the ancillary water pipeline between CD1 and CD4 crosses State and Kuukpik Corporation lands. In addition, resources that migrate through the study area, such as caribou, waterfowl, and migratory fish, may be harvested outside of the study area on other state, federal, or private lands. In Alaska, subsistence hunting and fishing are regulated under a dual management system by the State of Alaska and the federal government. Federal subsistence law regulates federal subsistence uses; state law regulates state subsistence uses. The federal government recognizes subsistence priorities for rural residents on federal public lands, while Alaska considers all residents to have an equal right to participate in subsistence hunting and fishing when resource abundance and harvestable surpluses are sufficient to meet the demand for all subsistence and other uses. Subsistence activities on all lands in Alaska, including private lands, are subject to state and federal subsistence regulations. Because the project is located on federally managed lands, Section 810 of Alaska National Interest Lands Conservation Act is applicable and requires a subsistence evaluation. This evaluation includes findings on the following:

- The effect of such use, occupancy, or disposition on subsistence uses and needs;
- The availability of other lands for the purpose sought to be achieved; and
- Other alternatives that reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 U.S.C. Section 3120).

3.4.6.3 Overview of Subsistence Uses

The following sections summarize the BLM (2004, Section 3.4.3.2), BLM (2012, Section 3.4.3.3), and BLM (2014, Section 3.4.5.3) descriptions of Nuiqsut's subsistence uses as well as incorporating new information that were not included in the previous EISs. Examples of subsistence baseline indicators that are useful in characterizing subsistence uses include:

- Subsistence use areas
- Travel method
- Travel routes
- Timing of harvest activity
- Duration and frequency of trips
- Observed change in resources
- Harvest diversity
- Harvest amount
- Harvest participation
- Harvest success
- Harvest sharing
- Harvest effort

The following discussion describes how these indicators can be used in characterizing subsistence uses under five primary categories: (1) subsistence use areas, (2) seasonal round, (3) method of transportation, (4) harvest data, and (5) community participation.

Subsistence use areas refer to the locations in which subsistence users search for and harvest subsistence resources. Use of an area for subsistence purposes is dependent on being able to access the area and on the availability of subsistence resources within the area. Subsistence use areas can range from small fishing locations to expansive overland caribou hunting areas and vary greatly in size depending on the targeted resource. Besides mapped data of these use areas, other key subsistence baseline indicators that are useful in characterizing subsistence use areas include frequency and duration of trips (e.g., harvest effort).

Seasonal round refers to the timing of subsistence activities and is often characterized by highs and lows of activity for different resources throughout the year. The timing of residents' subsistence activities can be influenced by a number of factors, including the availability of the wildlife and vegetation harvested by residents, climate and weather conditions, harvest regulations, and even personal reasons such as work commitments, financial means, and family needs. Rarely are individual resources pursued with equal intensity throughout the year.

Method of transportation addresses user access and refers to the equipment (e.g., four-wheeler, snowmachine, truck, boat) used within subsistence use areas and the travel routes that are used to access subsistence use areas. Methods of transportation are factors in determining the size and location of subsistence use areas. Communities with residents who can afford airplanes, for example, may access a larger area than communities without, while residents with more limited means of transportation (e.g., four-wheelers) or limited funds often subsist within a smaller use area near the community. Travel routes may vary from season to season based on factors such as snow and ice conditions, water levels, and the presence of infrastructure which blocks or facilitates access. However, despite annual variations, harvesters often follow similar paths to specific harvesting locations using routes which have been proven to be safe and efficient based on terrain and other factors.

Harvest data address resource availability by describing the subsistence resources that are available within the study area or that may move through the study area and are later harvested in other areas. Successful subsistence harvests depend on continued resource availability in adequate numbers and health in traditional use areas. Key subsistence indicators that characterize harvest data and resource availability include per capita and household harvest amounts, harvest numbers, percent of households harvesting, and harvest diversity. Habitat areas for subsistence resources are also important in characterizing resource availability. In some cases, habitat areas may be located outside the range of a community's subsistence use areas, yet they are still important because they ensure the health and availability of those resources within the community's subsistence use area. Traditional knowledge is an important source of information that is useful in characterizing existing resource availability, resource changes, and habitat areas.

Community participation refers to the levels of existing community involvement in subsistence activities. Participation in subsistence activities promotes the transmission of skills from generation to generation, and participation in sharing strengthens community cohesion within and among communities in the region and provides for an extensive distribution network of subsistence foods. Because Alaska Native culture is integrally tied to subsistence activities, higher levels of participation provide more opportunities for community members to pass on traditional knowledge and cultural values to younger generations. Subsistence participation levels are most often described using baseline indicators from community household harvest surveys, including percent of households or harvesters using, attempting to harvest (harvest effort), and sharing subsistence resources.

Sources of data that inform the above-described indicators for Nuiqsut include harvest data from the North Slope Borough, Alaska Department of Fish and Game, and Stephen R. Braund and Associates, and subsistence mapping studies such as Pedersen (1979), BLM (2004), Stephen R. Braund and Associates (2010a, 2010b, 2011, 2012, 2013, 2014, 2015, 2016, and 2017). Table 3.4-7 presents a summary of the available subsistence data for the community of Nuiqsut. Additional subsistence harvest and use area data not addressed in any of the previous EISs related to GMT2 include caribou use area and harvest data from the Nuiqsut Caribou Subsistence Monitoring Project (Stephen R. Braund and Associates 2014, 2015, 2016, and 2017), and Alaska Department of Fish and Game Division of Subsistence's 2016 publication: Harvests and Uses of Wild Resources in 4 Interior Alaska Communities and 3 Arctic Alaska Communities, 2014 (Brown et al. 2016).

Table 3.4-7. Community of Nuiqsut data sources, subsistence and traditional land uses

Harvest Data			Subsistence Use Area Data			Seasonal Round
Study Year	**Resource**	**Source**	**Study Year**	**Resource**	**Source**	
1985	All Resources	Alaska Department of Fish and Game (2017)	Lifetime to 1979	All Resources	Pederson (1979)	Bacon et al. 2009
1992	All Resources	Fuller and George (1999)	Early 1970s	All Resources	Brown (1979)	Brower and Hepa 1998
1993	All Resources	Alaska Department of Fish and Game (2017)	1973–1986	All Resources	Pederson (1986)	Brown 1979
1994–1995	All Resources	Brower and Hepa (1998)	1994–2003	Non-Marine	BLM (2004)	Brown et al. 2016
1995–1996	All Resources	Bacon et al. (2009)	1995–2006	All Resources	Stephen R. Braund and Associates (2010a)	EDAW Inc. 2008
2000–2001	All Resources	Bacon et al. (2009)	2003–2007	Caribou	Braem et al. (2011)	Fuller and George 1999
2003–2007	Caribou	Braem et al. (2011)	2008–2015	Caribou	Stephen R. Braund and Associates (2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017)	Impact Assessment Inc. 1990
2010–2015	Caribou	Stephen R. Braund and Associates (2012, 2013, 2014, 2015, 2016, 2017)	2014	All Resources	Brown et al. (2016)	Libbey et al. 1979
2014	All Resources	Brown et al. (2016)				Research Foundation of the State University of New York 1984
						Stephen R. Braund and Associates 2010a

Subsistence Use Areas

Figure 3.4-2 shows Nuiqsut contemporary subsistence use areas for several time periods, as documented by Pedersen (1986), BLM (2004), Stephen R. Braund and Associates (2010a)[4], and Brown et al. (2016). All four study periods cover a similar area ranging from between Utqiagvik (formerly Barrow) in the west and Kaktovik in the east, and as far south as Anaktuvuk Pass. Stephen R. Braund and Associates (2010a) all resources use areas document Nuiqsut residents traveling beyond Atqasuk to Utqiagvik (formerly Barrow) in the west, offshore more than 50 miles northeast of Cross Island, to Camden Bay in the east, and beyond the Colville River in the south. The majority of Nuiqsut 1995–2006 use areas are concentrated around the Colville River, overland areas to the south and southwest of the community, offshore areas north of the Colville River Delta, and northeast of Cross Island. Pedersen (1986) and BLM (2004) use areas for Nuiqsut are all within the extent of Stephen R. Braund and Associates (2010a) use areas described above with the exception of the 1973–1986 data extending as far as Kaktovik in the east and Anaktuvuk Pass in the south. Alaska Department of Fish and Game recently completed a harvest survey in Nuiqsut with a 1-year mapping component (Brown et al. 2016).

Nuiqsut's 2014 use areas are concentrated in areas showing the highest overlapping use documented by Stephen R. Braund and Associates 2010a except for more extensive 2014 overland areas located west of Umiat and farther south into the Brooks Range as far as Anaktuvuk Pass (Stephen R. Braund and Associates [2010a] notes that use areas extended farther south than field maps allowed). All four study periods overlap with the project study area. Subsistence use area data from ConocoPhillips's Nuiqsut Caribou Subsistence Monitoring Project, including more recent information for the 2012 to 2015 study years (Stephen R. Braund and Associates 2010b, 2011, 2012, 2013, 2014, 2015, 2016, and 2017) are presented in Figure 3.4-3. These 8 years of data show high use of the Colville River and areas west of the community for caribou hunting during the 2008–2015 study years. Appendix F, Figures A-2 through A-9 display individual, resource-specific, subsistence use areas for available study years in Nuiqsut.

Pedersen's (1979) lifetime (pre-1979) use areas (Figure 3.4-4) show Nuiqsut residents utilizing a smaller area than the contemporary subsistence use areas shown on Figure 3.4-2, but still an extensive area centered around the community to harvest subsistence resources. Reported use areas extended offshore approximately 15 miles, as far east as Camden Bay, south along the Itkillik River, and west as far as Teshekpuk Lake. As part of Nuiqsut Paisaŋich-Nuiqsut Heritage: A Cultural Plan, Brown (1979) recorded all resources use areas (Figure 3.4-4). For all subsistence resources, the study documented early 1970s use areas that extended south around the Colville and Itkillik river drainages, offshore between Cross Island and Cape Halkett, and in overland areas east and west of the community. Both studies documented a similar extent of use areas because they were conducted during the same study year for the relatively same time period.

[4] Stephen R. Braund and Associates 2010a interviews reported information for the following resources: caribou, moose, bowhead whale, Arctic cisco, Arctic char/Dolly Varden, broad whitefish, burbot, geese, eider, ringed seal, bearded seal, walrus, wolf, and wolverine. Other resources such as ptarmigan, polar bear, vegetation, or other types of non-salmon fish and salmon were not documented and thus project area specific data are not available for these resources.

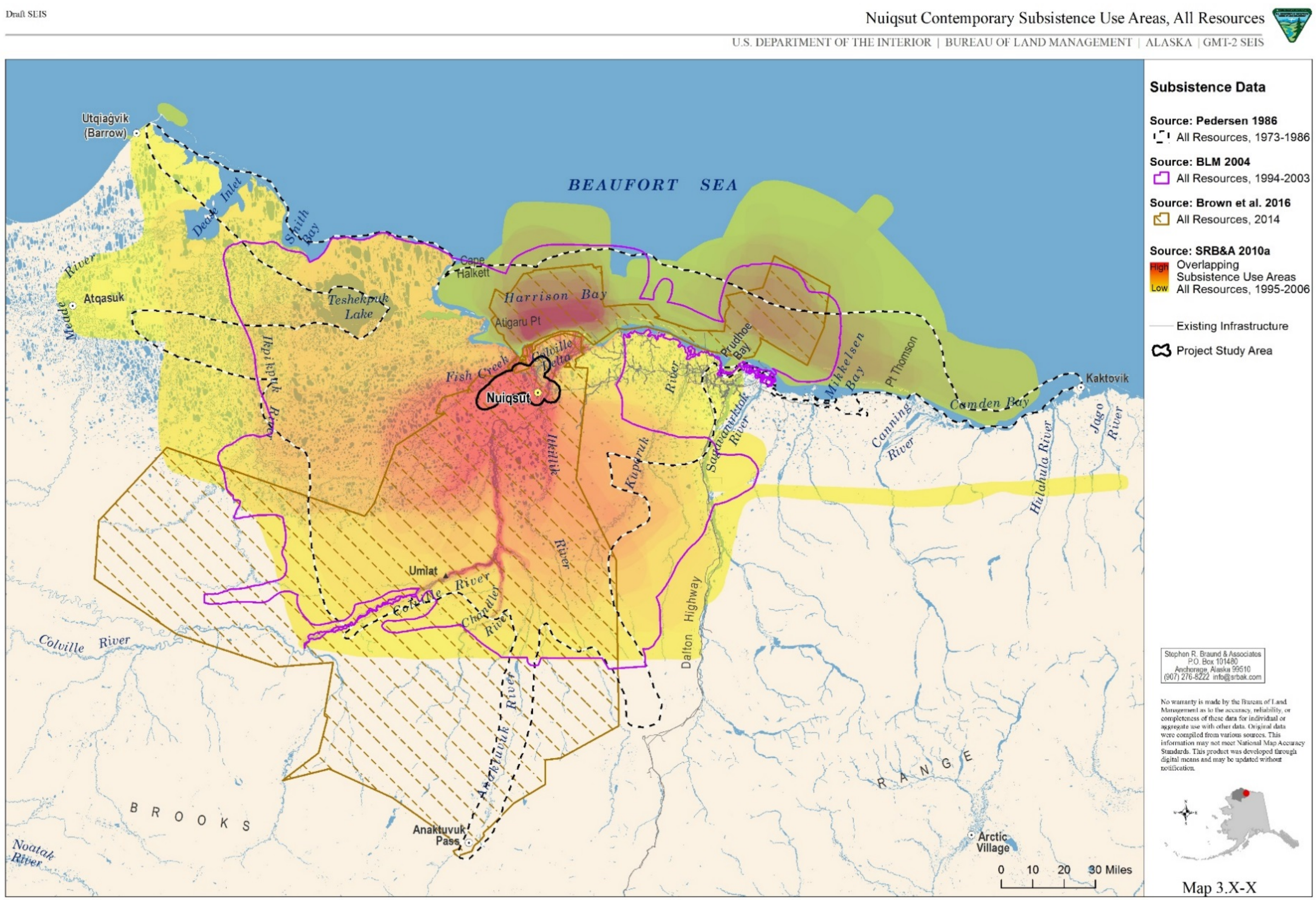

Figure 3.4-2. Nuiqsut contemporary subsistence use areas, all resources

AE Nuiqsut Caribou Subsistence Use Areas, 2008-2015

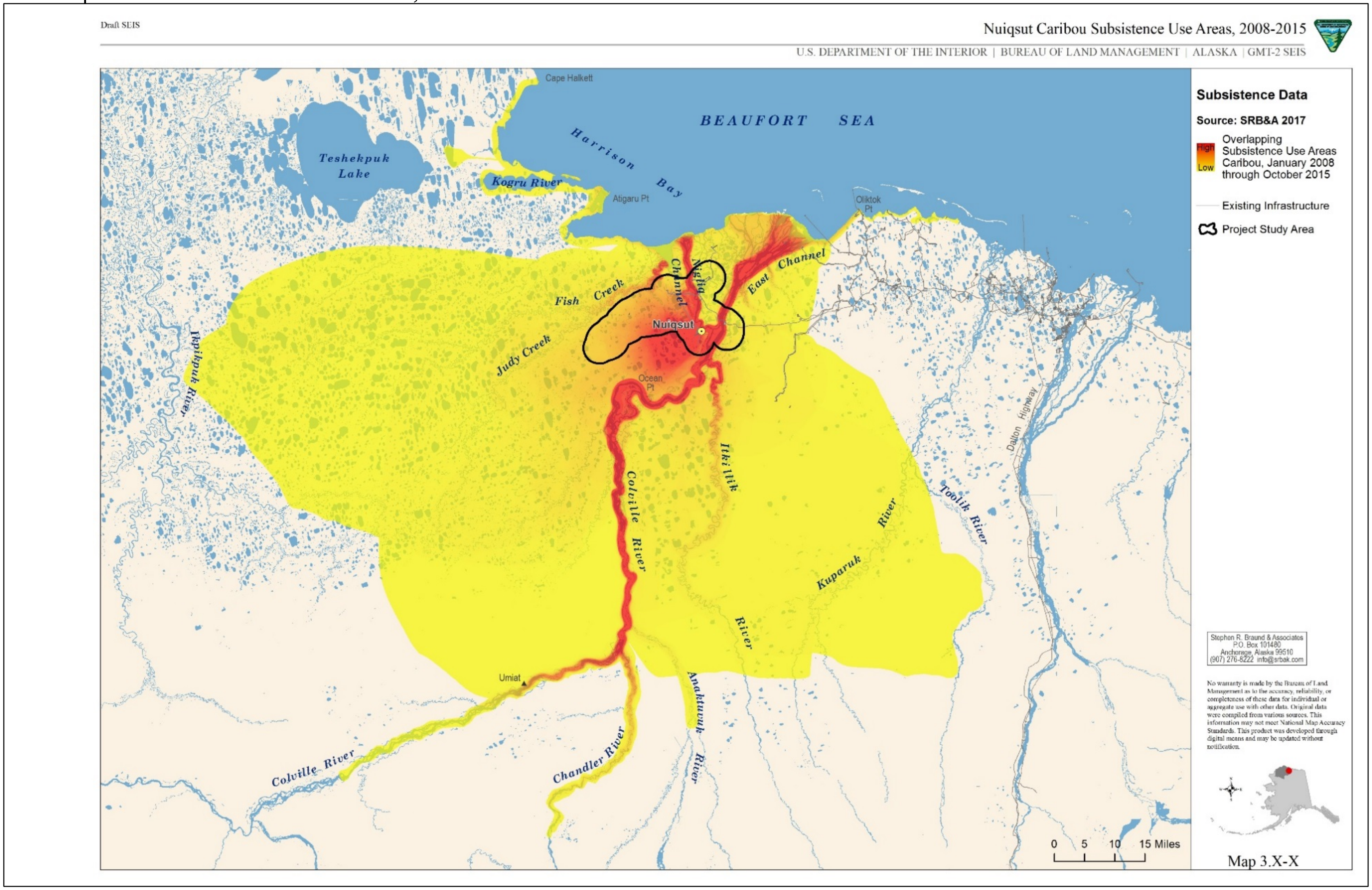

Figure 3.4-3. Nuiqsut caribou subsistence use areas, 2008–2015

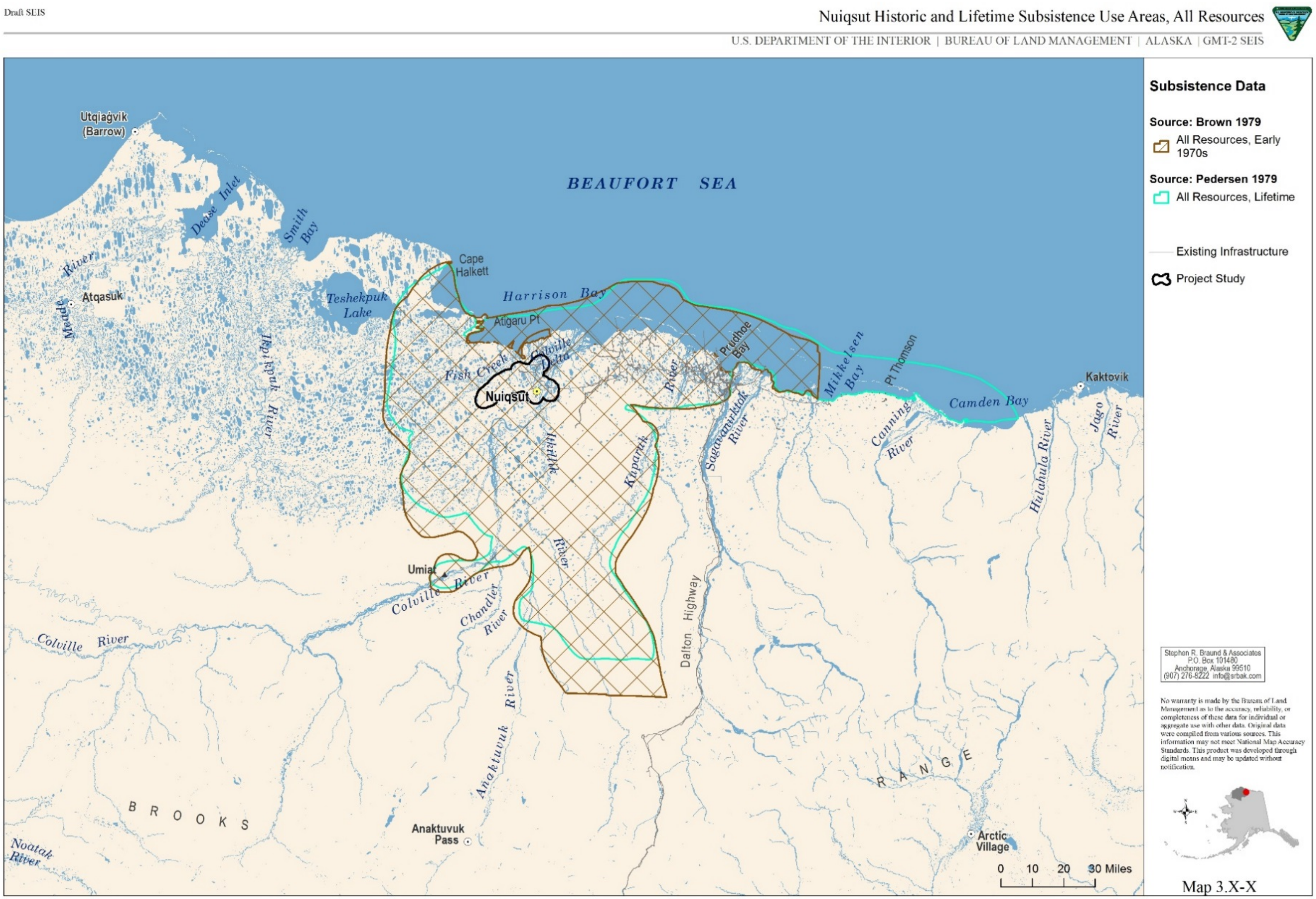

Figure 3.4-4. Nuiqsut historic and lifetime subsistence use areas, all resources

Seasonal Round

Table 3.4-8 provides seasonal round data based on reports from the 1970s through the 2010s. The spring month of April marks a transition from the late winter/early spring harvesting of furbearers, seals (through the ice), and upland game birds to the spring waterfowl hunting season which peaks in May and June. Beginning as early as May, residents travel by boat along the local river system and into the Beaufort Sea to harvest various resources including caribou, waterfowl, seals, and fish. Caribou (tuttu) harvests occur throughout the year, but with the most intensity during the summer and fall months of June through October. Summer harvests of non-salmon fish such as broad whitefish (aanaaqłiq) begin in July and continue into August and September. In addition to traveling inland along the Colville River during the summer for fishing and caribou hunting, residents continue to travel to the ocean to hunt for ringed seals (qaiġulik), bearded seals (ugruk), and king and common eiders (qiŋalik, amauligruaq) during the months of June, July, August, and September (Stephen R. Braund and Associates 2010a). Berry and plant gathering also occur during the summer months. Moose (tuttuvak) hunting takes place, often alongside caribou hunting, in August and September along river hunting areas south of Nuiqsut. Bowhead (aġviq) whaling occurs in September when whaling crews are stationed at Cross Island, with preparations for the whaling season beginning in August. The fall month of October is spent fishing and harvesting caribou close to the community. Gill netting, primarily for Arctic cisco (qaaqtaq), is most productive between October and mid-November. During the winter months, furbearer hunters pursue wolves (amaġuq) and wolverines (qavvik), target caribou and ptarmigan (aqargiq) as needed and available, and fish for burbot (tittaaliq) through the ice. Overall, Nuiqsut harvesters target the highest numbers of resources during the summer/fall months of August and September (Figure 3.4-5).

Method of Transportation

The travel methods used to access subsistence harvesting areas are important to understanding how a project may reduce, obstruct, or facilitate harvester access. Nuiqsut travel methods to subsistence use areas have been documented by Stephen R. Braund and Associates (2010a) for several species of fish, moose, wolf, wolverine, bowhead whale, seals, geese, and eider for the 1995–2006 time period. Stephen R. Braund and Associates (2017) has also documented travel methods to caribou subsistence use areas for the time period of 2008–2015. Figure 3.4-6 and Table 3.4-9 present the various methods of transportation used to travel to use areas for different resources.

Nuiqsut residents travel by boat to access the greatest diversity of resources (nine) (Figure 3.4-6). These resources include caribou, moose, bowhead whale, seals, eider, Arctic char/Dolly Varden (paikfuk/iqalukpik), and broad whitefish. The majority of boat travel occurs along the Colville River and associated tributaries, in addition to the Beaufort Sea. Arctic cisco and burbot, wolf and wolverine, and geese were the only resources in which the primary method of travel was not by boat. For these resources, Nuiqsut residents reported traveling by snowmachine to net sets or jigging locations for fish, primarily on the Colville River, or traveling in larger overland areas to search for furbearers or to access waterfowl hunting areas. Residents use other travel methods less commonly, including foot travel (fish, moose, and geese), car/truck (Arctic cisco, burbot, caribou, and geese), four-wheeler (caribou and geese), and plane (wolf and wolverine). In recent years, Stephen R. Braund and Associates has documented greater use of four-wheelers and cars/trucks when hunting for caribou, which may reflect increased use of the recently constructed Spur Road for hunting (Stephen R. Braund and Associates 2017).

Table 3.4-8. Nuiqsut annual cycle of subsistence activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-salmon	Moderate	Limited	Moderate	Moderate	Limited	Limited	Moderate	High	High	High	High	Limited
Marine Non-salmon	--	--	--	--	--	--	--	--	High	High	--	--
Salmon	--	--	--	--	--	--	High	Moderate	--	--	--	--
Caribou	Limited	Limited	Limited	Limited	Limited	Moderate	High	High	Moderate	Moderate	Limited	Limited
Moose	Limited	--	--	--	--	--	Limited	High	High	Moderate	Limited	Limited
Bear	Moderate	Moderate	Moderate	Limited	Limited	Limited	Limited	Limited	High	Moderate	Moderate	Moderate
Muskox	--	--	--	--	--	--	--	High	High	High	--	--
Furbearers	High	High	High	High	Moderate	Limited	Limited	Limited	Limited	Limited	Moderate	High
Small Land Mammals	--	--	--	--	Limited	Limited	High	High	Limited	--	--	--
Marine Mammals	--	--	Moderate	High	Limited	Limited	Moderate	High	High	Limited	Limited	Limited
Upland Birds	Moderate	Moderate	High	High	Moderate	Limited	--	Limited	Limited	Moderate	Moderate	Moderate
Waterfowl	--	--	--	Limited	High	High	Moderate	Moderate	Moderate	Moderate	Limited	Limited
Eggs	--	--	--	--	--	High	--	--	--	--	--	--
Plants and Berries	--	--	--	--	Limited	Limited	High	High	--	--	--	--

Sources: Bacon et al. (2009); Braem et al. (2011); Brower and Hepa (1998); Brown (1979); Brown et al. (2016); EDAW Inc. (2008); Fuller and George (1999) (where resource category data are available); Galginaitis (2014); Hoffman et al. (1988); Libbey et al. (1979); Stephen R. Braund and Associates (2010a, 2017).

(-) = No activity and/or harvest; Limited = Limited activity and/or harvest; Moderate = Moderate activity and/or harvest; High = High activity and/or harvest

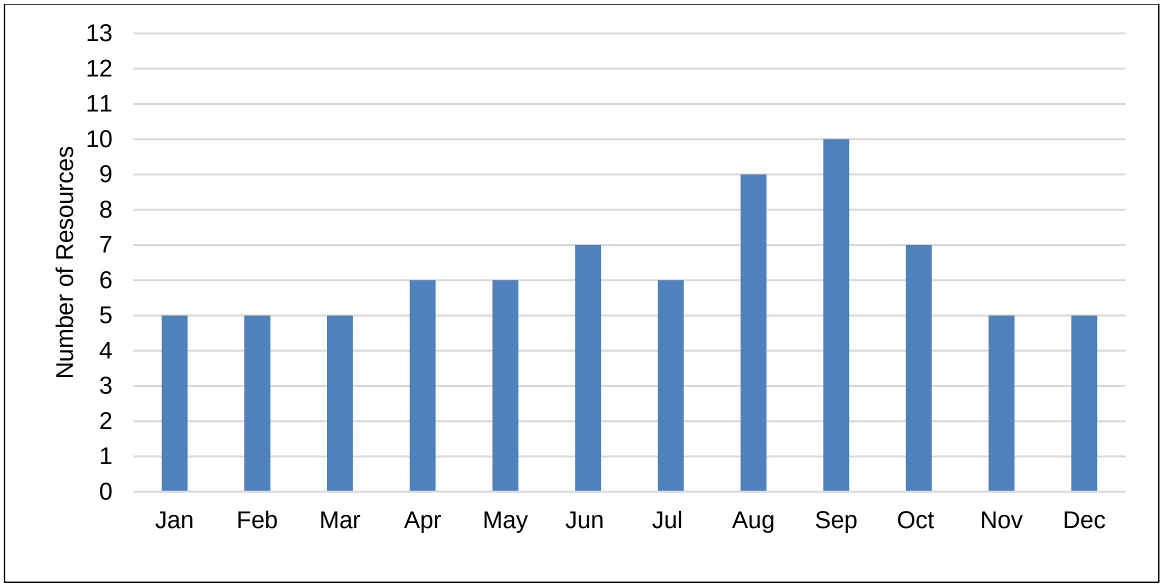

Figure 3.4-5. Nuiqsut number of subsistence resource categories by month

Sources: Bacon et al. (2009); Brown et al. (2016); Brower and Hepa (1998); EDAW Inc. (2008); Fuller and George (1999); Galginaitis (2014); Libbey et al. (1979); Stephen R. Braund and Associates (2010a, 2017).

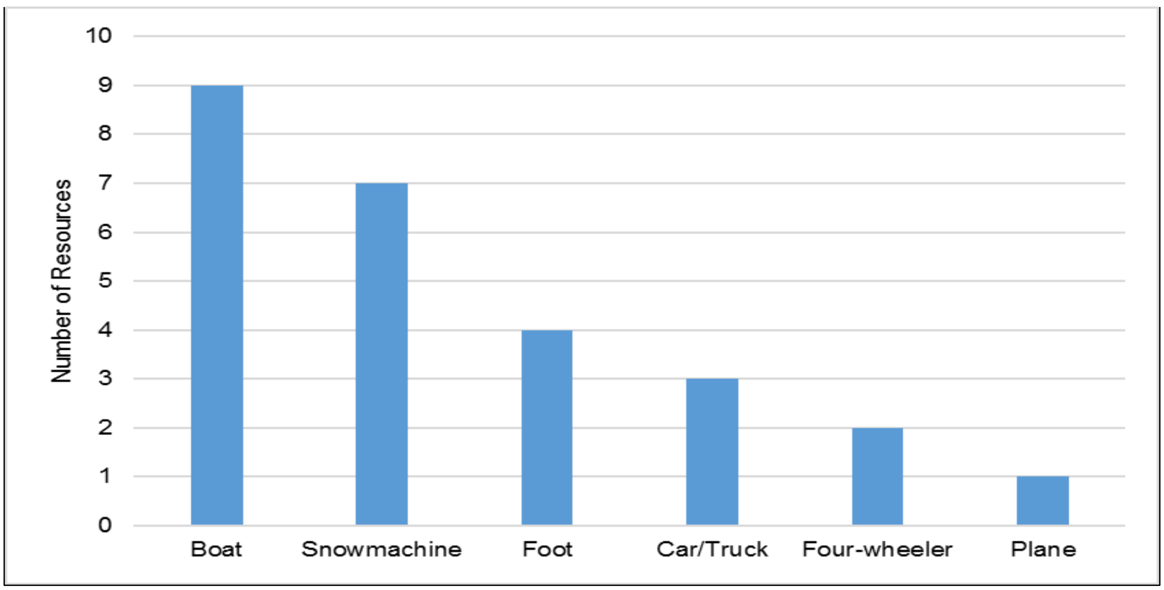

Figure 3.4-6. Nuiqsut number of subsistence resource categories by travel method

Sources: (parentheses depict the study years represented by the data): Stephen R. Braund and Associates (2010a [1995–2006]), (2017 [2008–2015]).

Table 3.4-9. Nuiqsut travel method by subsistence resource

Resources	Boat	Snowmachine	Foot	Car/Truck	Four-wheeler	Plane
Arctic Cisco & Burbot						
Arctic Char/ Dolly Varden & Broad Whitefish						
Caribou						
Moose						
Wolf & Wolverine						
Bowhead Whale						
Seals						
Geese						
Eider						

Notes: For each resource, darker shades indicate greater use of a travel method; lighter shades indicate lesser use of a travel method. Caribou data based on Stephen R. Braund and Associates 2017, all other resources based on Stephen R. Braund and Associates 2010a.

Harvest Data

Data on per capita pounds are available for 3 study years and range from 399 pounds in 1985 to 896 pounds in 2014. Resources providing the highest percentage of the total harvest vary over the study years; marine mammals (primarily bowhead whale) contributed the highest amount to the total subsistence harvest during 1992, 1995–1996, 2000–2001, and 2014; non-salmon fish were the top harvested resource during the remaining 3 study years (1985, 1993, and 1994–1995). Large land mammals (primarily caribou, but also moose) were generally the second or third most harvested resource during all study years. In terms of species, bowhead whales, caribou, Arctic cisco, broad whitefish, and moose were generally the top harvested species during most study years (Appendix F, Tables F-1 and F-2). Other subsistence species that have contributed highly to Nuiqsut subsistence harvests over the study years include seals, geese, least cisco (iqalusaaq), Arctic grayling (sulukpaugaq), and burbot. In 2014, the most recent comprehensive household harvest survey conducted in Nuiqsut, bowhead whales were the top species harvested (accounting for 39.8 percent of the harvest), followed by caribou (28.3 percent), broad whitefish (9.8 percent), and Arctic cisco (8.7 percent) (Table F-2). Over half of Nuiqsut households participated in harvests of non-salmon fish, large land mammals, marine mammals, migratory birds, and vegetation (Table F-1). Salmon harvests are relatively minor in Nuiqsut; however, according to a recent study sponsored by the Bureau of Ocean Energy Management there is evidence that suggests salmon catches in Nuiqsut are increasing (Carothers et al. 2013). The most recent household survey in Nuiqsut (2014) show higher salmon harvests than in previous years (Table F-1).

Community Participation

According to the available data, in 1985, 1993, and 2014, 100 percent of Nuiqsut households reported using subsistence resources (i.e., harvesting, processing, storing, distributing, preparing, and/or consuming) and over 90 percent of households participated in subsistence activities (i.e., attempted harvests of subsistence resources). During all 3 study years, households most commonly participated in harvests of non-salmon fish, large land mammals, and migratory birds (Appendix F, Table F-1). In 2014, the most recent comprehensive study year for Nuiqsut, the highest rates of harvest participation were for caribou (66 percent of households), geese (66 percent), broad whitefish (60 percent), cloudberries (aqpik) (55 percent), and Arctic cisco (52 percent) (Appendix F, Table F-2). Rates of household participation in caribou hunting were even higher in 2015 (Stephen R. Braund and Associates 2017), at 84 percent of households attempting harvests of caribou. Participation in sharing of subsistence resources is an important cultural value among Iñupiaq communities, including Nuiqsut. Over 90 percent of households both gave and received subsistence resources during all available study years. In 2014, marine mammals were the most commonly received resource (95 percent of households), followed by large land mammals (72 percent), and non-salmon fish (71 percent).

Subsistence Resource Importance

Understanding the relative importance of different subsistence resources to a community is important when considering the potential magnitude of project effects. While subsistence users consider all resources (including non-subsistence resources) to be of high importance to their communities, their region, and the environment as a whole, certain resources may provide a greater proportion of a community's nutritional needs, or they may facilitate more opportunities for community participation in culturally important activities such as harvesting, processing, sharing, and consuming subsistence foods. The following analysis quantitatively ranks Nuiqsut subsistence resources in terms of their material and cultural importance, with the recognition that all subsistence resources are important to Nuiqsut residents' health, identity, and well-being. The Alaska Department of Fish and Game Division of Subsistence, the North Slope Borough Department of Wildlife Management, and private consulting businesses (e.g., Stephen R. Braund and Associates) have collected household harvest data in Nuiqsut since the 1980s (see "Harvest Data," above). These data allow for the quantitative measurement of certain aspects of the material and cultural importance of subsistence resources.

Material Importance

In this analysis, material importance was measured in terms of a resource's contribution toward Nuiqsut's total subsistence harvest (i.e., edible pounds for each resource divided by the total edible pounds for all resources). This analysis used averages based on harvest data from Alaska Department of Fish and Game, North Slope Borough, and industry sponsored caribou monitoring studies (e.g., Stephen R. Braund and Associates 2012, 2013, 2014, 2015, 2016, 2017) for study years between 1985 and 2015. Table 3.4-10 shows the average percentage each resource contributed to total subsistence harvests (in terms of pounds of usable weight) harvested by residents of Nuiqsut for all available study years. The majority of community subsistence harvests come from a relatively small number of resources. Resources contributing less than 1 percent to the total harvest are not included in Table 3.4-10 and are considered minor in terms of material importance.

Resources of major material importance are those that have contributed an average of 9 percent or more to the total harvest in terms of pounds useable weight; resources of moderate material importance have contributed an average of between 2 percent and 9 percent; and resources of minor material importance have contributed less than 2 percent. While the minimum cutoff of 9 percent to qualify as "major" may seem low, it is important to note that a review of harvest amounts across communities in Alaska that participate in the mixed cash-subsistence economy shows that few individual resources actually contribute more than 9 percent. This is due in part to the high diversity of resources harvested by subsistence communities (i.e., a large number of individual species), and the limited number of resources that are available in a size or quantity large enough to provide a large portion of a community's subsistence diet. As shown in Table 3.4-10, four resources are considered major in terms of material importance: caribou, bowhead whale, broad whitefish, and Arctic cisco. An additional three resources are considered moderate: moose, ringed seal, and bearded seal. Of the minor resources, seven contribute at least 1 percent (but less than 2 percent) to the total harvest: white-fronted geese (niglivik), least cisco, Arctic grayling, burbot, humpback whitefish, Arctic char, and chum salmon (iqalugruaq). All other species have contributed an average of less than 1 percent of the total harvest and are considered minor.

Table 3.4-10. Average resource contribution over all available study years, Nuiqsut

Resource Level	Resource	Percent of Total Harvest (Pounds of Useable Weight)
Major Resources (>9% of Total Harvest)	Caribou	30
	Bowhead whale [a]	30
	Broad whitefish	15
	Arctic cisco	9
Moderate Resources (2% to 9% of Total Harvest)	Moose	3
	Ringed seal	2
	Bearded seal	2
Minor Resources (<2% of Total Harvest)	White-fronted geese	1
	Least cisco	1
	Arctic grayling	1
	Burbot	1
	Humpback whitefish	1
	Arctic char	1
	Chum salmon	1

Note: Table includes resources that contribute 1 percent or more toward the total harvest based on data presented in Appendix F, Table F-2. All other resources contributed an average of less than 1 percent and are categorized as minor, and thus, the table does not add to 100 percent.

[a] Averages include unsuccessful bowhead whale harvest years.

Sources: Alaska Department of Fish and Game (2017), Fuller and George (1999), Brower and Hepa (1998), and Bacon et al. (2009).

Cultural Importance

Household harvest data used to quantitatively measure the cultural importance of subsistence resources include data related to participation (percent of households attempting harvests of each resource) and sharing (percent of households receiving each resource). These measures were chosen as informing the cultural importance of subsistence resources because participation in subsistence activities promotes the transmission of skills from generation to generation, and sharing of subsistence resources between households strengthens cohesion in the community and region. Cultural importance of resources includes a multitude of other factors, including harvesting and processing activities, transfer of knowledge, satisfaction from eating traditional food, continuity of harvesting in traditional places, and harvesting resources unique to an area. While quantitative data have not been collected systematically for these measures, they are still important in assessing potential impacts in an environmental consequences analysis.

Table 3.4-11 shows the average percentage of households attempting harvests of each resource for all available study years, and Table 3.4-12 shows the average percentage of households receiving resources in each community for all available study years. The tables break subsistence resources into categories of major, moderate, and minor, based on their contributions toward participation and sharing. Resources considered to contribute highly to cultural importance were those with the majority (50 percent or more) of households either sharing or participating in the harvests of that resource. For Nuiqsut, these resources are caribou, broad whitefish, white-fronted geese, Arctic cisco, cloudberries, burbot, Arctic grayling, bowhead whale, and bearded seal. Resources of moderate (11 percent to 49 percent of households) and minor (10 percent or less of households) cultural importance are also shown in Table 3.4-11 and Table 3.4-12. These tables do not include resources with less than 5 percent of households attempting harvests or receiving.

Combined Material and Cultural Importance

The material and cultural importance of resources for Nuiqsut are combined and summarized in Table 3.4-13. In all cases, resources are categorized based on their highest ranking under either material or cultural importance. For example, to be categorized as a resource of major importance, the resource must be ranked as "major" under either material or cultural importance (Table 3.4-10, Table 3.4-11, and Table 3.4-12). Resources of major importance to Nuiqsut residents include multiple species of fish (Arctic cisco, Arctic grayling, broad whitefish, and burbot), white-fronted geese, caribou, bowhead whale, bearded seal, and cloudberries.

Table 3.4-11. Average percentage of Nuiqsut households attempting harvests, all available study years

Resource Level	Resource	Percent of Households
Major Resources (≥50%)	Caribou	73
	Broad whitefish	69
	White-fronted geese	62
	Arctic cisco	61
	Cloudberries	55
	Burbot	51
	Arctic grayling	50
Moderate Resources (11% to 49%)	Ptarmigan	48
	Ground squirrel	45
	Canada geese	42
	Moose	40
	Least cisco	40
	Arctic char	38
	Ringed seal	36
	Bearded seal	32
	Squirrel	31
	Bowhead whale	30
	Blueberries	29
	Pink salmon	28
	Humpback whitefish	26
	King eider	24
	Chum salmon	23
	Red fox	22
	Wolverine	22
	Snow geese	19
	Wolf	18
	Brant	17
	Brown bear	14
	Arctic fox	14
	Rainbow smelt	13
	Spotted seal	13
	Geese eggs	11

Resource Level	Resource	Percent of Households
Minor Resources (≤10%)	Dolly Varden	10
	Cranberries	9
	Long-tailed duck	8
	Walrus	7
	Common eider	7
	Northern pike	7
	Saffron cod	7
	Crowberries	7
	Polar bear	7
	Arctic cod	7
	Round whitefish	5
	Sourdock	5
	Northern pintail	5
	Weasel	5

Sources: Alaska Department of Fish and Game (2017); Fuller and George (1999); Brower and Hepa (1998); Bacon et al. (2009); Braem et al. (2011); Stephen R. Braund and Associates (2012–2017).

Note: Table includes resources with at least 5 percent of households attempting harvests, based on data presented in Appendix F, Table F-2. All other resources had less than 5 percent attempting harvests and are categorized as minor.

Table 3.4-12. Average percentage of Nuiqsut households receiving resource, all available study years

Resource Level	Resource	Percent of Households
Major Resources (≥50%)	Bowhead whale	96
	Caribou	75
	Arctic cisco	57
	Bearded seal	50
Moderate Resources (11% to 49%)	Broad whitefish	49
	Walrus	43
	Ringed seal	43
	Moose	41
	White-fronted geese	36
	Burbot	35
	Cloudberry	29
	Polar bear	29
	Beluga	24
	Canada geese	24
	Arctic grayling	24
	Arctic char	22
	Rainbow smelt	22
	King eider	19
	Brown bear	18
	Least cisco	17
	Pink salmon	17
	Blueberries	16
	Ptarmigan	15
	Long-tailed duck	13
	Geese eggs	12
	Bird eggs	12
	Chum salmon	11
Minor Resources (≤10%)	Brant	9
	Chinook salmon	9
	Humpback whitefish	9
	Dall sheep	9
	Muskox	8
	Lake trout	8
	Ground squirrel	8
	Snow geese	7
	Northern pike	7
	Sourdock	7
	Arctic cod	7
	Sockeye salmon	6
	Wolf	6
	Sheefish	6

Resource Level	Resource	Percent of Households
Minor Resources (≤10%) (continued)	Cranberries	5
	Spotted seal	5
	Coho salmon	5
	Unknown seal	5
	Wolverine	5
	Squirrel	5

Sources: Alaska Department of Fish and Game (2017); Fuller and George (1999); Brower and Hepa (1998); Bacon et al. (2009); Braem et al. (2011); Stephen R. Braund and Associates (2012–2017).

Note: Table includes resources with at least 5 percent of households receiving the resource, based on data presented in Appendix F, Table F-2. All other resources had less than 5 percent receiving and are categorized as minor.

Table 3.4-13. Combined material and cultural importance

Major Resources	Moderate Resources	Minor Resources
Caribou	Brown bear	Dall sheep
Bowhead whale	Moose	Muskox
Bearded seal	Arctic fox	Beaver
Arctic cisco	Ground squirrel	Marmot
Arctic grayling	Red fox	Weasel
Broad whitefish	Wolf	Arctic cod
Burbot	Wolverine	Bering cisco
White-fronted geese	Beluga	Chinook salmon
Cloudberries	Polar bear	Coho salmon
	Ringed seal	Dolly Varden
	Spotted seal	Flounder
	Walrus	Halibut
	Arctic char	Lake trout
	Burbot	Northern pike
	Chum salmon	Rockfish
	Humpback whitefish	Round whitefish
	Least cisco	Saffron cod
	Pink salmon	Sculpin
	Rainbow smelt	Sheefish
	Brant	Sockeye salmon
	Canada geese	Common eider
	King eider	Loons
	Long-tailed duck	Mallard
	Snow geese	Northern pintail
	Geese eggs	Sandhill crane
	Ptarmigan	Spectacled eider
	Blueberries	Teal
		Tundra swan
		Brant eggs
		Eider eggs
		Gull eggs
		Seabird & loon eggs
		Snowy owl
		Cranberries
		Crowberries
		Hudson Bay tea
		Other wild greens
		Sourdock

Sources: See Tables 3.4-4, 3.4-5, and 3.4-6.

3.4.6.4 Subsistence Uses in the Project Study Area

This section describes Nuiqsut's subsistence uses that have been documented within and near the project study area. Data from these harvest and subsistence mapping studies have been provided and/or discussed in the previous sections, and selected indicators, based on data availability, are included in the following section as relevant to describing subsistence uses in the project study area.

The project study area for the construction period was established using a 2.5-mile buffer around all project infrastructure and activity (see Map 3.3-1). The project study area for the construction phase includes all project components, including seasonal infrastructure needed to support construction, i.e., ice roads. A separate project study area was created for the drilling and operations phase, and was established using a 2.5-mile buffer around all permanent and temporary infrastructure and activity that would occur in the drilling and operation phase (see Map 4.4-1).

Subsistence Use Areas

The project study area overlaps with Nuiqsut subsistence use areas. Table 3.4-14 indicates which types of subsistence use areas are overlapped by the two project study areas, by resource. According to these data, residents of Nuiqsut use the project study area to hunt for or harvest nearly all types of subsistence resources including large land mammals, furbearers and small land mammals, fish, birds, and vegetation. Marine mammals use areas also intersect the project study area; however, these use areas begin in the Colville River and extend to offshore areas. See Appendix F, Figures F-2 through F-9 for maps depicting resource category use areas vis-à-vis the project study area. The reader should keep in mind that the information presented in this "Subsistence Use Areas" section is specific to activities that occur within the project study area (Figure 3.4-2, Figure 3.4-3). Thus, any activities that occur outside of the specific project study area polygons are not included in the discussion.

Table 3.4-14. Use areas overlapping project study area by resource category [a]

Resource Categories	Nuiqsut Use Areas Overlapping Project Study Area
Moose	yes
Caribou	yes
Other Large Land Mammals	yes
Furbearers & Small Land Mammals	yes
Marine Mammals [b]	yes
Fish	yes
Birds	yes
Vegetation	yes

Notes: Not all studies addressed each of the resource categories listed in this table.

[a] This table applies to both the construction project study area and the drilling and operation project study area.

[b] Marine mammal subsistence use areas begin in Colville River and extend to offshore areas.

Sources: Brown (1979), Pedersen (1979), Pedersen (1986), BLM (2004), Stephen R. Braund and Associates (2010a), Brown et al. (2016), Stephen R. Braund and Associates (2017).

In order to characterize the subsistence uses of areas with new infrastructure, the study team removed boat use areas from the analysis of subsistence uses within the project study area because there are no new infrastructure associated with GMT2 occurring in use areas accessed by boat. The project study area is a 2.5-mile buffer of the three action alternative footprints, including infrastructure that is east of the CD5 development and in areas of existing infrastructure between CD1 and CD2. Except for a new pipeline between CD1 and CD4 that is parallel to an existing pipeline, the only areas of new infrastructure proposed for GMT2 occur southwest of CD5, in an area that is not directly accessible by boat. The project study area includes a portion of the Colville River that is commonly accessed by boat and used for subsistence, but will not be overlapped by new permanent infrastructure associated with GMT2. While boating activities may be affected indirectly through changes in resource availability (see the discussion of “Resource Availability” below), a majority of direct impacts (occurring at the same time and place) on subsistence use areas will be limited to inland areas that are not accessed during boating activities. Therefore, in order to focus on current subsistence uses within areas of new infrastructure associated with the proposed project and to most accurately represent the directly affected use areas by excluding boat based subsistence activities, the analysis of uses within the project study area for months of use and method of transportation excludes subsistence use areas that are accessed by boat. Instead, these sections provide data on subsistence use areas within the project study area that have been traditionally accessed by other modes of transportation such as snowmachines and four-wheelers.

During their subsistence mapping project, Stephen R. Braund and Associates (2010a) documented a total of 758 Nuiqsut use areas that characterized the 1995–2006 subsistence use areas of 33 active and knowledgeable Nuiqsut subsistence harvesters. In total, 321 of the 758 individual use areas (approximately 42 percent) documented for the 1995–2006 time period (Stephen R. Braund and Associates 2010a) overlapped with the project study area (Table 3.4-15, Table 3.4-16). Excluding use areas accessed by boat, a total of 206 overland use areas (27 percent) overlapped with the project study area. Each use area represents the area in which an individual Nuiqsut respondent searched for a particular resource; areas vary in size depending on the resource being targeted and can range from a small net site for Arctic cisco to large overland areas covering many square miles in search of resources such as caribou or wolf and wolverine. Data from the Nuiqsut Caribou Subsistence Monitoring Project (Stephen R. Braund and Associates 2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017) recorded 1,497 caribou use areas over the 8 study years. Of these 1,497 use areas, 1,309 (87 percent) are overlapped by the project study area; 374 caribou use areas (25 percent) overlapped overland use areas (i.e., non-boat use areas) within the project study area. Similar results for the drilling and operation project area are presented in Table 3.4-16.

Table 3.4-15. Sources of Project-Specific Subsistence Use Area Information, Project Area for Construction

Source	Resource Type	Time Period	Total Number of Use Areas	Total Number (%) of Use Areas in Project Study Area	Total Number (%) of Overland Use Areas in Project Study Area
Stephen R. Braund and Associates (2010a)	All Resources	1995–2006	758	321 (42%)	206 (27%)
Stephen R. Braund and Associates (2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017)	Caribou	2008–2015	1,497	1,309 (87%)	374 (25%)

Table 3.4-16. Sources of Project-Specific Subsistence Use Area Information, Project Area for Drilling & Operations

Source	Resource Type	Time Period	Total Number of Use Areas	Total Number (%) of Use Areas in Project Area for Drilling & Operations	Total Number (%) of Overland Use Areas in Project Area for Drilling & Operations
Stephen R. Braund and Associates (2010a)	All Resources	1995–2006	758	231 (30%)	171 (23%)
Stephen R. Braund and Associates (2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017)	Caribou	2008–2015	1,497	549 (37%)	188 (13%)

Table 3.4-17 and Table 3.4-18 shows the percentage of Nuiqsut respondents reporting overland use areas within the project study area for the 1995–2006 time period (Stephen R. Braund and Associates 2010a). Overall, 100 percent of Nuiqsut active harvesters interviewed for the 1995–2006 time period reported overland use areas crossed by the project study area. Of these respondents, 100 percent of wolf and wolverine hunters reported hunting in the project study area, the highest of any single resource, followed closely by 91 percent of caribou harvesters hunting in the project study area. Burbot, geese, and Arctic cisco use areas within the project study area were reported by between 73 and 77 percent of respondents. Both Arctic cisco and burbot use areas in the project study area are accessed by snowmachine along the Colville River or overland via the frozen tundra. Broad whitefish and eider harvesters accounted for the remaining overland uses within the project study area at 8 percent and 7 percent, respectively.

Table 3.4-17. Percent of Nuiqsut Harvesters Using Project Area for Construction, Overland Use Areas Only

Resource Category	Percent of Nuiqsut Resource Respondents in Project Study Area	Number of Last 10 Year Respondents for Resource
Wolverine	100	24
Wolf	100	23
Caribou	91	32
Burbot	77	30
Geese	76	33
Arctic cisco	73	33
Broad whitefish	8	26
Eiders	7	28
Percent of Total Harvesters Using Project Study Area	100	33
Total Number Interviewed in Study	33	--

Source: Stephen R. Braund and Associates (2010a).

Table 3.4-18. Percent of Nuiqsut Harvesters Using Project Area for Drilling & Operations, Overland Use Areas Only

Resource Category	Percent of Nuiqsut Resource Respondents in Project Area for Drilling & Operations	Number of Last 10 Year Respondents for Resource
Wolverine	88	24
Wolf	87	23
Caribou	84	32
Burbot	7	30
Geese	67	33
Arctic cisco	70	33
Broad whitefish	4	26
Eiders	0	28
Percent of Total Harvesters Using Project Study Area	100	33
Total Number Interviewed in Study	33	--

Source: Stephen R. Braund and Associates (2010a).

Figure 3.4-7 through Figure 3.4-15 provide additional characterization of Nuiqsut residents' use of the project study area in terms of high to low overlapping use areas. This information is based on Stephen R. Braund and Associates (2010a) for the 1995–2006 time period and Stephen R. Braund and Associates (2017) for the 2008–2015 time period for caribou only. For all resource use areas combined (Figure 3.4-7), residents reported the highest overlapping use areas along Colville River channels (including Nigliq Channel) and in overland areas west of the community; areas of moderate overlapping use occurred east of the Nigliq Channel.

Overlapping caribou subsistence use areas for the 1995–2006 and 2008–2015 time periods are shown on Figure 3.4-8 and Figure 3.4-9. Similar to their all resources use for the 1995–2006 time period, Nuiqsut residents reported the highest overlapping use areas for caribou along the Colville River channels and west of the community with moderate use east of Nigliq Channel. More recent caribou use areas from 2008 through 2015 show a changing pattern of use within the project study area with the areas of highest overlapping use still concentrated along the Colville River channels and directly west of the community, but more moderate use to the northwest and low overlapping use areas east of the Nigliq channel. Other land mammals hunted for in the project study area, for which there are overlapping subsistence use area data, include wolf and wolverine (Figure 3.4-10). These use areas show the highest overlapping use to the west and south of the community. These furbearers are less commonly found in areas closer to the coast, which show low to moderate overlapping use areas. Overland hunting patterns for land mammals in the project study area were discussed by Nuiqsut residents during the Stephen R. Braund and Associates (2010a) and caribou monitoring studies:

> [Caribou hunting] a little past Fish Creek and follow the lakes [to the south to the edge of the hills]. I did cross the Colville once or twice but I usually stay on the west side because there is a lot of willows and deep snow. The last time I crossed the river was around five years ago. Up the Nigliq Channel about two to three miles. December to April or May. That is about when we start getting low in December. We try to get as much in the fall as we can because they are fat and healthy. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

> Not until February [did I go hunting]; I already got what I needed in the fall. I just went in this back yard area. Just up to Judy Creek, Tinmiaqsiugvik, I believe that’s it. I came up to somewhere around here and I followed this creek. No, I didn’t quite go out that way [to Fish Creek]. I followed this creek, went straight to Ocean Point and back home. That’s pretty much the same route I take every time, and you’ll see something out there. I went out, I think it was in March or April ….I just got a couple of caribou after whaling, so it’s still in September because it was a quick season [for whaling], it was after everyone came home. I gave all my caribou out, so I’ve got to go out and get some more. Right in the back yard. I went everywhere in this [same area]. I went on maybe eight or nine Honda trips. The first one is where I caught that one, and the next three or four [trips], just nothing out there. These were July and August – late July and August, and September. (Stephen R. Braund and Associates Nuiqsut Interview November 2015)

> Within the last ten years, [I hunted wolf and wolverine] within this area. I know we lost a couple of them [wolverine] here, on the Fish Creek area. I got some there, by the cabins and by the ocean there. November until the end of March. We are looking for them now, when we look for caribou. When we see something black, we ignore the caribou and go for it. They move constantly. The wolves are the same. They do travel. (Stephen R. Braund and Associates Nuiqsut Interview November 2005).

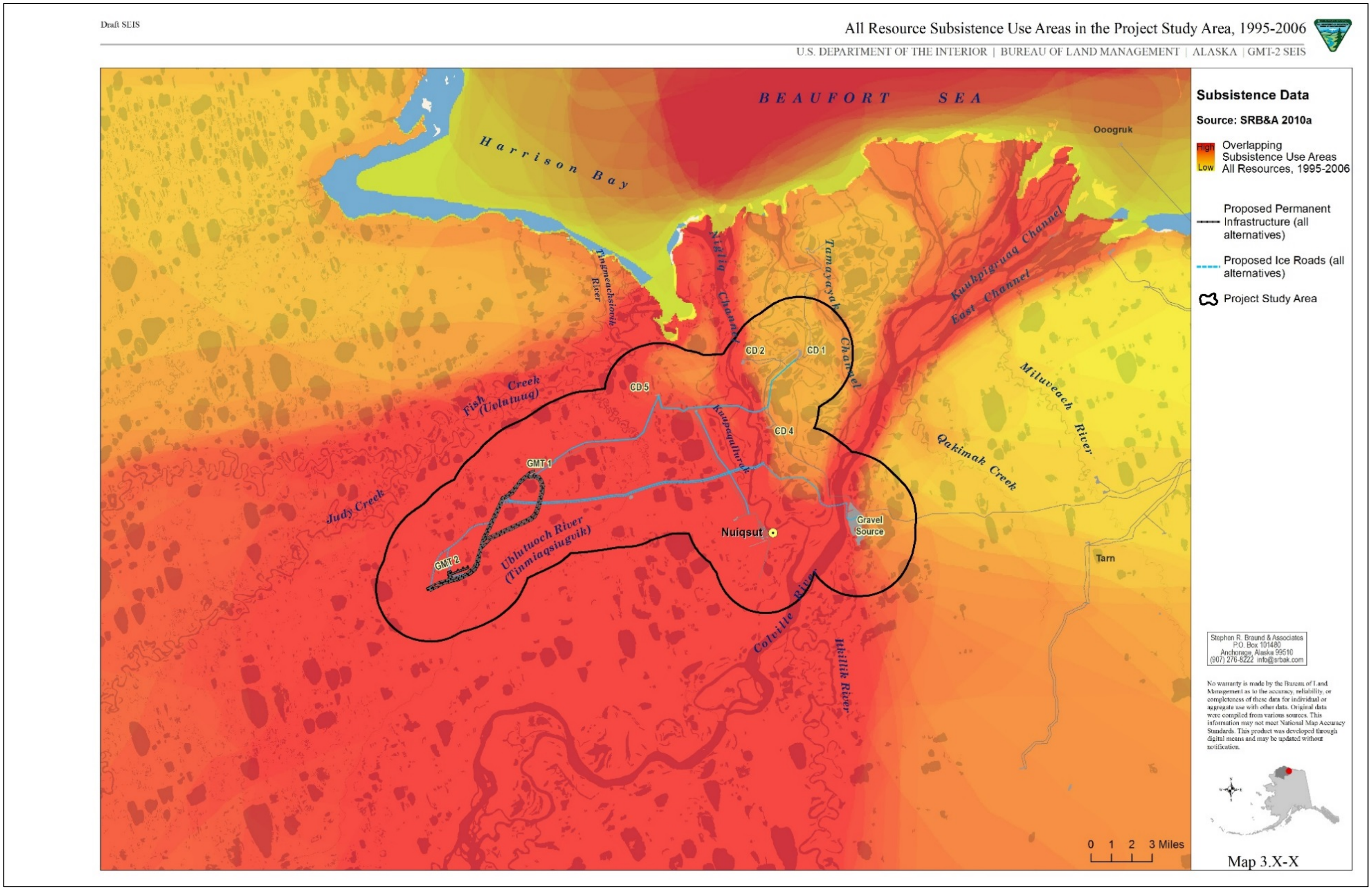

Figure 3.4-7. All resources subsistence use areas in the project study area, 1995–2006

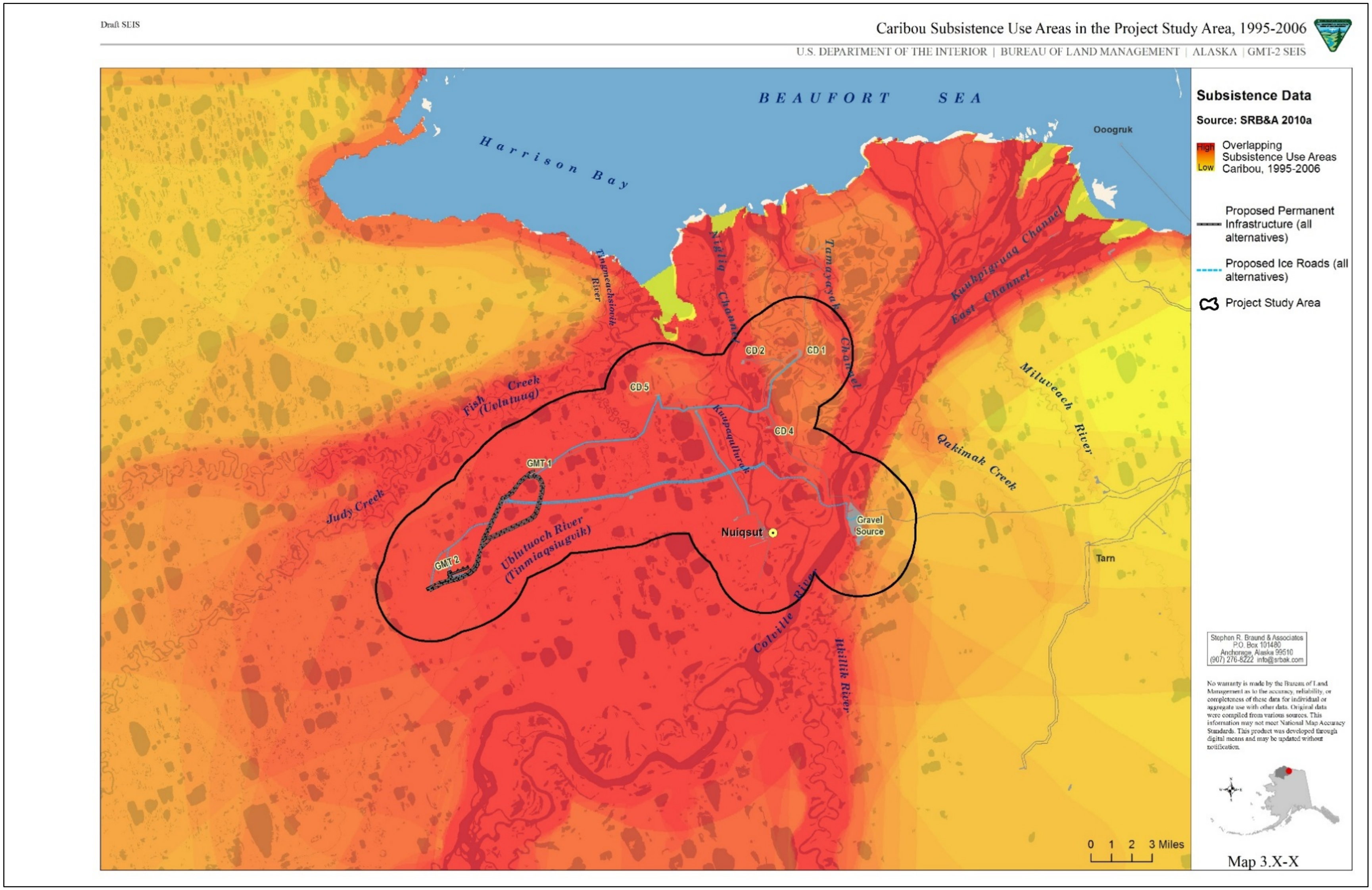

Figure 3.4-8. Caribou subsistence use areas in the project study area, 1995–2006

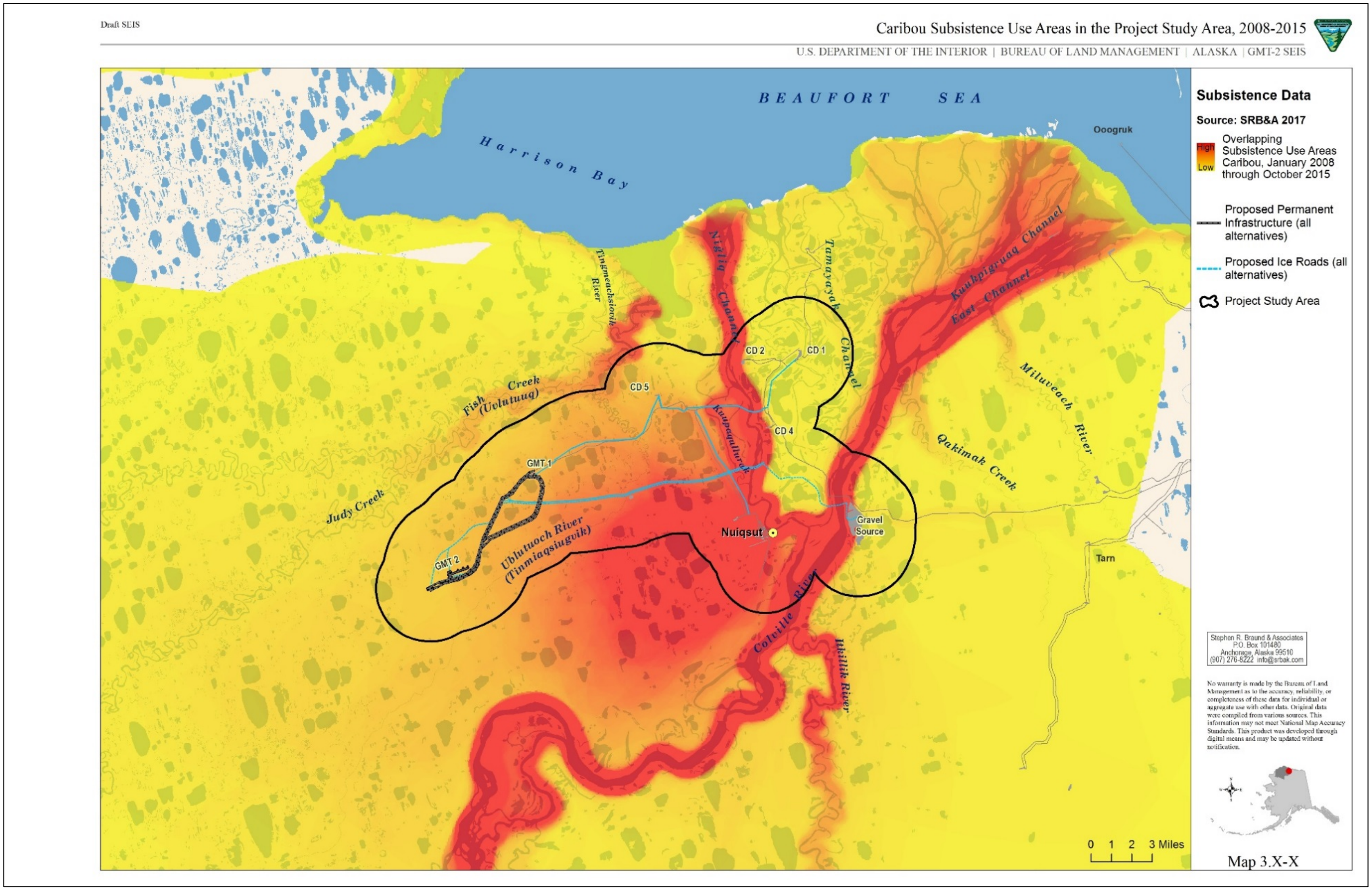

Figure 3.4-9. Caribou subsistence use areas in the project study area, 2008–2015

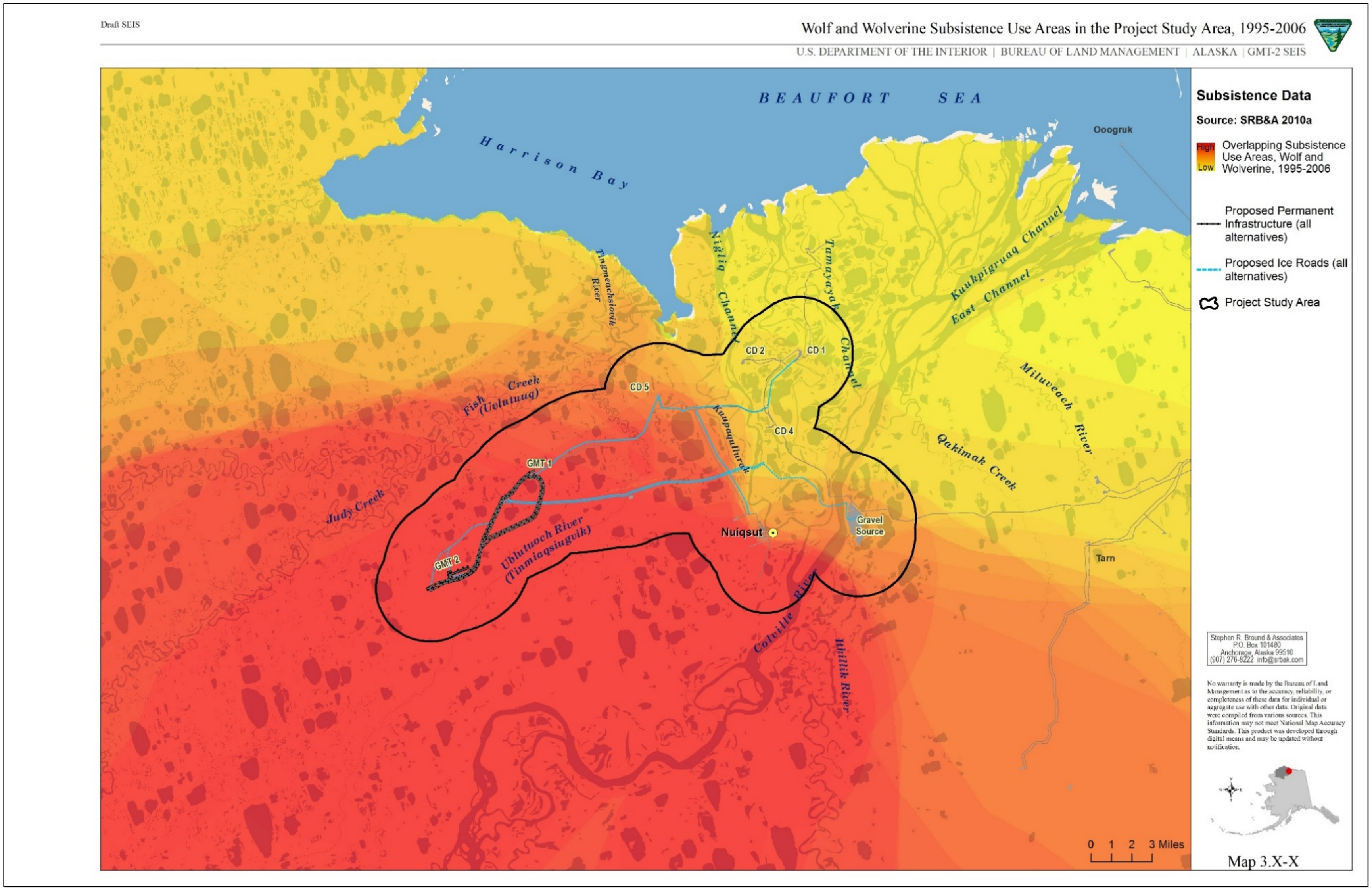

Figure 3.4-10. Wolf and wolverine subsistence use areas in the project study area, 1995–2006

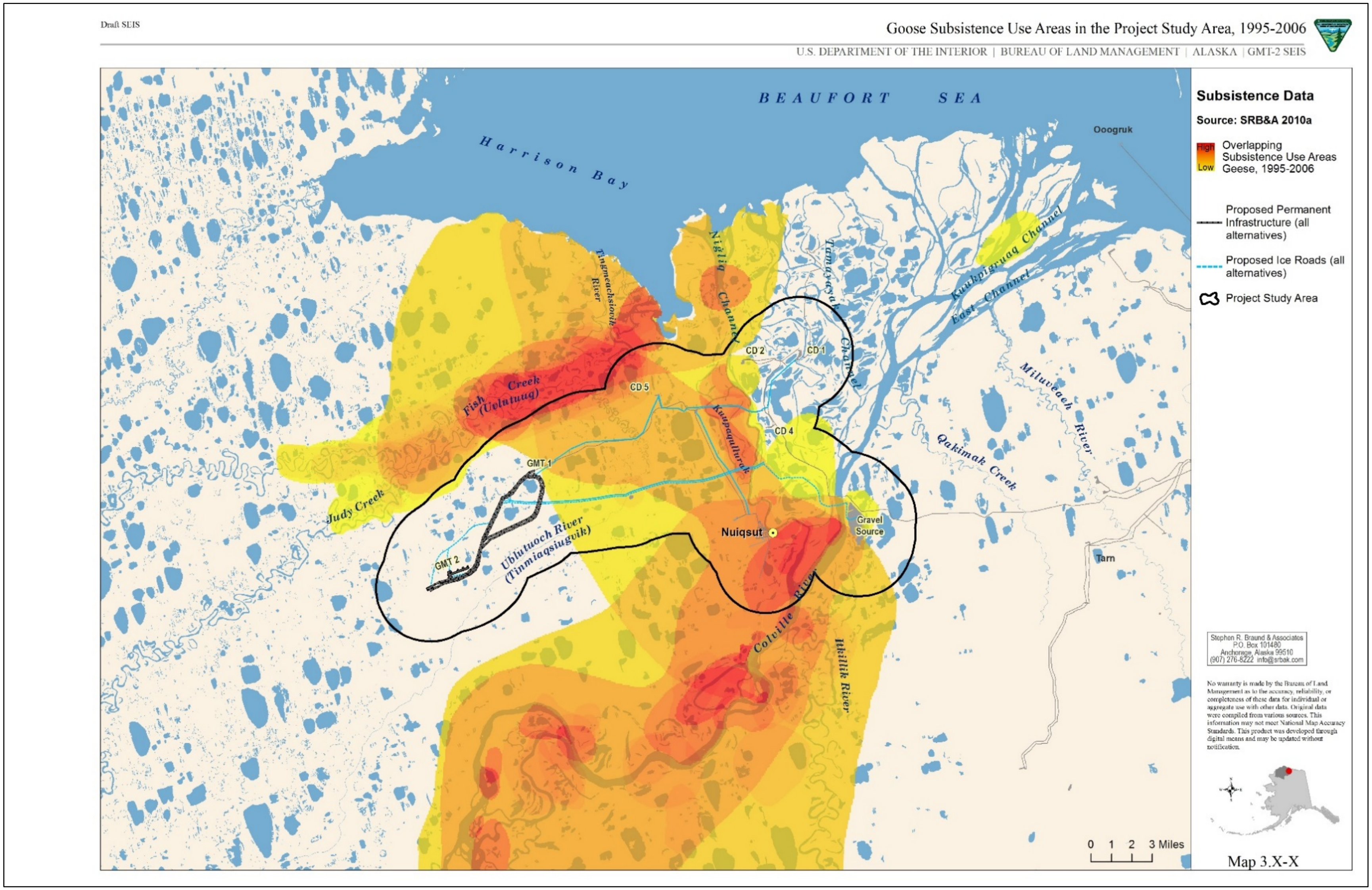

Figure 3.4-11. Geese subsistence use areas in the project study area, 1995–2006

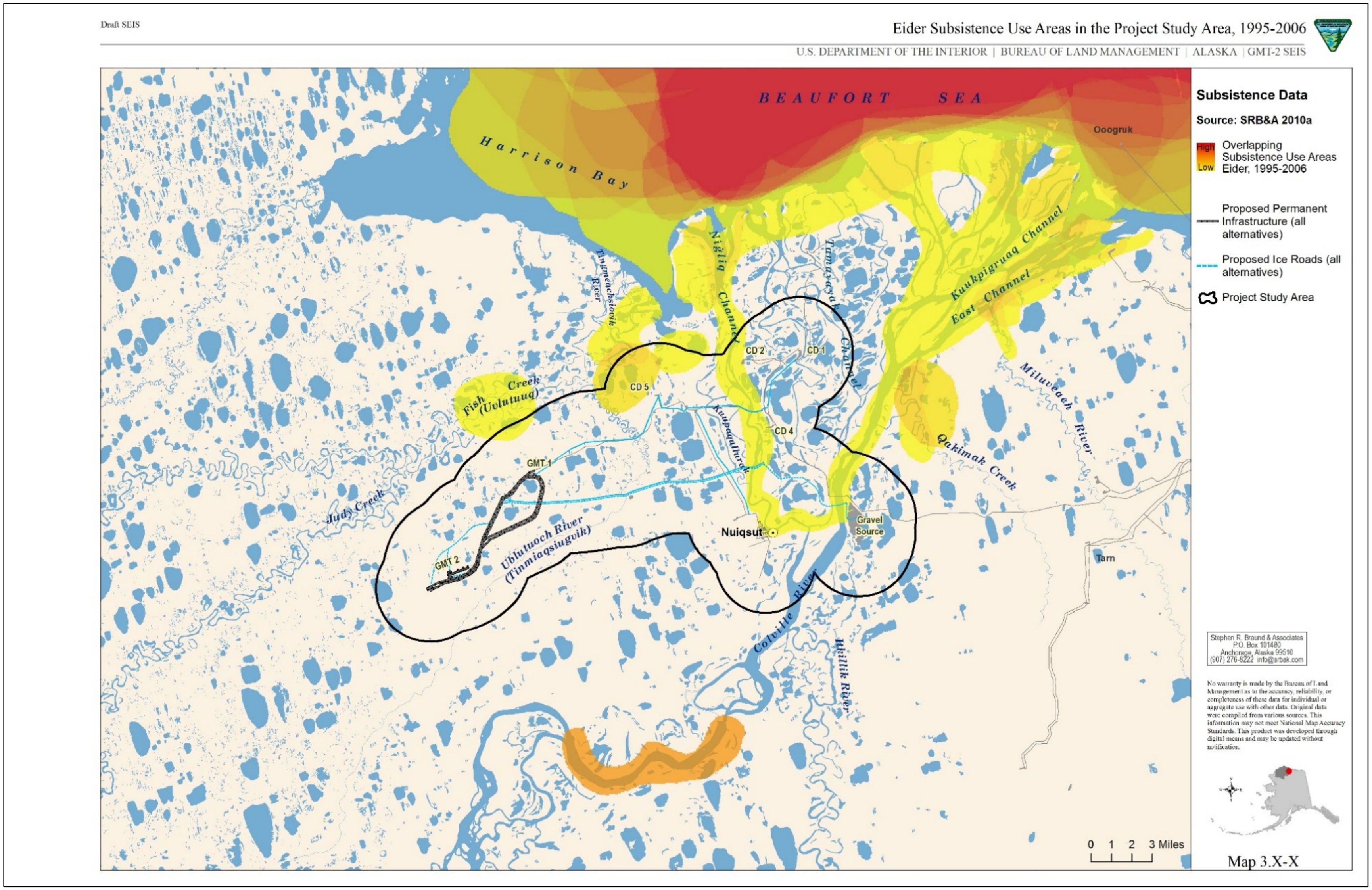

Figure 3.4-12. Eider subsistence use areas in the project study area, 1995–2006

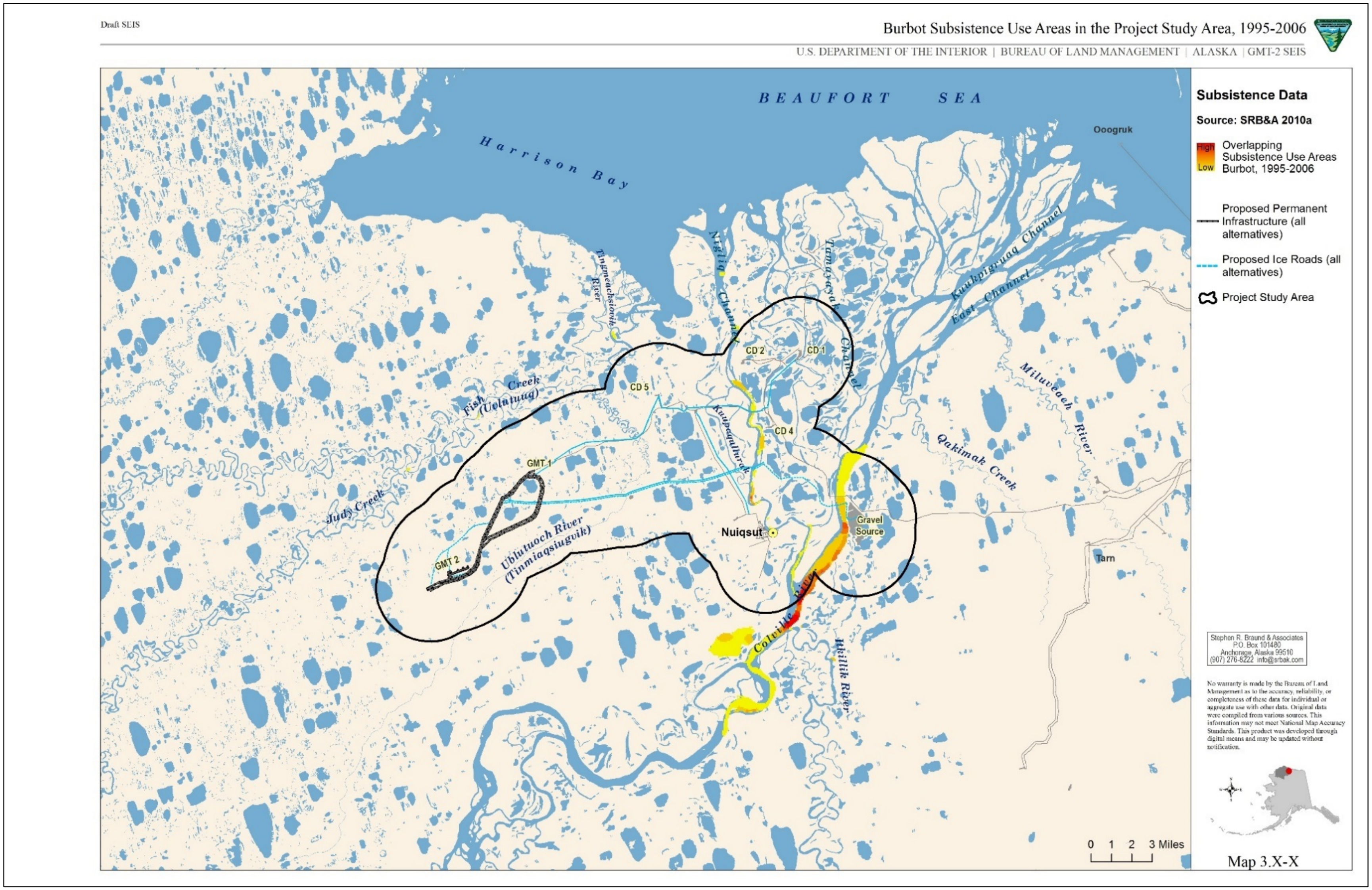

Figure 3.4-13. Burbot subsistence use areas in the project study area, 1995–2006

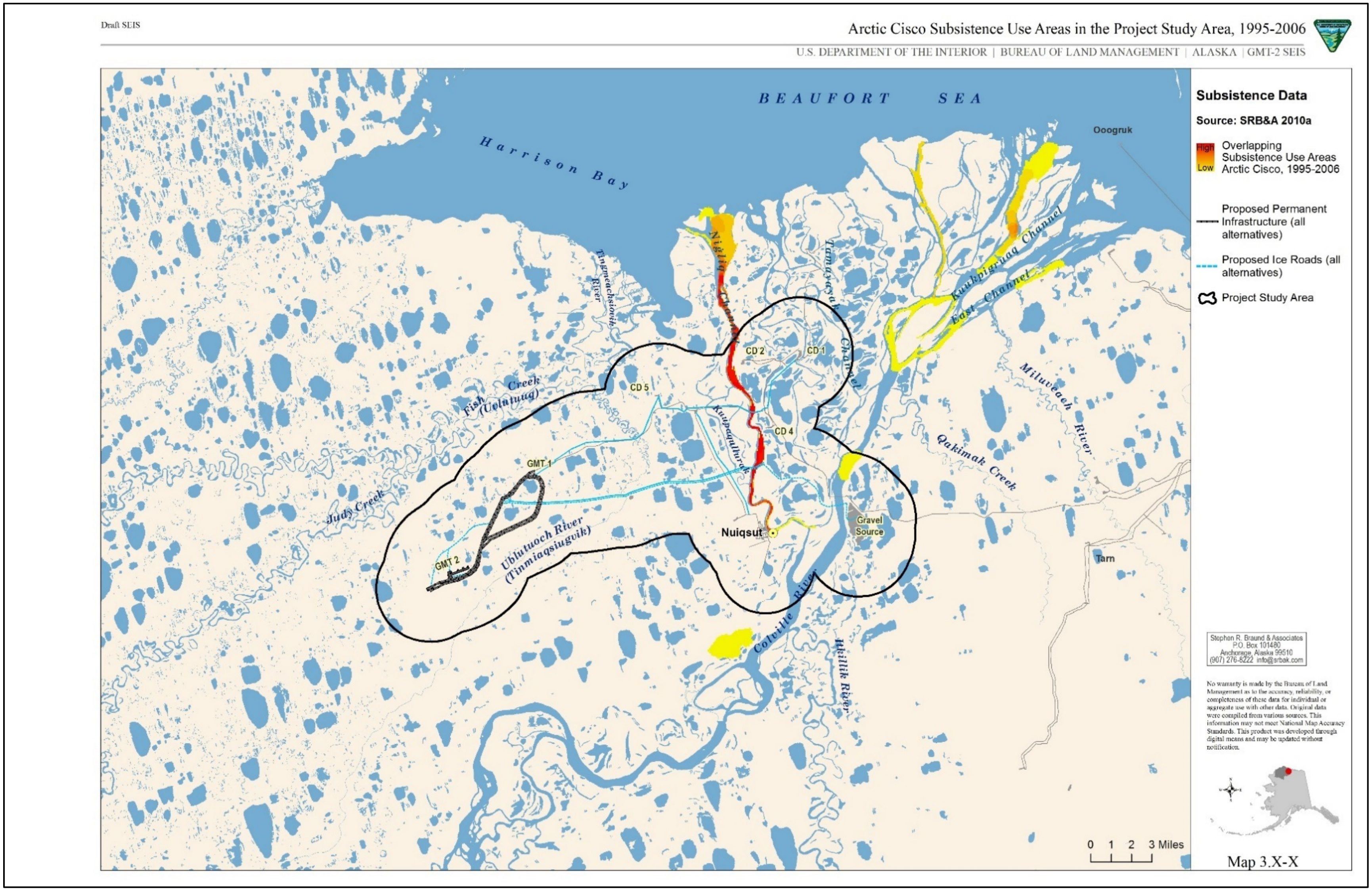

Figure 3.4-14. Arctic cisco subsistence use areas in the project study area, 1995–2006

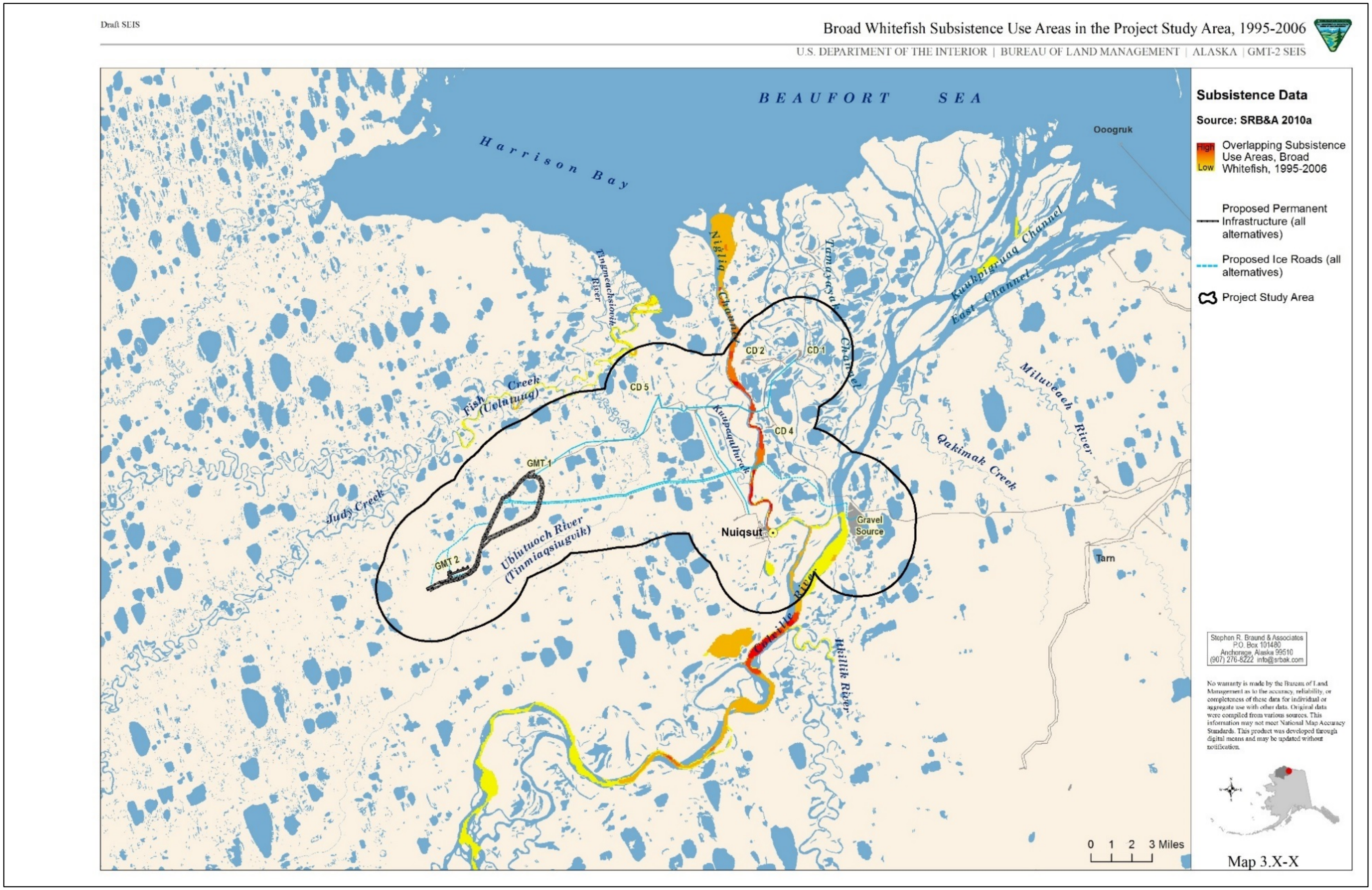

Figure 3.4-15. Broad whitefish subsistence use areas in the project study area, 1995–2006

Migratory bird use areas are shown on Figure 3.4-11 and Figure 3.4-12 for geese and eiders in the project study area. Areas of highest overlapping use for geese occur along the waterways of Fish Creek, Colville River, and Kuupaqullurak, as these are the areas where the geese concentrate during spring breakup. Moderate use occurs in overland areas between these three locations. Within the project study area, no geese use areas were documented for the 1995–2006 time period west of GMT1 (except some limited use extending east from the Fish Creek area), and few geese use areas were documented east of the Nigliq Channel. Unlike geese, eiders are typically harvested offshore, although as shown in Figure 3.4-12, Nuiqsut residents identified a few areas of low overlapping use that intersect with the project study area, including along the Nigliq Channel and near CD5 and Fish Creek. During the Stephen R. Braund and Associates (2010a) study, Nuiqsut residents described their use of the project study area for geese hunting and more limited eider hunting as follows:

> Mostly [geese hunting] in the Fish Creek area. They are all over; you find a good spot by watching the geese and their pattern. You see them going in one area and you go find a good spot. All in that area and up the Colville. We don't go very far up north. And then we go towards Fish Creek. As far as that second fishing hole. I don't really go anywhere else. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)
>
> One of my favorite spots is at Fish Creek but I didn't go this last year. It is past this creek. It is a big area. May, snowmachine. We get the Canadian, greater Canadian and the black ones with the ring around their necks, black brants and the white-fronted and the snow geese. That is a hot spot. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)
>
> I did before with my father, here in this area [between Fish Creek and Nigliq Channel], we were actually on land when we were looking for them [eiders], we didn't catch any but we were there, that was early June. Snowmachine. Could have been May. Last catch right off the island. Mostly in the channel too also. Couple of trips maybe. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

Fish use areas for burbot, Arctic cisco, and broad whitefish have been documented within the project study area (Figure 3.4-13 through Figure 3.4-15). Burbot use areas are primarily concentrated along the Colville River southeast of the community with a few areas of moderate use located north of Nuiqsut along the Nigliq Channel; these areas are primarily accessed during the winter months when burbot are in prime harvesting condition. Unlike burbot, Arctic cisco use areas are primarily concentrated in the Nigliq Channel, with fewer use areas along the main Colville River, and are also primarily accessed during the early winter months when cisco migrate into the river. Lastly, broad whitefish are also primarily harvested in the Nigliq Channel, but during the summer months. Describing their use of the Nigliq Channel for Arctic cisco fishing and the main Colville for burbot fishing residents said:

> This stretch of Nigliq Channel is where most of Nuiqsut sets their subsistence fish nets. [His] uncle has a tent camp on Nanuq Lake, by Alpine CD-2. Stayed at camp that long to watch the nets and save gas. He monitors the nets to make sure they are catching the right fish-too close to the mouth and they got too many sculpins. (Stephen R. Braund and Associates Nuiqsut Interview November 2004)
>
> I caught a couple of burbot in my net. I keep them in the fall time we get them. Usually the best time to get those is in later part of this month and January, February, March, and April. That is when their liver becomes almost half their body weight, it is just rich, we don't even need seal oil, the way we have our fish is frozen and dipped in seal oil and with the tittaaliq you don't even need seal oil, but if you have too much of that liver you will get sick, and if it is just right you will catch a little buzz and get tired and nice. Right here at this point [north of Itkillik] right on that east bank, ¼ mile of that is good fishing for tittaaliq. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

Seasonal Round

Several sources provide specific data on the seasonal round and methods of transportation (see following section) of Nuiqsut subsistence activities in the project study area. Stephen R. Braund and Associates (2010) provided data on all resources subsistence use areas by month and methods of transportation (Stephen R. Braund and Associates 2010a); in addition, the ongoing Nuiqsut Caribou Subsistence Monitoring Project (Stephen R. Braund and Associates 2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017) provides similar data specific to caribou uses by month and method of transportation.

Figure 3.4-16 shows the percentage of overland use areas in the project study area, by month, as documented in Stephen R. Braund and Associates (2010a) for Nuiqsut. According to these data, overland uses of the project study area by Nuiqsut residents occur year-round, with the greatest peak of overland activity occurring in the winter from October through May with lower levels of activity in June, July, August, and September. Nuiqsut harvesters have provided traditional knowledge for why the project study area is most utilized in these months; reasons include the availability of resources, condition of animals, and traveling conditions:

> I go straight across here. I got one out here before, too. And one at Fish Creek, this whole area. One time [I went] all the way down to Judy Creek. Sometimes I go there. December until maybe the first week of April. It depends on the furs. When the sun comes out too early, it makes the skin dull. (Stephen R. Braund and Associates Nuiqsut Interview November 2005)

> When we get Arctic cisco, that is the best fish we like, we mostly like to eat qaaktaq because it is more tasty, more meat. Nearby Alpine, sometime [in] October or November all the way to December, depends on how the river ice is getting thicker and thicker and when ice gets thicker we stop fishing, and some people keep fishing, and when ice gets 4-5 feet thick they even keep on fishing. Snowmachine I mostly take, and some people take their truck along. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

> I do a lot of that [geese hunting] during May. Just right out where they first come we use to go to Ocean Point. Right around this area. When the snow is melting we move farther upstream about to where our cabin is. And when the snow is really melting again we go towards Fish Creek about middle of May. About right around this area. White front geese, Canadian or snow geese. No brant. Snowmachine. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

> You don’t have to go that far with a snowmachine [to catch caribou], right around the west side, right around by Fish Creek. About this whole area is what we usually use during winter time. Sometimes we [go] past Ocean Point. Somewhere in March and April. Yeah [we also hunt] in October and November but the only time we catch in October is cows, [because of rutting bulls]. (Stephen R. Braund and Associates Nuiqsut Interview November 2006)

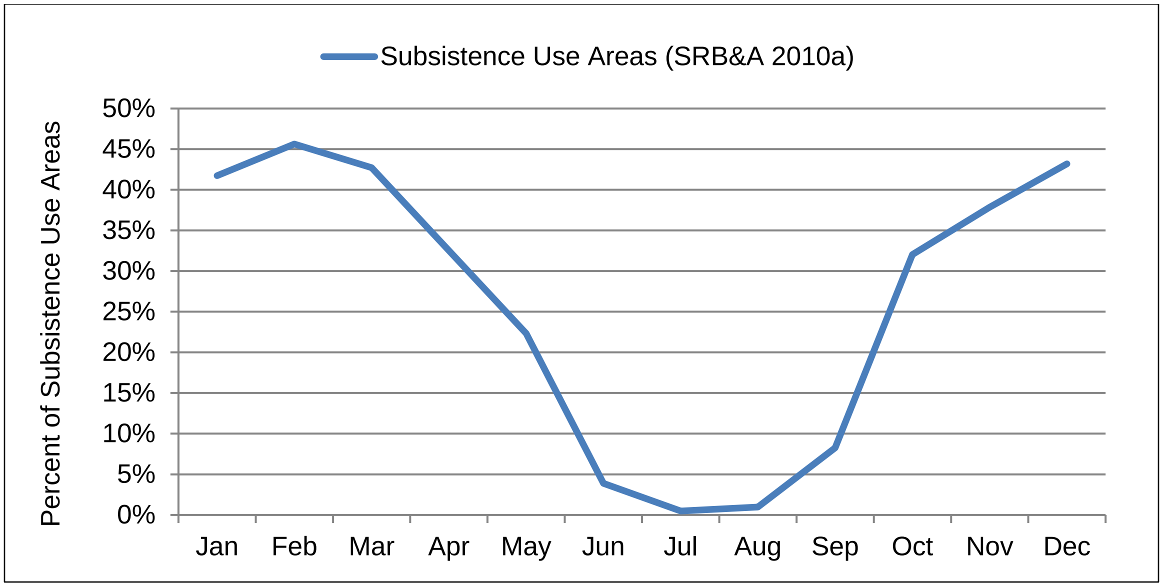

Figure 3.4-16. Overland all resources subsistence use areas by month in project study area, 1995–2006

Figure 3.4-17 and Figure 3.4-18 provides a specific depiction of the timing of caribou subsistence activities within the project study area from Stephen R. Braund and Associates (2010a) and the Nuiqsut Caribou Subsistence Monitoring Project. According to these data, Nuiqsut harvesters (similar to their all resources use areas) access the project study area for caribou hunting primarily during the winter months. Months of caribou hunting activities collected during the Nuiqsut Caribou Subsistence Monitoring Project (Figure 3.4-18) display a shift in the timing of caribou hunting activities in the project study area with a smaller percent of caribou use areas in the project study area accessed during the winter months and a slightly higher percentage (30 percent) accessed in September. August caribou hunting activity also increased slightly during the study years for the caribou monitoring project (Figure 3.4-18) compared to the Stephen R. Braund and Associates (2010a) study years (Figure 3.4-17). Possible explanations for this shift include documentation of the use of four-wheelers by younger Nuiqsut hunters, an activity that occurs primarily during August and September. Another possible explanation could be more caribou being available in the project study area during August and September. In either case, the available data do not provide a definitive answer as to the reason for the shift.

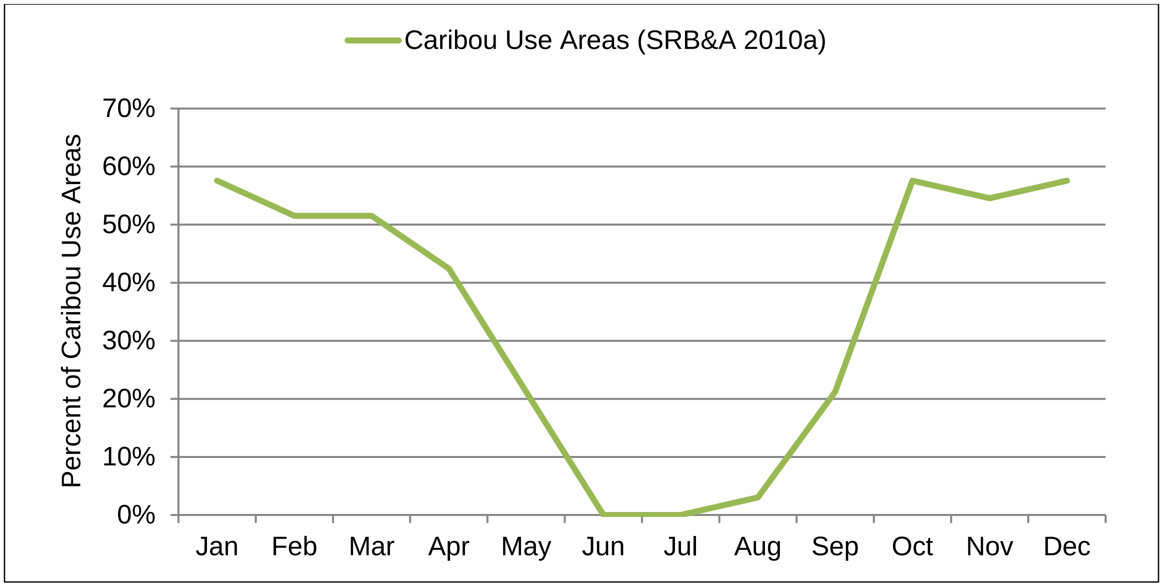

Figure 3.4-17. Overland caribou subsistence use areas by month in project study area, 1995–2006

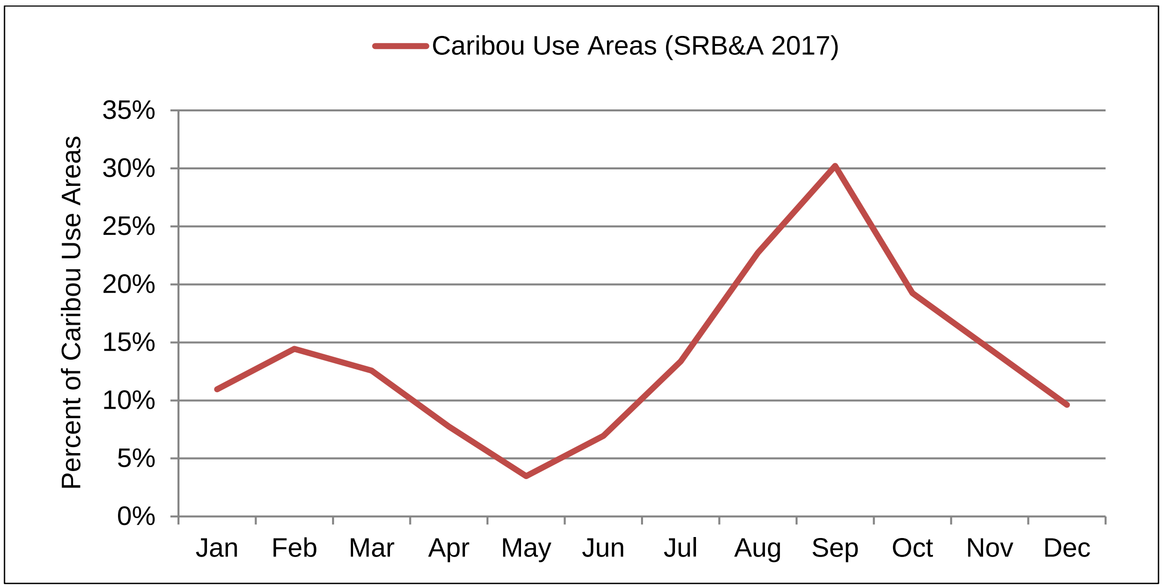

Figure 3.4-18. Overland caribou subsistence use areas by month in project study area, 2008–2015

As shown in Table 3.4-, use of the project study area occurs for various resources at differing times of the year. As defined by total number of use areas, geese hunting, Arctic cisco and burbot fishing, caribou hunting, and wolf and wolverine hunting are the primary activities that occur in the project study area. As discussed above, overland caribou hunting occurs year-round in the project study area with the greatest number of use areas accessed during late fall and throughout the winter (September to April), when travel by snowmachine and four-wheeler is most common. Wolf and wolverine hunting also peaks during the winter particularly from January through March. Geese hunting within the project study area primarily occurs during May. Fishing primarily occurs for Arctic cisco and burbot, with the peak of Arctic cisco harvesting occurring in October and November in the Colville River and burbot fishing occurring throughout the winter, particularly from November through March. Other documented hunting activities are more limited within the project study area and include eider hunting (two use areas) and broad whitefish fishing (two use areas).

Table 3.4-16. Nuiqsut months of use in project study area[1], overland use areas only

Resource Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Use Areas
Geese	--	--	--	Med	High	Low	--	--	--	--	--	--	42
Arctic cisco	--	--	--	--	--	--	--	--	Low	High	High	Med	35
Burbot	High	High	High	Med	Low	--	--	--	Low	Med	High	High	34
Caribou	High	High	High	Med	Low	--	--	Low	Low	High	High	High	33
Wolverine	High	High	High	Med	--	--	--	--	--	Low	Low	Med	30
Wolf	High	High	High	Med	--	--	--	--	--	Low	Low	Med	28
Eiders	--	--	--	--	High	High	--	--	--	--	--	--	2
Broad whitefish	--	--	--	--	High	High	High	High	High	High	High	--	2

Note: Does not include use areas accessed by boat in order to capture the timing of overland travel in the project area.
(-) = No use; Low = 1-24% of Use Areas; Med = 25-49% of Use Areas; High = 50-100% of Use Areas

Source: Stephen R. Braund and Associates (2010a).

Method of Transportation

Residents of Nuiqsut access the project study area using various modes of travel. Figure 3.4-19 shows the percentage of all resources use areas overlapping the project study area by reported method of transportation based on Stephen R. Braund and Associates (2010a). As shown in this figure, snowmachines are the most common mode of travel to the project study area. Less than 8 percent of use areas in the project study area were accessed by truck, four-wheelers, planes, or foot. As mentioned above, this analysis excludes use areas accessed by boat, because the area where new infrastructure is proposed is primarily accessed using overland methods of travel such as snowmachine and four-wheeler.

When viewing use area data specific to caribou for the same 1995–2006 study period, Nuiqsut residents reported using similar methods of transportation in the project study area, with snowmachine the primary mode of transportation and limited use of all other travel methods (Figure 3.4-20). During the Nuiqsut Subsistence Caribou Monitoring Project for the 2008 through 2015 study years, Nuiqsut residents reported nearly equal percentages of overland caribou use areas accessed using either snowmachine (47 percent) or four-wheeler (46 percent); of note, the caribou monitoring study reported a much higher percent of use areas in the project study area accessed using four-wheeler compared to the 1995–2006 study period (Figure 3.4-20). This is consistent with the higher percentage of caribou use areas accessed in August and September than in previous studies (Figure 3.4-18); overland travel during these months is generally limited to four-wheeler.

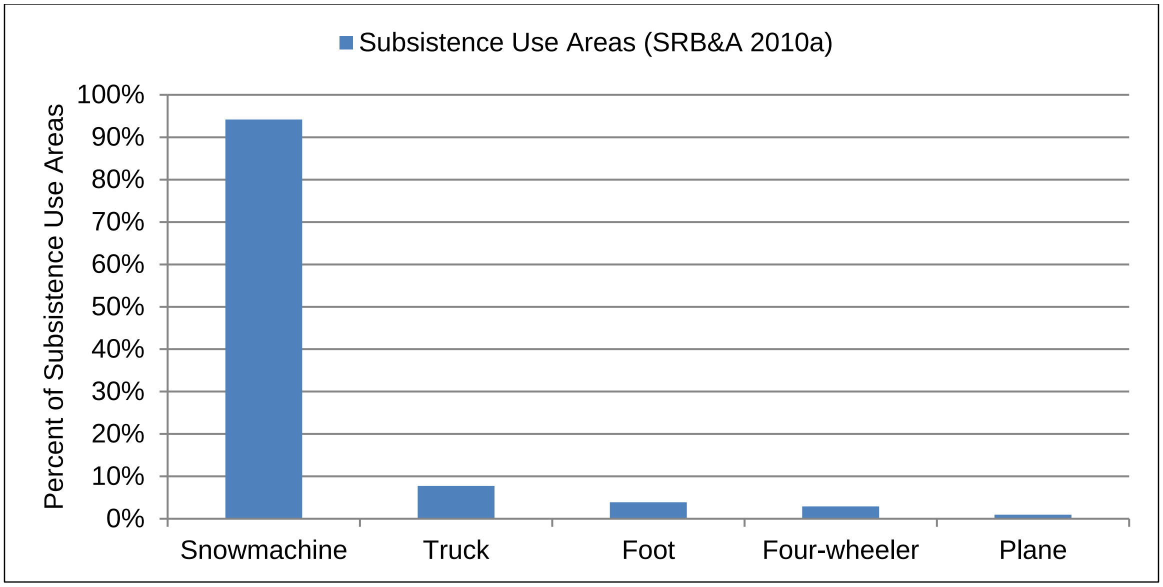

Figure 3.4-19. All resources subsistence use areas by method of transportation in project study area

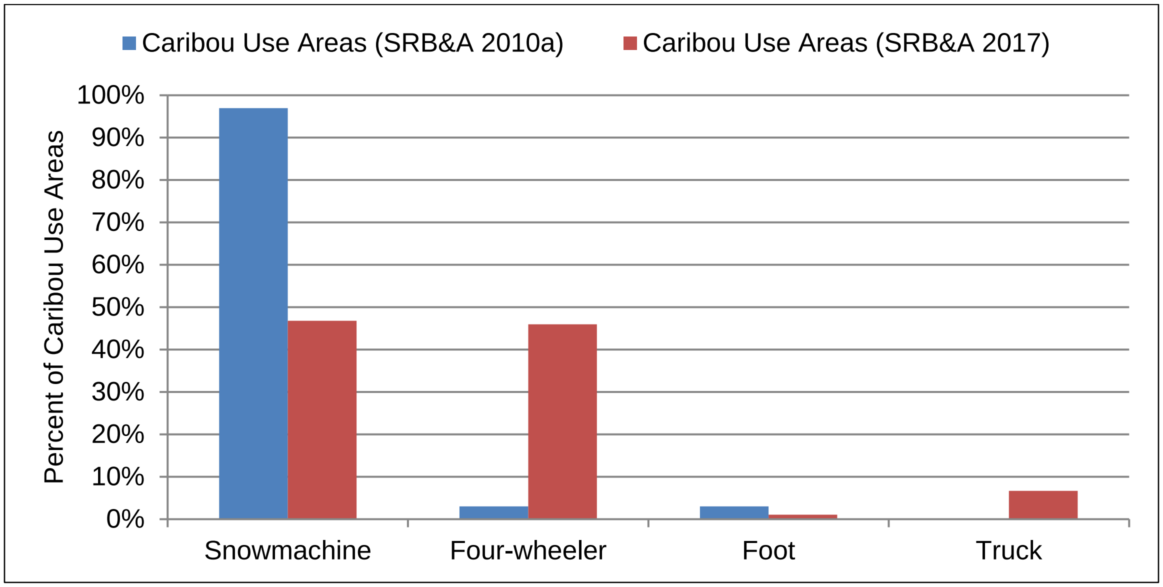

Figure 3.4-20. Caribou subsistence use areas by method of transportation in project study area

Figure 3.4-21 shows the types of travel method used to access caribou subsistence use areas within the project study area by month. All resource travel method by month data are not available from the Stephen R. Braund and Associates (2010a) study; however, as Figure 3.4-21 shows, the majority of travel method to the project study area is by snowmachine, which typically occurs from October to May. Specifically for caribou, Nuiqsut respondents reported using snowmachine during the winter (September to April) and four-wheeler during the summer and fall (primarily June to October) to access the project study area during the 2008 through 2015 study years (Figure 3.4-21).

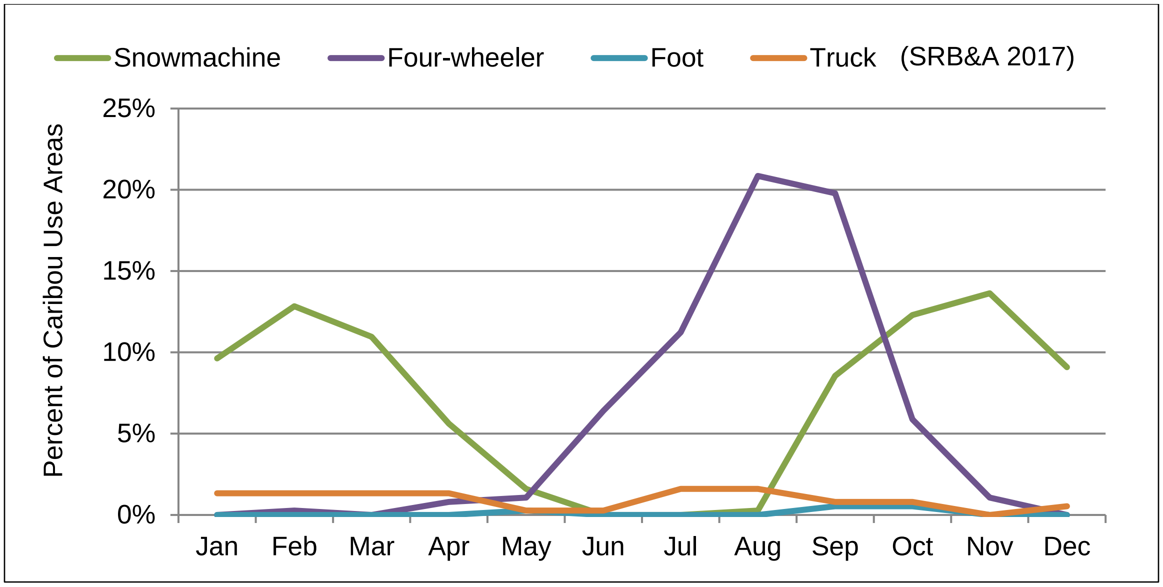

Figure 3.4-21. Travel method by month in project study area, caribou only

Figure 3.4-22 shows travel routes that have been documented for Nuiqsut based on Stephen R. Braund and Associates (2010a) interviews. Multiple travel routes within the project study area have been reported by residents of Nuiqsut. The majority of these travel routes head northwest of the community towards the coast and Utqiagvik (formerly Barrow). The Nigliq channel of the Colville River is also a heavily utilized travel corridor to access use areas in the Colville Delta, Beaufort Sea, and Fish and Judy creeks.

Harvest Data

As noted above, a key indicator of resource availability is per capita harvests within a community. Increases or decreases in these numbers may indicate an increase or decrease in the availability of subsistence resources to local harvesters. This discussion focuses on providing baseline indicator data for eight subsistence resources harvested within the entire project study area including the Colville River area based on information collected by Stephen R. Braund and Associates (2010a) for 14 resources. Of those 14 resources, the resources harvested within the project study area are as follows: caribou, geese, eiders, Arctic cisco, burbot, broad whitefish, wolf, and wolverine.

Figure 3.4-23 shows the average pounds per capita for six of the resources (caribou, eiders, geese, Arctic cisco, broad whitefish, and burbot). These data represent total harvests from all subsistence areas based on data presented in Appendix F; per capita data are not available specifically to the project study area. Because pounds per capita are generally not applied to furbearers and small land mammals, wolf and wolverine were excluded from the figure. Despite the limitations, these data are still useful for describing the relative importance of these key subsistence resources for Nuiqsut in terms of edible pounds.

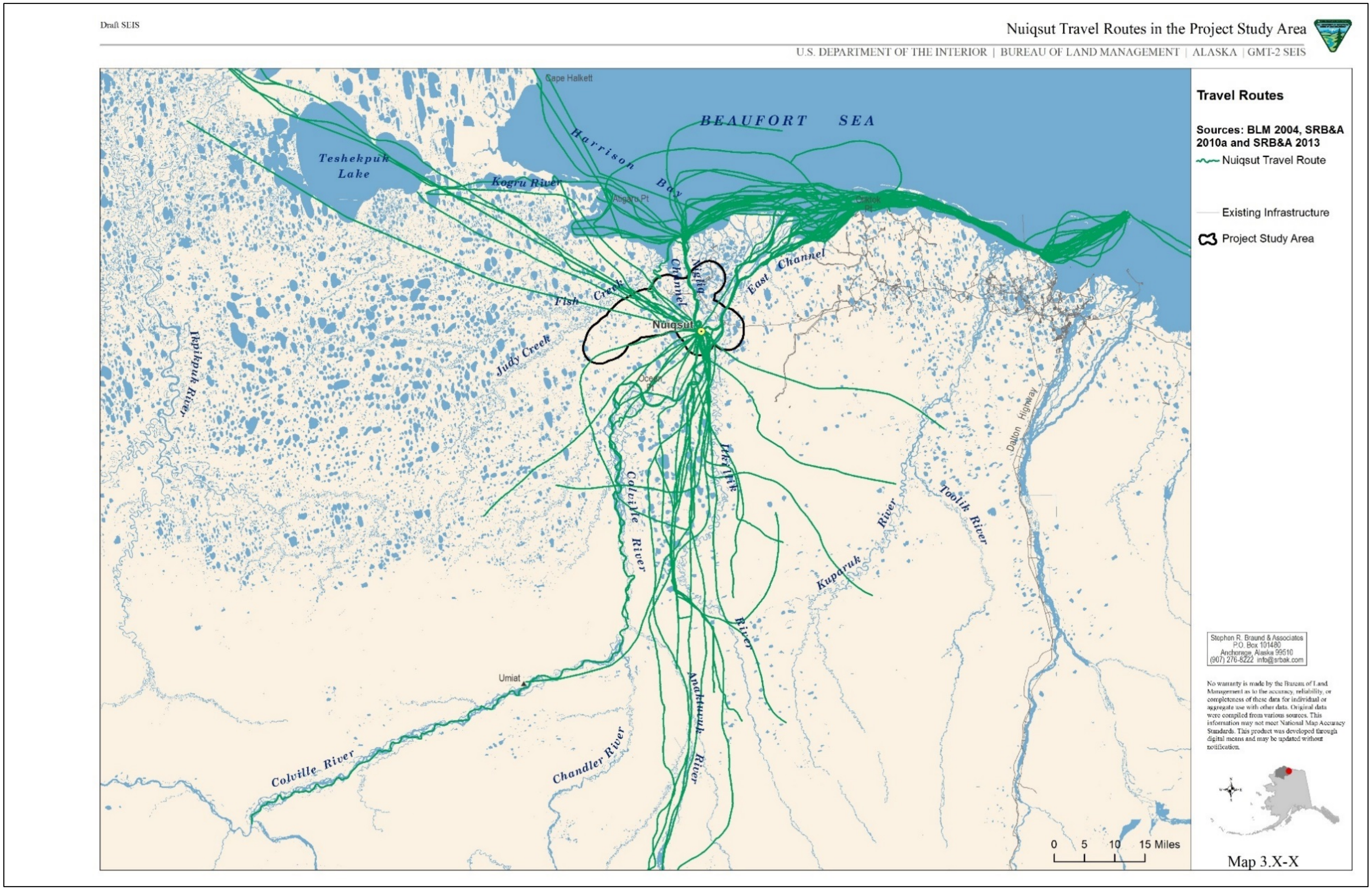

Figure 3.4-22. Nuiqsut travel routes

According to Figure 3.4-23, the average per capita harvest of caribou was 157 pounds, the highest of the six resources harvested in the project study area. Harvests of broad whitefish and Arctic cisco were similar with an average of 90 and 80 per capita pounds for each resource respectively. The Colville River is a particularly productive spawning and overwintering area for both broad whitefish and Arctic cisco. During years when the Arctic cisco run is strong, this resource may provide a substantial portion of the yearly harvest for Nuiqsut. Burbot, geese, and eiders contributed a lower amount at between 2 and 10 pounds per capita.

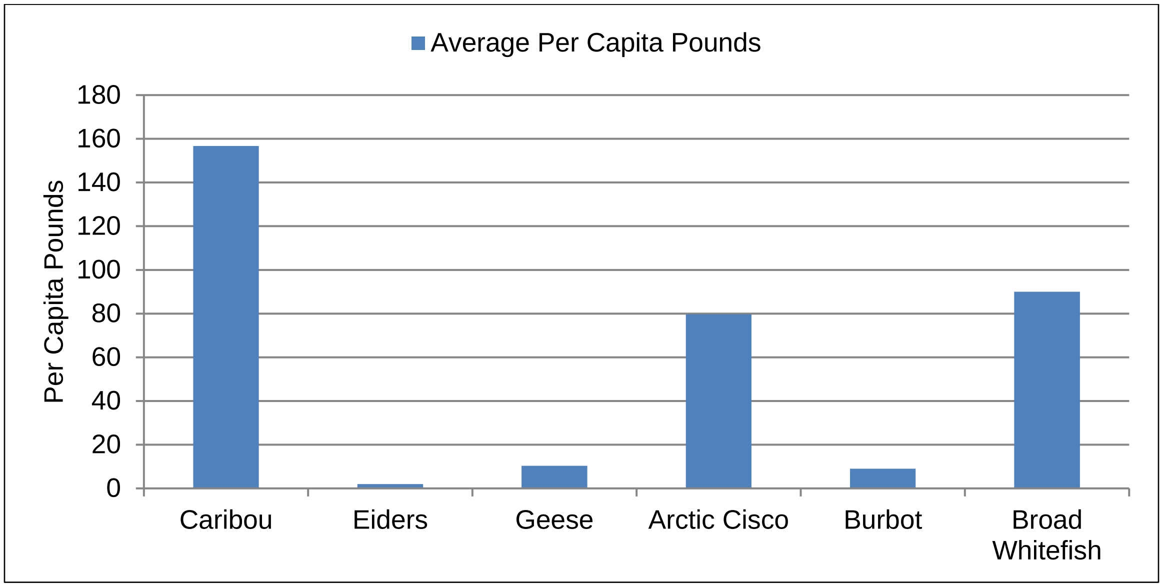

Figure 3.4-23. Per capita pounds harvested for key resources, all study years

Sources: See Appendix F, Table F-2 for individual data and references.

Data from the Nuiqsut Caribou Subsistence Monitoring Project provide project study-area-specific harvest data that show the percent of the caribou harvest that came from the project study area by study year (Table 3.4-). These data only represent the harvests reported by the interviewed respondents and are not based on the total community harvest. For the 8 study years (2008–2015), 20 to 41 percent of respondents' caribou harvest came from harvest sites located within the project study area. In general, the 8 years of data show an upward trend of the caribou harvests coming from locations within the project study area. One possible reason for this increase includes increased use of four-wheelers in recent years (see above under "Method of Transportation"), including use along the recently constructed Spur Road. Another reason for this increase could be due to the effect of increased development activity in the Colville Delta and a shift of residents hunting patterns to areas west of the community where the proposed project is located. Although there are yearly exceptions, over the 8 study years (2008–2015), the Nuiqsut Caribou Subsistence Monitoring Project has documented a general increase in the percentage of harvests occurring in the area west of Nuiqsut, and a general decrease in the percentage of harvests occurring along Nigliq Channel (Stephen R. Braund and Associates 2017).). From 2013 through 2015, when asked about places of avoidance, between 58 and 61 percent of harvesters responded that there were places they no longer used or avoided. In just over one-quarter of cases, those harvesters specifically identified the Alpine/Alpine Satellites areas; caribou harvesters also identified more general geographic locations in the vicinity of Alpine/Alpine Satellites, including Nigliq Channel, Colville Delta, and Tamayayak Channel, citing development-related reasons. For all responses related to avoidance, development-related causes were cited as the cause in nearly two-thirds of observations (Stephen R. Braund and Associates 2017, Table 24 and Table 25).

Table 3.4-17. Percent of caribou harvested in the project study area

Caribou Study Year	Percent of Harvest in Total
2008	20
2009	26
2010	32
2011	41
2012	37
2013	31
2014	28
2015	35

Source: Stephen R. Braund and Associates (2010b, 2011, 2012, 2013, 2015, 2015, 2016, 2017).

Other indicators of resource availability include the percent of households attempting to harvest a particular resource and the percent of households that are successful. In general, the percentage of Nuiqsut households that successfully harvested a resource is comparable to the percentage of households attempting to harvest resources including caribou, broad whitefish, Arctic cisco, burbot, and geese (Figure 3.4-24). Stephen R. Braund and Associates (2017) reports that data from the 8 year (2008–2015) monitoring study indicate fluctuations in those who believed they had not harvested enough caribou during the previous 12 months, with approximately 40 to 50 percent not harvesting enough in Years 1, 2, 5, and 6, and between 16 and 32 percent not harvesting enough in Years 3, 4, 7, and 8. Reasons for not harvesting enough range from personal commitments, climate conditions, equipment failures, and development-related causes. Certain resources such as burbot and geese, although not yielding a high number of per capita pounds (9 and 10 pounds per capita, Figure 3.4-23), have a high percent of households (51 and 77 percent, respectively) that participate in those activities (Figure 3.4-24). Wolf and wolverine show a greater disparity between the percentage of households attempting harvests and the percentage of households reporting successful harvests, indicating that overall success rates for these resources is lower than for other key resources harvested in the project study area (Figure 3.4-24). However, the two indicators presented in Figure 3.4-24 do not provide information on whether the households harvested enough to meet their needs and/or how much effort (e.g., number of trips, duration of trip, costs) was expended in order to harvest the target resource. The table shows that, in general, Nuiqsut households that attempt to harvest key resources are successful in doing so.

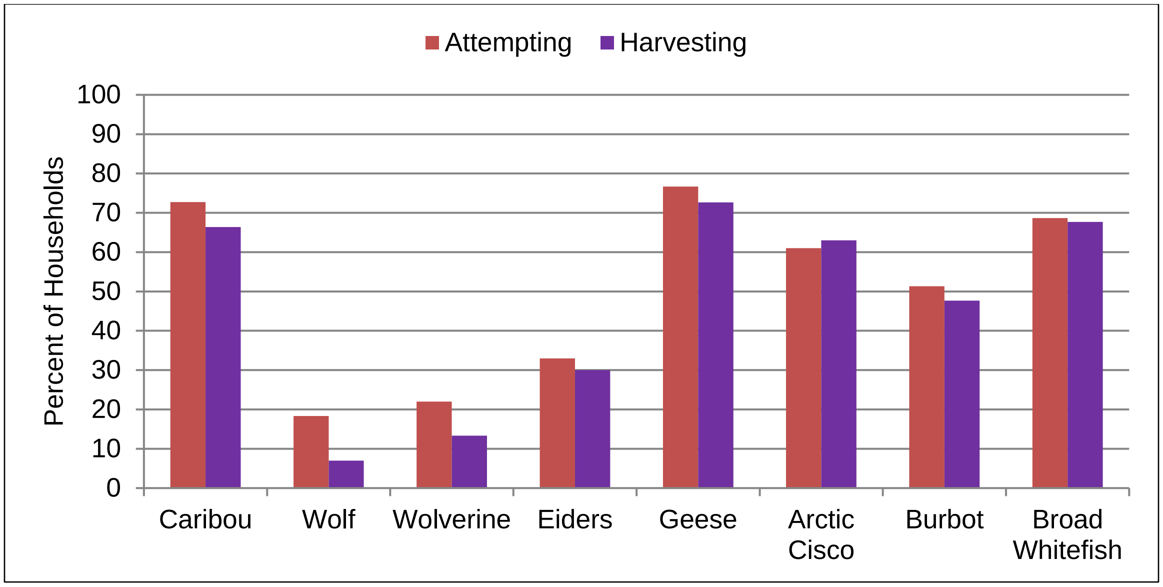

Figure 3.4-24. Harvesting and attempting to harvest for key resources, all study years

Sources: See Appendix F, Table F-2 for individual data and references.

Community Participation

As noted above, key indicators of community participation include percent of households using, attempting to harvest, and sharing subsistence resources. This discussion focuses on providing community participation baseline indicator data for the eight resources harvested within the project study area: caribou, geese, eiders, Arctic cisco, burbot, broad whitefish, wolf, and wolverine. Figure 3.4-25 shows the average percentage of households reporting using and receiving resources. Similar to per capita pound data, the data represent all community harvests; data for percent of households using and receiving resources are not available specifically to the project study area. According to the figure, the greatest percentage of households reported using caribou and Arctic cisco (greater than 90 percent). A high number of households also reported using broad whitefish (86 percent), geese (85 percent), and burbot (64 percent). Furthermore, caribou hunting, broad whitefish and Arctic cisco fishing, and geese hunting are subsistence activities that are conducted by a large percent of Nuiqsut households (between 61 percent and 77 percent, Figure 3.4-24). Among the key resources harvested in the project study area, wolf and wolverine use was reported among the fewest households.

Sharing of these key resources is high among all households, particularly for caribou which had an average of 75 percent of households receiving the resource. Fish, geese, and eiders are also shared among an average of between 32 percent and 57 percent of households. Wolf and wolverine, which are not harvested for consumption, but for use of the furs, are shared less often.

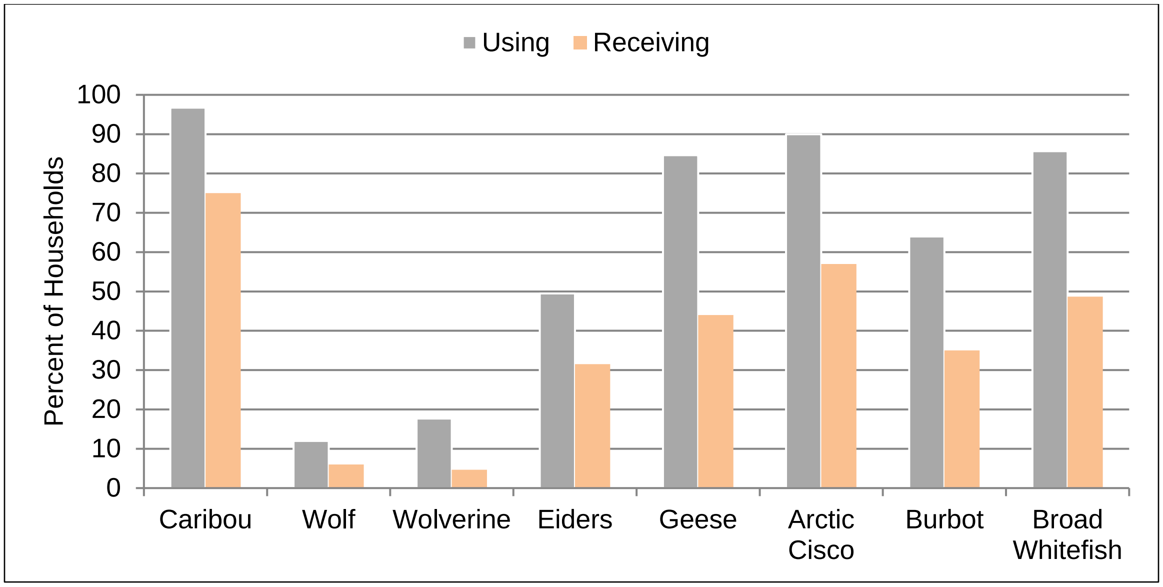

Figure 3.4-25. Percent of households harvesting key resources, all study years

Sources: See Appendix F, Table F-2 for individual data and references.

3.4.7 Public Health

The following section describes the community health and welfare in the community of Nuiqsut.

3.4.7.1 Community Health and Welfare.

The BLM NPR-A Integrated Activity Plan/EIS (2012) contains a detailed discussion regarding analysis of public health status in the North Slope Borough based on demographic and health infrastructure through 2010. The following discussion of community health and welfare is tiered to BLM (2012, Section 3.4.12, Public Health) and BLM public health analysis for the GMT1 Project (2014, Section 3.4.6). The BLM NPR-A Integrated Activity Plan (2012) considers all eight villages of the North Slope Borough and village of the Northwest Arctic Borough, a broader perspective than the analyses for GMT1 (BLM 2014) and the proposed GMT2 Project, which focus more narrowly on Nuiqsut.

Information from the North Slope Borough Final Baseline Community Health Analysis Report (North Slope Borough 2012) was incorporated into BLM (2012, 2014). In 2017, the Alaska Department of Health and Human Services prepared a Human Health Baseline Summary for the GMT2 Project (Appendix G), which draws from the North Slope Borough health report (North Slope Borough 2012), the U.S. Census (U.S. Census ACS 2014), and the North Slope Borough Economic Profile and Census Reports (North Slope Borough 2010, 2016). The 2017 Human Health Baseline Summary (Alaska Department of Health and Social Services 2017) provides the basis for much of the following discussion, which augments BLM (2012, 2014, Public Health).

The earlier EIS prepared by BLM for the Alpine Satellites (2004) provides a community health and welfare discussion that is brief and broad scale, yet it provides relevant general information when evaluating trends. That discussion is provided in BLM (2004, Section 3.4.1.5).

The analysis for GMT1 (BLM 2014) addressed community health status for the eight North Slope villages with reference to biomedical health outcomes, health determinants, and public health.

North Slope Borough and Nuiqsut Health: Overview

The main health conditions that burden the population in North Slope communities are the same as seen elsewhere in Alaska and the U.S.: cancer, heart disease, respiratory diseases, injury, overweight/obesity, and diabetes. However, rates for several of these health conditions are higher on the North Slope and in Nuiqsut than they are in the rest of the state of Alaska or the Nation. Appendix G provides a Baseline Human Health Summary for the community of Nuiqsut.

There are some apparent reasons for these health differences (for example, more people on the North Slope smoke cigarettes). However, researchers find that many health disparities (mental and physical) in Native American and Alaska Native communities are due to poverty, lack of access to healthy food, lack of immediate to health care, and the effects of historical trauma (Yellowhorse Braveheart and DeBruyn 1998; Whitbeck et al. 2004; Basset et al. 2014; Diep 2015).

In both Alaska overall and the North Slope Borough specifically, the leading causes of death are cancer, heart disease, and accidents/injuries. Among chronic diseases, high blood pressure (20 percent) and arthritis (21 percent) are the most frequently reported across the North Slope Borough. This is a lower rate of high blood pressure than across all Alaska (26 percent). Motor vehicle accidents represent the single leading cause of unintentional injury deaths in the North Slope Borough, with a rate three times that for all of Alaska (BLM 2012, page 508).

Self-reported health is one of the most consistent predictors of illness. In 2010, more than three-quarters (79 percent) of Nuiqsut heads of households reported their health to be at least good, and 21 percent reported fair to poor health, which is generally consistent with other North Slope Borough villages. The percentage of adults reporting very good to excellent health was lower in Nuiqsut (39 percent) than it was statewide (56 percent) (Alaska Department of Health and Social Services 2017).

The Final Baseline Community Health Analysis Report (North Slope Borough 2012) provides an extensive discussion of factors that are anticipated to impact the health of North Slope Borough residents. These factors are categorized as likely having either positive, negative, or mixed impacts on public health. Those considered to have positive impacts include:

- Participation in subsistence lifestyle and diet;
- Support and promotion of Iñupiaq culture and language;
- Increase in education levels;
- Availability of health, social, emergency, and public safety services, and having health insurance coverage;
- Improvements in water and sanitation infrastructure;
- A local economy with below-average unemployment and poverty rates, and above-average median household income;
- Self-determination: civic participation and advocacy;
- Restrictive alcohol policies;
- Tobacco taxes and indoor air quality laws (i.e., second-hand smoke); and
- Youth that are connected and engaged with their schools and communities.

The first two bullets above are those health factors with the most potential to be negatively affected by local development that occurs within a community’s subsistence harvest area. However, the next four bullets could also increase through development, leading to positive impacts on health relative to baseline conditions. The other three bullets are unlikely to be substantially affected by development.

Conversely, several factors are anticipated to negatively impact public health:

- High rates of tobacco use;
- High levels of food insecurity and difficulty accessing food for healthy meals;
- Difficulty accessing health services;
- Historical and multi-generational trauma (such as epidemics, forced removal of children to boarding schools, and other traumatic events that lead to multigenerational grief and victimization);
- Drug and alcohol addiction;
- Child neglect and abuse;
- Education: high drop-out and low graduation rates;
- Environmental issues (e.g., climate change, contaminants);
- High consumption of sodas and sweetened beverages;
- Insufficient levels of physical activity;
- Low utilization of safety practices (e.g., helmets, seat belts); and
- Poverty and unemployment.

Finally, the following factors are considered to likely have mixed impacts:

- Oil and gas development;
- Employment opportunities; and
- Income level and distribution.

Specific to oil and gas development, the North Slope Borough (2012, page 45) report provides the following commentary:

> The health impacts of oil and gas development in the North Slope Borough are complex, as it has touched many aspects of community life in the region. Following the formation of the North Slope Borough, oil and gas revenues have created employment opportunities, provided money for essential services and infrastructure, and raised the average household income. An influx of outside interests and money can also create conflict, alter social structure, and divide communities, affecting community well-being. Real and potential impacts to the environment and subsistence are also ongoing sources of tension and concern. Natural resource development and fossil fuel extraction worldwide has also contributed to the climate change that is disproportionately affecting arctic communities.

Impacts to health factors can result from oil and gas development. The following sections summarize health data for Nuiqsut; complete descriptions can be found in Appendix G: Human Health Baseline Summary for the GMT2 Project.

Asthma

The prevalence of self-reported asthma has consistently been lower in the North Slope Borough than the prevalence statewide. In 2011–2013, the prevalence of asthma was 9.7 percent compared to 14.4 percent for all of Alaska. Multiple environmental factors can trigger or exacerbate asthma, including tobacco smoke, exhaust from heating sources and vehicles, and poor indoor and outdoor air quality.

A 2003 study of respiratory illness in Nuiqsut, conducted in response to community concerns, examined patient visits for respiratory illness in Nuiqsut and a control village. The study showed that asthma accounted for 75 percent of respiratory illness visits in Nuiqsut and 81 percent in the control village.

Cancer

The prevalence of self-reported cancer in the North Slope Borough was lower than the prevalence statewide from 2011–2013. For this period, the prevalence of cancer in the North Slope Borough was 3.6 percent compared to 6.7 percent for Alaska Natives statewide and 8.0 percent for all of Alaska. The North

Slope Borough had the second lowest self-reported cancer prevalence of Alaska boroughs and census areas (Alaska Department of Health and Social Services Environmental Public Health Program 2017).

During 2013–2015, cancer was the leading cause of death among North Slope Borough residents and among Alaskans statewide. Highest types of cancer that resulted in death were lung cancer, cervical cancer, and ovarian cancer (15 deaths each) (Alaska Department of Health and Social Services Environmental Public Health Program 2017).

Tobacco

The high smoking rate in the North Slope Borough exacerbates lung cancer incidence: almost half of adults smoke regularly. Smoking and exposure to second-hand smoke are also associated with heart disease (Center for Disease Control 2016). From 2011–2013, the North Slope Borough had the third-highest prevalence of current tobacco users (includes current smokeless tobacco users). The prevalence of current tobacco users in the North Slope Borough was 52.9 percent. Comparatively, 46.5 percent of Alaska Natives statewide and 26.1 percent of all Alaskans reported tobacco use (Alaska Department of Health and Social Services Environmental Public Health Program 2017).

In Nuiqsut, smoking among adults is high (62 percent) teens (as reported by the household) was notably and significantly more common (43 percent) than the rest of the North Slope Borough communities overall (16 percent) (North Slope Borough 2012).

Air Quality

Air quality concerns in rural Alaska villages include diesel emissions, indoor air quality, road dust, solid waste burning, and wood smoke. Residents in the North Slope Borough have also expressed concern about air pollution generated by nearby oil and gas extraction activities.

Assessments of air pollution in Nuiqsut, based on monitoring data from the ConocoPhillips air monitoring station, have found that pollutant concentrations are generally well below the national ambient air quality standards.

The most frequently identified source of air pollution during key informant interviews in Nuiqsut was oil and gas development (Alaska Native Tribal Health Consortium 2011). The available air monitoring data do not support this perception, as measured air pollutant concentrations are consistently low. It will be crucial to continue to monitor air quality in Nuiqsut over time.

Alaska Department of Health and Social Services investigated air pollution and respiratory illness in Nuiqsut in response to community concerns in 2003 and 2012. Air pollution data were collected from the ConocoPhillips monitoring station and reviewed by Alaska Department of Health and Social Services. Health data were collected from inpatient and outpatient visits for respiratory illness. Air pollution was not found to be associated with respiratory illness in these investigations (Alaska Department of Health and Social Services SOE 2003; Alaska Department of Health and Social Services SOE 2012).

Some residents of Nuiqsut have little confidence in these assessments and continue to assert that the air quality in the community is poor and causing high rates of disease. BLM recognizes that these problems of distrust and fear are important: this type of stress poses health issues in and of itself. Furthermore, recent research into the transportation of pollution nanoparticles (not regulated by the EPA) from oil and gas activities in Prudhoe Bay (Kolesar et al. 2017) indicates that there are potentially forms of pollution that are not currently monitored in Nuiqsut.

Lower respiratory disease can be aggravated by air pollutants that are commonly linked to oil development activities as well as road dust and poor air quality in homes. The North Slope Borough has had consistently higher rates of death due to respiratory disease since at least 1996 (North Slope Borough

2012). The mortality rate of North Slope Borough residents due to chronic pulmonary disease is 130 out of 100,000 compared to 45 out of 100,000 persons for the U.S. as a whole (Wernham 2007).

Food Security

North Slope Borough households, particularly Iñupiat households, reported high levels of food insecurity in the North Slope Borough 2010 Census (North Slope Borough Census 2010; Table 5). In the North Slope Borough, 35 percent of household heads reported that there were times when they found it difficult to get the food needed to make healthy meals. 19 percent of household heads reported that there were times in the previous year when household members did not have enough to eat (Alaska Department of Health and Social Services Environmental Public Health Program 2017).

However, Nuiqsut is one of the most food secure communities on the North Slope. From 2015 estimates, 9% of Nuiqsut households reported food insecurity, compared to higher percentages food insecurity for other North Slope communities and 24%, collectively, for the North Slope Borough census area (Table ##) (NSB, 2015).

Statewide and national food insecurity data are not easily comparable with North Slope Borough data because state and national surveys do not ask about subsistence food security or take into account the lack of availability of many foods in remote communities. North Slope Borough data cited in the North Slope Borough Baseline Community Health Analysis Report (North Slope Borough 2012) are not directly comparable with statewide estimates. However, the results suggest that food insecurity is a serious problem across the North Slope Borough and, like other rural areas, exists at levels higher than statewide estimates (Alaska Department of Health and Social Services Environmental Public Health Program 2017).

Table 3.4-18. Food security indicators in the North Slope Borough, , 2010

Community	Times Last Year When Household Found it Difficult to Get the Food They Needed to Eat Healthy Meals (%)	If Household Found it Difficult, Was Difficult Because They Could Not Get Enough Subsistence Foods (%)	If Household Found it Difficult, Was Difficult Because They Could Not Get Enough Store Foods (%)	Households that Get at Least Half of Their Meals From Subsistence Sources (%)
North Slope Borough	35	43	90	54
Anaktuvuk Pass	57	71	80	67
Atqasuk	59	34	100	58
Kaktovik	40	44	88	67
Nuiqsut	38	53	87	67
Point Hope	36	59	86	64
Point Lay	51	48	96	61
Utqiaġvik	38	34	90	44
Wainwright	46	36	95	67

Source: North Slope Borough Census (2010).

The Alaska Department of Fish and Game conducted a harvest study in Nuiqsut during 2015. Several questions focused on food security and the study found that 12 percent of Nuiqsut households worried about having enough food at one or more times during 2014. Approximately 26 percent of households reported that they lacked the resources (i.e., time, money, and equipment) to obtain either subsistence or store-bought foods (Alaska Department of Fish and Game 2016). In this study, Nuiqsut had a slightly higher percentage of food secure households (90 percent) and slightly lower very food insecure households (2 percent), compared to 2014 estimates for the entire state (88 percent food secure, 4 percent very food insecure) (Brown et al. 2016).

Health Infrastructure and Capacity

The North Slope Borough and the Arctic Slope Native Association are jointly responsible for delivering health services to North Slope Borough residents (North Slope Borough 2012). With the exception of Utqiaġvik, all North Slope Borough communities maintain a clinic that is staffed by medical personnel via the Community Health Aide Program. These clinics do not have a physician or physician's assistant in residence. The Samuel Simmonds Memorial Hospital is located in Utqiaġvik and is a 14-bed hospital with an outpatient unit that consists of a 6-room clinic and a 2-bed emergency room (Arctic Slope Native Association 2017). Utqiaġvik is the tertiary care center for the North Slope Borough villages; cases are referred to Fairbanks or Anchorage if they cannot be admitted by Samuel Simmonds Memorial Hospital. Utqiaġvik also has a community mental health center, a dental clinic, and is the location of the North Slope Borough Department of Health and Social Services (North Slope Borough 2012).

Access to services is limited by the remote location of the villages, cost of travel, and severity of the climate (North Slope Borough 2010). Many of the communities in the North Slope Borough suffer from chronic health care workforce shortages and turnover (North Slope Borough 2012). The U.S. Health Resources and Services Administration characterizes the North Slope Borough as a medically underserved and health professional shortage area (North Slope Borough 2012). The County Health Rankings for 2011 report that there was only one primary care physician for every 961 people in the North Slope Borough, while there was one primary care physician for every 731 Alaska residents (Alaska Department of Health and Social Services 2017).

Contaminants

Almost half (44 percent) of Iñupiat village residents have reported concerns that fish and animals may be unsafe to eat due to environmental contamination. Regardless of the actual exposure, if any, to environmental contamination, the perception of contamination may result in stress and anxiety about the safety of subsistence foods and avoidance of subsistence food sources, with potential changes in nutrition-related diseases as a result. These health impacts (perceived or real) arise regardless of whether or not there is any contamination at levels of toxicological significance; the impacts are linked to the perception of contamination, not to measured levels. This important discussion (BLM 2012, page 512) suggests that impacts can occur in the absence of significant chemical release, based only on perception of a potential threat.

3.4.8 Environmental Justice

Environmental Justice is defined in EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which requires that proposed projects be evaluated for "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

In 2016, the Department of the Interior released an updated Environmental Justice Strategic Plan that establishes goals, objectives, and detailed guidance for Federal agencies to accomplish the task of ensuring that no racial, ethnic, cultural, or socioeconomic group disproportionately bears the negative environmental consequences resulting from governmental programs, policies, or activities (DOI 2016)[5] .

[5] Available online as of May 22, 2017: https://www.doi.gov/sites/doi.gov/files/uploads/doi_ej_strategic_plan_final_nov2016.pdf

Guidelines for evaluating the potential environmental effects of projects require specific identification of minority populations when either: (1) the minority population of the affected area exceeds 50 percent or; (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The community of Nuiqsut is identified as being the closest community to be potentially affected by the project study area. The State of Alaska socioeconomic characteristics were selected as the reasonable reference population (BLM 2004, page 327).

According to 2010 Census data, 87.1 percent of the population of Nuiqsut is Alaska Native or American Indian (specifically Iñupiat), an identified minority group. The statewide population is 14.8 percent American Indian or Alaska Native. The ethnic composition of Nuiqsut compared with the State of Alaska is shown in Table 3.4-19. Based on the census data, the minority population in Nuiqsut is well above the 50 percent threshold specified in the EPA guidelines, so it is appropriate to consider potential environmental justice issues in evaluating the effects of the proposed plan.

Table 3.4-19. Ethnic composition of Nuiqsut compared with State of Alaska

Category	State of Alaska		Nuiqsut	
	Population	Percent	Population	Percent
Total	710,231	100.0	402	100.0
Hispanic or Latino	39,249	5.5	0	0.0
Not Hispanic or Latino	670,982	94.5	402	100
Population of One Race	658,356	92.7	391	97.3
White	473,576	66.7	40	10.0
Black or African-American	23,263	3.3	1	0.2
American Indian or Alaska Native	104,871	14.8	350	87.1
Asian	38,135	5.4	0	0.0
Native Hawaiian and Pacific Islander	7,409	1.0	0	0.0
Some Other Race	11,102	1.6%	0	0.0
Two or More Races	51,875	7.3%	11	2.7

Source: The 2010 population numbers are actual counts from decennial censuses. Alaska Department of Labor and Workforce Development, Research and Analysis Section, 2010 Census, Demographic Profiles for Alaska and Nuiqsut, http://live.laborstats.alaska.gov/cen/dp.cfm (February 13, 2017).

The Council on Environmental Quality guidance on environmental justice under the National Environmental Policy Act (Council on Environmental Quality 1997) directs federal agencies to apply Council on Environmental Quality guidance with flexibility and to consider them as a point of departure rather that conclusive direction in applying the terms of the Executive order on environmental justice. Following this guidance, analyses of potential impacts should recognize if the question of whether agency action raises environmental justice issues is highly sensitive to the history or circumstances of a particular community or population. The historical context within which environmental justice issues are considered for the Iñupiat of the North Slope is discussed in BLM (2012, Section 4.4.5). BLM continues to recognize and monitor the interrelated cultural, social, occupational, historical, or economic factors that are associated with the natural and physical affected environment for the GMT2 Project.

The goals established in the 2016 DOI Environmental Justice Strategic Plan are:

- **Heightened Sensitivity:** Ensure responsible officials are aware of the provisions of Executive Order 12898 and are able to identify and amend programs, policies, and activities under their purview that may have disproportionately high and adverse human health or environmental effects on minority, low-income, or Tribal populations.

- **Public Participation:** Ensure minority, low-income, and Tribal populations are provided with the opportunity to engage in meaningful involvement in the Department's decision making process.
- **Decreasing Our impacts:** The Department will, on its own or in collaboration with partners, identify and address environmental impacts that may result in disproportionately high and adverse human health or environmental effects on minority, low-income, or Tribal populations.
- **Grants and Technical Assistance:** Use existing grant programs, trainings, and educational opportunities, as available, to aid and empower minority, low-income, and Tribal populations in their efforts to build and sustain environmentally and economically sound communities.
- **Title VI Enforcement:** Integrate the DOI's environmental justice strategies with its Title VI of the Civil Rights Act enforcement responsibilities to improve efficiencies while preserving the integrity of Title VI and environmental justice activities.

The analysis conducted for the GMT1 project concluded that, due to findings of adverse impacts to subsistence and sociocultural systems, the GMT1 project raises environmental justice issues. The BLM continues to work closely with the community of Nuiqsut to implement compensatory mitigation actions that address negative impacts to subsistence and sociocultural systems that will likely result from the GMT1 project. The BLM also continues to consult with Nuiqsut to identify and address environmental impacts that may result from GMT2.

Chapter 4. Environmental Consequences

4.1 Introduction

Comprehensive analyses of environmental consequences of development of the entire Alpine Field, including GMT2 as it was designed in 2004, were performed in the program-specific BLM (2004). Environmental impacts of anticipated oil and gas development in the NPR-A, also including GMT2, were analyzed in BLM (2012). The analyses of potential environmental consequences of the proposed GMT2 Project provided in this section are tiered to, and incorporate by reference these previous analyses, with specific references cited in the discussions in the following sections. Alternative A (ConocoPhillips's proposed project) and two other action alternatives for project development were carried forward through impact analysis. All action alternatives and the no-action alternative (Alternative D) are described in Chapter 2.

The BLM has identified Alternative A, the Proponent's Proposal, as the Agency's preferred alternative in this draft supplemental EIS. This is not a final decision. The BLM will consider input from all stakeholders submitted during the public comment period before identifying the Agency's final preferred alternative in the final supplemental EIS. The identification of a preferred alternative does not constitute a commitment or decision in principle, and there is no requirement to select the preferred alternative in the Agency's record of decision. If warranted, the BLM may select a different alternative than the preferred alternative in its record of decision.

4.1.1 Project Alternatives and Major Project Components

Major project components of each action alternative are listed in Table 4.1-1. The project component values, such as road lengths and pad acreage, are approximations based on best available data. Due to differences in data processing systems (e.g., GIS) and methodologies (e.g., number rounding), the values presented in the final supplemental EIS may differ slightly from values presented in other project-related documents such as permit drawings. These differences have been reviewed and determined to be insignificant to the analysis as well as to the overall permitting process. A brief description of each alternative is below:

- **Alternative A, Proponent's Proposal, Draft Preferred Alternative:** Alternative A consists of a 14-acre gravel pad with up to 48 wells connected to existing infrastructure with an 8.2-mile gravel road. See Section 2.5, "Alternative A," and Map 2.5-1.
- **Alternative B, Alternate Road Alignment:** Alternative B consists of a 14-acre gravel pad with up to 48 wells connected to existing infrastructure with a 9.3-mile gravel road. See Section 2.6, "Alternative B," and Map 2.6-1.
- **Alternative C, Roadless Development:** Alternative C consists of a 19-acre pad with up to 48 wells and an airstrip. Alternative C would be serviced via aircraft and would not have a gravel access road connected to existing infrastructure. See Section 2.7, "Alternative C," and Map 2.7-1.
- **Alternative D, No Action:** Under Alternative D, the GMT2 Project would not be developed.

Table 4.1-1. Major project components of the action alternatives

Project Component	Alternative A Proponent's Proposal, Draft Preferred Alternative	Alternative B Alternate Road Alignment	Alternative C Roadless Development
Drill Pad	14.0 acres	14.0 acres	19.1 acres
Occupied Structure Pad	None	None	18.4 acres
Air Access Facilities	None	None	47.3 acres; airstrip and apron
GMT1–GMT2 Access Road	8.2 miles; 62.8 acres of fill	9.4 miles, 72 acres of fill	None
Tundra Access Subsistence Pullouts	3 pullouts	3 pullouts	None
Airstrip Access Road	None	None	0.9 mile, 7.2 acres
Ice Roads and Pads	Year 1–2: 52.6-mile ice road, 175-acre ice pad Year 2–3: 43.9-mile ice road, 135-acre ice pad Year 3–10: 10-acre ice pad to support drilling	Year 1–2: 51.9-mile ice road, 175-acre ice pad Year 2–3: 43.3-mile ice road, 135-acre ice pad Year 3–10: 10-acre ice pad to support drilling	Year 1–2: 51.6-mile ice road, 205-acre ice pad Year 2–3: 51.2-mile ice road, 175-acre ice pad Years 3–10: 7.0-mile ice road, 10-acre ice pad Years 11–32: 7.0-mile ice road, 2.0-acre ice pad
Total Water Requirements	395 million gallons	398 million gallons	691 million gallons
Fish Stream Crossings	1 (Lake M9925 outlet)	None	None
GMT1–GMT2 Pipeline System	8.6 miles; 0.1 acre of fill from new vertical support members	9.4 miles, 0.1 acre of fill from new vertical support members	8.6 miles; 0.1 acre of fill from new vertical support members
Ancillary Pipelines	None	None	Diesel & mineral oil supply, 2-inch water supply
Total Gravel Footprint	78.0 acres	87.2 acres	92.0 acres
Gravel Supply	Arctic Slope Regional Corporation Mine site	Arctic Slope Regional Corporation Mine site	Arctic Slope Regional Corporation Mine site
Total Gravel Requirement	671,300 cubic yards	747,300 cubic yards	930,000 cubic yards
Construction Schedule	4Q Year 1–3Q Year 3	4Q Year 1–3Q Year 3	4Q Year 1–3Q Year 3
Drilling Timeframe	7.1 years, 2Q Year 3–Year 10	7.1 years, 2Q Year 3–Year 10	7.1 years, 2Q Year 3–Year 10
Post-Construction Operation	30 years	30 years	30 years
Lodging Requirements-Construction	Year 1–2: 305 beds Year 2–3: 305 beds in winter, 70 beds in summer	Year 1–2: 305 beds Year 2–3: 305 beds in winter, 70 beds in summer	Year 1–2: 305 beds Year 2–3: 445 beds in winter, 140 beds in summer
Lodging Requirements-Drilling	75-bed drilling camp	75-bed drilling camp	120-bed drilling camp 80-bed operations camp
Lodging Requirements-Operations	None	None	25-bed operations camp
Access	Year-round access via gravel road	Year-round access via gravel road.	Year-round access by aircraft only, weather permitting. Seasonal access by ice road.

4.1.2 Impact Criteria

For this supplemental EIS, criteria were developed to guide the analyses of potential impacts from GMT2 Project. Impact criteria were based on the recent NEPA analysis done for the GMT1 Project (BLM 2014). This analysis was completed in 2014 and analyzed a project that is similar in size, scope and location to the GMT2 Project.

Using the impact criteria as a guide, analysis of the impacts of GMT2 Project are based on previous related NEPA analyses, best available new information, and best professional judgment. This supplemental EIS considers both the nature and degree of expected impact as described below. In this supplemental EIS, the nature of an impact is generally defined by the magnitude of the intensity of the impact, the duration or the impact, the context of the resource, and the geographic extent of the impact. Below is a general description of the impact criteria; however, these criteria are not definitive for every impacted resource. Specific impact criteria for individual resources may change significantly from what is described here to better characterize what constitutes a significant impact for that particular resource. A resource specific description of the impact criteria is included in each section of this chapter.

4.1.2.1 Intensity

Low: A change in a resource condition is perceptible, but it does not noticeably alter the resource's function in the ecosystem or cultural context.

Medium: A change in a resource condition is measurable or observable, and an alteration to the resource's function in the ecosystem or cultural context is detectable.

High: A change in a resource condition is measurable or observable, and an alteration to the resource's function in the ecosystem or cultural context is clearly and consistently observable.

4.1.2.2 Duration

Temporary: Impacts would be intermittent, infrequent, and typically last less than a few months.

Interim: Impacts would be frequent or extend for a longer time period (a year or several years).

Long term: Impacts would cause a permanent change in the resource that would perpetuate even if the actions that caused the impacts were to cease.

4.1.2.3 Context

Common: The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation. The portion of the resource affected does not fill a distinctive ecosystem role within the region.

Important: The affected resource is protected by legislation (other than the Endangered Species Act). The portion of the resource affected fills a distinctive ecosystem role (such as an important subsistence resource) within the region.

Unique: The affected resource is listed as threatened or endangered (or proposed for listing) under the Endangered Species Act (for biological resources) or is depleted either within the locality or the region (resources other than biological resources). The portion of the resource affected fills a distinctive ecosystem role within the region.

4.1.2.4 Geographic Extent

Limited: Impacts would be limited geographically (e.g., within the indirect impact zone, or within the supplemental EIS project study area), depending on the resource; impacts would not extend to a broad region or a broad sector of the population, such as the entire Arctic Coastal Plain.

Local: Impacts would extend beyond a local area, potentially affecting resources or populations beyond the supplemental EIS project study area depending on the resource.

Regional: Impacts would extend beyond the supplemental EIS project study area and affect an entire region (e.g., Arctic Coastal Plain) or other relevant, resource-specific geographic area, depending on the resource.

4.1.3 Impact Levels

For impact analysis of each resource, a separate impact criteria table was developed and used to guide the analyses. The impact criteria tables present terms and relative thresholds that are quantified for some components and qualitative for other components (depending on resource characteristics). Summary impact levels were then determined using the following guidance and the best professional judgement of the resource subject matter expert:

Negligible: Impacts are generally extremely low in intensity (often they cannot be measured or observed), are temporary, localized, and do not affect unique resources.

Minor: Impacts tend to be low in intensity, of short duration, and limited geographic extent, although common resources may experience more intense, longer-term impacts.

Moderate: Impacts can be of any intensity or duration, although common resources may be affected by higher intensity, longer-term, or broader extent impacts while important and/or unique resources may be affected by impacts of medium or low intensity, temporary duration, and limited to local geographic extent.

Major: Impacts are generally medium or high intensity, long-term or permanent in duration and have a regional geographic extent for common resources, or affect important or unique resources with impacts of medium or high intensity, interim or long term duration and local or regional geographic extent.

The potential impacts were analyzed by reviewing ConocoPhillips' project description and design components intended to reduce impacts, data collected by ConocoPhillips, and other information provided by ConocoPhillips. Previous publications and data collected within and near the project study area by state, federal, and local agencies were also reviewed. ConocoPhillips' information was verified by independently reviewing reference sources and previous publications on these resources. The information regarding existing conditions as presented in Chapter 3, "Affected Environment," was assessed relative to the ConocoPhillips' proposed action and the other alternatives described in Chapter 2, "Proposed Project and Alternatives," to assess impacts.

4.1.4 BLM Protective Measures

The NPR-A Integrated Activity Plan Record of Decision includes a number of protective measures that would be imposed on activities permitted by the BLM in the NPR-A. These protective measures are in the form of lease stipulations and best management practices, provided in Appendix J. As explained further in Section 4.7, "Mitigation Measures and Monitoring," stipulations are specific to oil and gas leases, and describe objectives for protection of certain resources and management of certain activities. Best management practices apply to all activities in the NPR-A. Stipulations and best management practices also provide a basis for analyzing potential impacts of an activity (BLM 2012, Section 2.3.5). Other agencies with permitting authority for the proposed project include protective measures and regulatory requirements as part of their permit processes, as described in Table 1.4-1 and Appendix J.

4.1.5 Summary of Impact Levels for Alternatives

Table 4.1-2 summarizes impact levels for physical and biological resources under each project alternative. Detailed descriptions of the impact criteria that determined the impact level can be found in each resource's section.

Table 4.1-2. Summary of impact levels for physical and biological resources

Resource or Issue	Alternative A, Proponent's Proposal, Draft Preferred Alternative	Alternative B, Alternate Road Alignment	Alternative C, Roadless Development	Alternative D, No-action Alternative
Terrestrial Environment	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	None
Aquatic Environment	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	None
Atmospheric Environment	Air Quality: Not significant Acoustical Environment: Moderate	Air Quality: Not significant Acoustical Environment: Moderate	Air Quality: Not significant Acoustical Environment: Moderate	None
Climate Change	N/A, see Section 4.2.4	N/A, see Section 4.2.4	N/A, see Section 4.2.4	N/A, see Section 4.2.4
Vegetation and Wetlands	Minor	Minor	Minor	None
Fish and Fish Habitat	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	None
Birds	Minor	Minor	Minor	None
Terrestrial Mammals (Including caribou)	Caribou: Minor Other species: Minor	Caribou: Minor Other species: Minor	Caribou: Minor Other species: Minor	None
Marine Mammals	Negligible	Negligible	Negligible	None
Threatened and Endangered Species	Spectacled Eider: Minor Steller's Eider: Negligible Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	None
Oil, Saltwater and Hazardous Materials Spills	No Impacts; Risks Discussed	No Impacts; Risks Discussed	No Impacts; Risks Discussed	None

4.1.6 Potential New Mitigation Measures

In addition to project design features and BLM lease stipulations and best management practices already applicable to the project, this chapter also considers several potential new mitigation measures designed to further avoid, reduce, or compensate for impacts from the proposed action. These measures are discussed in the relevant resource sections that follow, and were developed based on suggestions from cooperating agencies, stakeholders, and BLM staff. The BLM will also seek input from the public on potential new mitigation measures as part of the public comment period for this draft supplemental EIS. As with existing BLM lease stipulations and best management practices, an objective and proposed requirement/standard are identified for each potential new mitigation measure and potential benefits and residual/unavoidable impacts are evaluated. Except where otherwise eliminated from further consideration herein, the decision to adopt or eliminate each new mitigation measure will be made in the record of decision.

4.2 Physical Characteristics

The following discussion regarding impacts on or by the physical environment is generally categorized and organized as it is in BLM (2014).

4.2.1 Terrestrial Environment

The action alternatives would result in impacts to the terrestrial environment. The impacts are discussed in this section, organized by the two primary phases of the project: (1) construction and (2) drilling and operation. These impacts are described in detail by BLM (2004, Section 4F.2.1) and generally for the Northeast NPR-A (BLM 2008, Section 4.3.2–4.3.3) and the entire NPR-A (BLM 2012, Section 4.3.2–4.3.3). The following discussion provides a summary of the impacts.

Impacts to the following resources of the terrestrial environment were analyzed:

- Physiography/Geomorphology
- Soils and Permafrost
- Geology and Mineral Resources
- Petroleum Resources
- Sand and Gravel Resources
- Paleontological Resources

The impact criteria for resources of the terrestrial environment are defined in Table 4.2-1, and each alternative has been evaluated to determine the potential impact levels of project activity on each resource.

Table 4.2-1. Impact criteria; terrestrial resources

Impact Category	Magnitude	Definition
Intensity	High	Adverse impacts to physiographic, geological, or paleontological resources for which no mitigation is available. Adverse impacts to soils or permafrost such that the resulting ground surface is below tundra grade and backfilling with overburden is required to prevent ponding and/or flow of water for restoration to be successful.
	Medium	Adverse effects to physiographic, geological, or paleontological resources that could be mitigated. Disturbance to soils or permafrost is such that revegetation by seeding or sodding with native tundra is required to prevent degradation of the thermal regime, erosion, or ponding or water flow for restoration to be successful.
	Low	Changes to physiographic, geological, or paleontological resource conditions with no adverse impact. The thermal regime is maintained and disturbance of vegetative cover such that successful site rehabilitation can be accomplished through natural recolonization.
Duration	Long-term	Impacts exceed the life of the project.
	Interim	Impacts last the life of the project.
	Temporary	Impacts occur during a phase of the project and last less than 15 years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Regional	Extends beyond the project study area.
	Local	Extends beyond project components, but within project study area.
	Limited	Within footprint of project components and extending up to 300 feet beyond the footprint of project components.

4.2.1.1 Physiography and Geomorphology/Soils and Permafrost

Physiography and geomorphology are closely related to soil and permafrost conditions in the project area and impacts are addressed together in this section. Direct impacts are related to the footprint of gravel fill for each action alternative. The footprint for each alternative is listed in Table 4.1-1.

Construction

Ground-impacting activities of the action alternatives could alter permafrost as described in BLM (2004, Section 4F.2.1.3) and BLM (2012, Section 4.5.3.2). The thermal regime of permafrost is the dominant control on soil formation and soil properties on the Arctic Coastal Plain. Placement of gravel on the tundra for roads, pads, and airstrip would directly impact the thermal regime of permafrost. Impacts to permafrost stem from alteration of ground temperature that can be caused by construction of infrastructure (e.g., gravel pads). Any disturbance that removes the insulating surface organic layer or decreases the solar reflectance of the surface may result in differential thawing of the permafrost and cause thermokarst, subsidence, and increased potential for soil erosion and sedimentation (BLM 2012, Section 4.3.3.2, page 105). Thermokarst often results where permafrost thawing occurs in ice-rich, fine-grained sediments (BLM 2004, Section 4A.2.1.3, page 416). Soils in the project study area are subjected to cold and anoxic conditions that retard soil formation, allowing exposed mineral soil layers to persist for decades.

Characteristics of the material used for gravel fill could also impact soil near gravel structures. For example, saline material used as fill increases the salinity of water draining off of or leaching through the structure. Increased salinity at a site could alter the soil properties in the immediate vicinity of the gravel structure.

Dust generated from the fill and pads will drift off of the pads and adversely affect the neighboring areas by adding loess materials to the soil profile up to 1,000 meters from the source (Walker 1987) as well as changing the albedo or reflectance of the surface (Hope et al. 1991). This combination may increase the rate of thaw and result in changes of soil properties.

Snowdrifts caused by gravel structures would increase the soil surface temperature in winter and increase thaw depth in the soil near the structures. Blockage of natural drainage patterns can lead to the formation of impoundments or redirection of surface water flow and may cause deposition or erosion of sediment. The use of adequate cross-drainage structures in gravel roads and attention to the natural drainage patterns during design of developments could help reduce impacts to soils from impoundments. (See also Section 4.2.2, “Water Resources,” and Section 4.3.1, “Vegetation and Wetlands.”)

Construction of ice roads and pads would locally cause compression of soils and vegetation (see also Section 4.3.1, “Vegetation and Wetlands”). A recent BLM study of ice road impacts found that the wetter the area (evaluated during summer), the less damage to insulating vegetation and soils from large-tired vehicles. Recovery of vegetation would be expected within a few years after ice roads and pads are no longer constructed. Impacts from long-term disturbance from ice pads, ice roads, and snow trails would be negligible to the health of the soils and proper functioning of the landscape. Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils or extensive changes in the active layer (BLM 2012, Section 4.3.3.2, page 107). A summary of ice road construction and associated water use for the project alternatives is presented in Section 2.5.4.1 and Table 2.3-2. Discussion of impacts to water resources and hydrology, vegetation, and wetlands is presented in Section 4.2.2 and Section 4.3.1, respectively.

Pipeline construction would displace soil during installation of vertical support members and would disturb a zone around the vertical support members that is approximately 24 inches in radius. Vertical support members would be installed in winter and spoils material would be collected at the surface for proper disposal. Approximately 0.007 acre of soil would be disturbed per pipeline mile for gathering lines. Pipelines could also impact soils indirectly by altering snow accumulation patterns and by shading vegetation, which may decrease soil temperatures and could potentially affect plant growth. Soil under a pipeline receives less direct sunlight during the growing season than does the soil that is not under a pipeline. Therefore, there could potentially be a reduction in heat absorption by the ground cover, leading to a shallower active layer. Shading from pipelines was not part of the evaluation of indirect impacts.

Low-ground-pressure vehicles may be permitted to travel on the tundra during periods other than when the ground is frozen and covered with snow, as authorized by BLM. Because of restrictions that would be placed on this activity, impacts to soil should be limited to the compression (reduction) of the insulating mat, similar to what happens during winter following traffic by low-ground-pressure vehicles.

Impacts caused by spills during construction (e.g., diesel fuel) would have the potential to impact the terrestrial environment as described in Section 4.5, “Impacts of Oil, Saltwater and Hazardous Materials Spills.”

Drilling and Operation

Direct impacts to physiography and geomorphology are closely related to impacts on soil and permafrost and are addressed together in this section. These impacts are essentially the same as during construction.

During operations, there would be indirect impacts to vegetation and wetlands adjacent to gravel roads, pads, and airstrip resulting from gravel spray and dust deposition, altered snow distribution, hydrologic impoundments, increased flooding, and thermokarst (Table 4.3-4). The effects of these impacts are likely to occur most often within 300 feet from the gravel feature, based on data presented in Auerbach et al. (1997). Gravel and dust could smother vegetation and cause early snowmelt, reduced soil nutrients, lower moisture, an altered soil organic horizon, higher bulk density, and greater depth of thaw. Other potential impacts identified by the U.S. Army Corps of Engineers (2012, Section 5.8.3.1) include: reduction in vegetation biomass, early green-up of plants, increases in graminoid composition, decreases in sphagnum and other mosses and lichens, shallower organic horizon, and changes to soil pH.

Indirect impacts to soil and permafrost would occur for all alternatives during drilling and operation. The passage of vehicle traffic over gravel pads, roads, and airstrip (depending on alternative) would result in a gravel spray/dust shadow with measurable impacts on soil, vegetation, and permafrost extending out to 300 feet from the edge of the gravel feature (Auerbach et al. 1997). Within gravel spray and dust deposition areas, soil properties such as moisture, temperature, chemistry, and nutrient regimes could be altered. In extreme instances, this deposition may bury the existing organic horizon of the soil with a new layer of higher bulk density that would restart the soil-forming processes. For this analysis, the area of potential indirect impact from gravel spray and dust deposition was evaluated by calculating the acreage within 300 feet of the edge of gravel roads, pads, and airstrip, as appropriate for each alternative.

Indirect impacts to soil and permafrost will also result from increased off road vehicle access to the tundra. Both Alternative A and B will provide access to the tundra for subsistence hunters via the GMT1—GMT2 Access Road. Several ramps along the proposed GMT2 road would allow crossing the elevated road from one side to the other and provide egress off the road and access back onto the road by four-wheelers and snow machines. Off-road vehicle use may be dispersed across the tundra while conducting subsistence activities, but the GMT2 road ramps will concentrate off-road vehicles use at their location because they will be the only way on and off the elevated roadway. Repeated passes by four-wheelers (or other wheeled vehicles) during non-frozen periods would likely result in trail braiding, breaking the tundra mat, ruts and channeling of water into vehicle tracks, and exposure of frozen soil with potential localized permafrost thawing and thermokarsting near the ramps. Four wheeler trails spoking away from the ramp would be susceptible to trail braiding from repeated vehicle passes until far enough away from the access ramp to disperse four wheeler use cross-country (see Section 3.2.1: Terrestrial Environment) and (Racine and Johnson 1988, Slaughter, Racine et al. 1990).

Other effects of the road would exacerbate tundra damage from four-wheeler traffic. Fugitive dust that falls out on nearby snow and ice could cause earlier melting in the spring, and snow buildup adjacent to the road would exacerbate small-scale thermokarst due to added insulation of deep snow which reduces frost penetration during winter months (O'Neill, et al, 2017). Mitigation measures would reduce fugitive dust but will not eliminate it. Apart from road and four-wheeler traffic effects, arctic permafrost is experiencing record warming (Richter-Menge, Overland et al. 2017): the volume of ice-rich permafrost soils is decreasing, which results in subsidence of the surface. Subsidence may occur over a broader area than solely in those areas that are directly impacted by vehicle traffic. Four-wheeler traffic would accelerate the subsidence of the permafrost in the track areas. Future four-wheeler traffic is expected to create more damage than under the present conditions (see § 3.4.2.3 Climate Change) and (Racine and Johnson 1988, Slaughter, Racine et al. 1990, Bane 2000).

Spills during drilling and post-drilling operation (e.g., diesel fuel) would have the potential to impact soil and permafrost as described in Section 4.5, "Impacts of Oil, Saltwater and Hazardous Materials Spills."

Comparison by Alternative

Alternative A. Of the action alternatives, this has the smallest area affected by gravel placement and a shorter road than Alternative B. The road constructed under this alternative will have the lowest and smallest pads, thus producing the least area of both direct impact (burial) and indirect impact to adjacent areas. The drifting of snow is projected to be less that other action alternatives due to the lower profile. The distribution of dust will be less due to the shorter road length. This alternative has the least potential to impact water flow patterns affecting permafrost stability, but there is still ample opportunity for there to be restrictions or alterations in flow patterns which negatively affect permafrost. Of the action alternatives, Alternative A is the least impactful.

Alternative B. Alternative B has more area affected by gravel placement than Alternative A; however, the gravel placement is similar in configuration to Alternative A. The roads constructed under this alternative will have a lower profile compared to the gravel thickness required for Alternative C, thus producing a moderate area of both direct impact (burial) and indirect impact to adjacent areas. The gravel area of Alternative B is 12 percent greater than that of Alternative A, which will result in a greater potential for drifting snow and dust. The distribution of dust will likely be highest under Alternative B due to the configuration of gravel placement (road versus pad) and the amount of traffic anticipated. More area disturbed and the longer road compared to Alternatives A and C will potentially mean a greater impact to water flow and permafrost stability.

Alternative C. Of the action alternatives, Alternative C has the greatest projected affected area and the greatest depth of material to be placed. Both of these factors increase the impact of the development on the soil resources. More equipment and materials will also need to remain onsite for longer periods of time since it will be more difficult to move things in and out as needed and certain safety equipment cannot be readily moved to the site when needed. These factors all contribute to a substantially higher impact than the other action alternatives. Having higher surface elevation above the tundra will result in more drifting (deeper and longer) of snow and allow dust to carry a further distance as well. Infrastructure under Alternative C will cover approximately 18 percent more surface area with gravel than Alternative A, which will increase direct impacts as well as indirect impacts due to drifting snow and dust. This alternative also has the greatest potential for altering local water flow patterns since the size of the pad is so large.

Alternative D. This is the no-action alternative and would have no additional impact on soils for this area.

Proposed New Mitigation Measures

Potential Mitigation Measure 1: Alaska Natural Resources Conservation Service Level II Soil Survey

Objective: Establish baseline conditions of soils within 1,000-meter radius of all planned gravel infrastructure.

Requirement/Standard: The permittee shall conduct a soil survey that meets the requirements of the Alaska Natural Resources Conservation Service Level II soil survey (including ecological site description). The soil survey will extend for a 1,000-meter radius from all planned gravel infrastructure and will be accomplished prior to construction activities.

Potential Benefits and Residual/Unavoidable Impacts: Establishing baseline conditions will allow the BLM to monitor changes to the soil profile and vegetation as a result of airborne soil movement resulting from industrial activity. Addition of loess material will affect albedo resulting in increased active layer depth. It may also affect the vegetative community composition over time.

4.2.1.2 Geology and Mineral Resources

The primary geologic resources impacted by the project during construction would be gravel resources and petroleum resources. Drilling oil production wells at the GMT2 production pad would directly impact the physical integrity of reservoir and overlying bedrock by pulverization and fracture. Impacts to petroleum geology would occur primarily from extraction of petroleum hydrocarbon resources which is the purpose of the proposed project.

This would constitute a loss of the committed resources, but result in beneficial economic impacts. A minor amount of bedrock would be disturbed and relocated to the surface during drilling. However, the volume of rock impacted by drilling is inconsequential compared to the total volume of bedrock in the project study area. Annular disposal and injection of fluids could have impacts on subsurface geology; however, regulations and permits control both types of activities, minimizing potential adverse effects. In addition to the BLM, the Alaska Oil and Gas Conservation Commission has regulatory oversight of all oil and gas drilling, production, and well abandonment for the protection of oil and gas resources (20 AAC 25.005–25.990).

Direct impacts to bedrock during construction would produce no measurable effect and are considered negligible under the action alternatives.

4.2.1.3 Petroleum Resources

Impacts to petroleum resources are expected to be major because GMT2 will result in the irreversible and irretrievable commitment of petroleum hydrocarbon resources. This is, however, the stated purpose for the project. Impacts to petroleum geology would be major across all action alternatives. Under the no action alternative there would be no impacts to petroleum resources.

4.2.1.4 Sand and Gravel Resources

Sand and gravel resources in the project study area and the region are discussed in BLM (2004, Section 3.2.1.5), BLM (2008, Section 3.2.8) and BLM (2012, Section 3.2.9). The sand and gravel material sites identified within the project study area include the existing Arctic Slope Regional Corporation Mine site located east of the Colville River and the proposed Clover site on the west side of the river described in BLM (2004, page 160). The Arctic Slope Regional Corporation Mine site is the gravel source proposed for the GMT2 Project.

A general relationship of 1 acre disturbed for a gravel mine to meet the gravel needs for 5 acres of gravel pad, road, airstrip, or other development is identified in BLM (2012, Section 4.2.2, page 26). However, more specific information regarding the Arctic Slope Regional Corporation Mine site is available since it was recently used for CD5 and the Nuiqsut Spur Road. Based upon this information, 23 acres of the Arctic Slope Regional Corporation Mine site footprint is expected to be disturbed to provide gravel for the GMT2 Project. For specific anticipated gravel requirements for each alternative see Chapter 2 of this supplemental EIS, however, all action alternatives (Alternatives A, B, and C) require similar types of facilities (gravel pads and roads/air access facilities) with a similar gravel footprint.

The area west of the Colville River is characterized by an apparent scarcity of suitable gravel for construction (BLM 2012, Section 3.2.9). On federally managed lands in the NPR-A, subsurface sand and gravel are owned by the federal government, and the Secretary of the Interior can dispose of these resources for use in permitted activities within the NPR-A, including energy production and development.

4.2.1.5 Paleontological Resources

The following is a discussion of potential environmental impacts for paleontological resources from the GMT2 Project alternatives. Actions related to the construction, drilling, operations and closure of the proposed GMT2 Project were analyzed for their potential for direct and indirect impacts to paleontological resources. This section details potential effects to paleontological resources based on the proposed alternatives as analyzed under NEPA regulations. For a discussion of paleontological resources in the GMT2 Project study area see Chapter 3, Section 3.2.1.6.

Methodology

This paleontological resources impacts analysis focused on determining potential project effects to verifiable remains, material evidence, and specific locations with items of paleontological importance. Data sources used to inventory project area paleontological resources include the Alaska Department of Natural Resources, Office of History and Archaeology, Alaska Heritage Resource Survey database (Alaska Department of Natural Resources, Office of History and Archaeology 2017). Recent paleontological resources surveys of the study area (Reanier 2009) also provide useful contextual information about sites in the project area.

For paleontological resources, direct affects typically occur due to ground disturbance during construction. Accordingly, the area of potential effect for direct effects to paleontological resources is limited to the proposed GMT2 Project footprint. This includes new permanent infrastructure (e.g., roads, airstrip, pads, and pipelines), existing infrastructure that will be used as part of the project, mining at the gravel source, and ice roads. Other activities and events that can directly impact paleontological resources might be in the vicinity of, rather than directly within, the project footprint. These can include damage caused by equipment during the construction, drilling, and operation phases of the project, and unanticipated incidents such as blowouts, spills, or fires and subsequent cleanup activities. Drilling, operations, maintenance, and closure of facilities would result in minimal new ground disturbance, with less of a chance for subsequent direct impacts.

Typically indirect effects to paleontological resources occur through increased use effects. These can include illegal collection due to increased access to an area, subsidence, and erosion. The area of potential effect for indirect effects relating to access consists of a 2.5-mile buffer surrounding new GMT2 new infrastructure components, including roads, the airstrip, pads and pipelines.

The level of impacts on paleontological resources will be based on levels of intensity, duration, geographic extent, and context as shown in Table 4.2-2 for paleontological resources. For the GMT2 Project, direct impacts could occur in the project footprint during the construction and/or operation phase of the action. Examples of direct impacts to paleontological resources could include ground-disturbing activities that result in physical destruction of or damage to all or part of a paleontological resource, or removal or moving of the resource from its original location.

Indirect impacts to paleontological resources for the GMT2 Project could occur away from the project infrastructure footprints within the 2.5-mile area of potential effect. Indirect impacts to paleontological resources could occur throughout the construction and operation phases of the project and during project closure. Examples of indirect impacts to paleontological resources in the analysis area could include removal, trampling, or dislocation of paleontological resources and sensitive areas by personnel and visitors; complete or partial destruction of a site from erosion, melting permafrost, subsidence, vibrations, or other landscape changes caused by new GMT2 infrastructure components; neglect of a resource that causes deterioration; and vandalism or the illegal collection of the resource.

Table 4.2-2. Impact criteria; paleontological resources

Impact	Magnitude	Definition
Intensity	High	A change in a paleontological resource condition that is clearly and consistently measurable and results in the loss of the paleontological resource's function or context, or loss of integrity that is unable to be mitigated.
	Medium	A change in a paleontological resource condition is measurable or observable, and results in an alteration to the paleontological resource's function or context that is detectable; however, these effects do not result in the loss of function or context, or are able to be mitigated.
	Low	A change in paleontological resource condition is perceptible, but it does not noticeably alter the paleontological resource's function or context.
Duration	Long Term	Impacts to paleontological resources would cause a change in the resource that would perpetuate even if the actions that caused the impacts were to cease.
	Interim	Paleontological resource integrity, function, or context would be impacted during project operations, anticipated to be 30 years.
	Temporary	Impacts to paleontological resources would be intermittent, infrequent, and of a limited duration. Paleontological resource function, context or integrity would be reduced for a limited period of time, typically less than two years or the amount of time required for project construction, and short-term mitigation would be expected to restore pre-activity levels.
Geographic Extent	Regional	Impacts would extend beyond the Arctic Coastal Plain region; and/or affect paleontological resources with statewide or national significance.
	Local	Impacts would extend beyond a local area of potential effect, potentially affecting paleontological resources throughout study area or Arctic Coastal Plain region; and/or impacts would affect a paleontological resource of regional significance.
	Limited	Impacts to paleontological resources would be geographically limited to discrete portions of area of potential effect. Impacts would not extend to a broad region, nor would they affect a resource of regional or statewide significance.
Context	Unique	The paleontological resource is protected by legislation and the affected resource is rare, scarce or unique, either within the locality or the region. The portion of the resource affected fills a distinctive role within the locality or the region.
	Important	The paleontological resource is protected by state or federal legislation. The portion of the resource affected fills a distinctive role within the locality or the region.
	Common	The paleontological resource is considered usual or ordinary in the locality or region; it is not locally scarce, rare or unusual; it is not protected by state or federal legislation. The portion of the resource affected does not fill a distinctive role within the locality or the region.

Impacts Resulting from Alternative A

ConocoPhillips's proposed GMT2 Project (Alternative A) includes a drill pad, a gravel access road (GMT1–GMT2 Access Road), and pipelines (Map 2.5-1). This section presents paleontological resource impacts by Alternative A and the analysis will only focus on potential site impacts due to infrastructural expansion under this alternative. As development under Alternative A overlaps with existing infrastructure relating to the village of Nuiqsut, the Alpine units (BLM 2004), and GMT1 (BLM 2014), this section will first delineate between (a) sites within the area of potential effects for Alternative A that may already be impacted by existing infrastructure, and (b) those sites that may be impacted by expansion under Alternative A. The resulting sites that may be potentially impacted due to expansion will then be assessed by expected effects due to construction, drilling, and operations under Alternative A.

Potentially-Impacted Sites

As shown in Table 3.4-3, no know sites reported in the Alaska Heritage Resources Survey are located within the Alternative A direct effects area of potential effect. Gravel for construction of Alternative A road and pads will come from the existing Arctic Slope Regional Corporation gravel mine which will not result in any new direct or indirect effects to paleontological resources.

The Alaska Heritage Resources Survey indicates five paleontological sites within the 2.5-mile indirect effects area of potential effect (Table 3.2-2). Two of these sites (HAR-00057 and HAR-00170) have been totally removed by excavation and cannot, therefore, be impacted by development in support of GMT2 Alternative A. Nuiqsut currently provides easier access to HAR-00031 than any development relating to Alternative A would, so Alternative A will not provide any easier access to this site. Site HAR-00066, which falls just along the 2.5-mile margin for GMT2 Project, is already in the vicinity of existing development areas for the Alpine units (BLM 2004) and GMT1 (BLM 2014) that overlap with Alternative A, so development relating to Alternative A will have no effect on accessibility to this site.

Site HAR-00067 could potentially be impacted by increased accessibility due to Alternative A. The site, which is located within a 0.25 mile of the southern GMT2 ice roads, is reportedly an intact deposit of bird and small mammal remains of an unknown age, thought to be from a former carnivore den.

Construction

The potential for the discovery of unanticipated paleontological deposits during construction activities exists within proposed disturbance areas and could result in direct effects. Unanticipated discoveries could result in displacement or loss—either complete or partial—of paleontological material. Such disturbance affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric biology and ecology. Given the number of previous surveys conducted in the study area, the relatively few number of paleontological resources documented, and the low probability of the construction footprint areas for containing shallow-buried paleontological resources, impacts from unanticipated discoveries are considered unlikely.

In terms of site HAR-00067 within the vicinity of the ice road, any impacts that alter accessibility will be a seasonal, winter, occurrence that is dependent on suitable conditions for constructing and maintaining the ice road. It can be expected that these snow-covered and frozen conditions will hinder surface visibility and soil erodibility and penetrability, thus limiting the likelihood of illegal collection, subsidence, and erosion due to increased access to an area. Construction activities for Alternative A would cause a low intensity, temporary, and local impact.

Drilling

Direct or indirect effects to undocumented and/or buried paleontological resources would be associated with those identified for the construction phase outlined above. Other components of the drilling phase for Alternative A (e.g., mobilization, moving, and demobilization of drilling equipment) are not expected to affect paleontological resources because they are temporary in duration and would occur within areas that have been previously disturbed during construction.

In terms of site HAR-00067 within the vicinity of the ice road, any impacts will be limited only to the construction phase of Alternative A.

Operations

Drilling is expected to proceed year-round for approximately 7 years, with operations continuing for an estimated 23 years post drilling. No major ground-disturbing activities are associated with the operations phase of Alternative A. The potential for spills would still exist, but this is a low probability. During operations, spills of hydrocarbons or toxic materials could disturb or contaminate the surface of shallowly buried unidentified paleontological resources; however, given the large amount of survey coverage and absence of known Alaska Heritage Resources Survey sites in the direct and indirect effects study areas, this is a remote possibility.

In terms of site HAR-00067 within the vicinity of the ice road, any impacts will be limited only to the construction phase of Alternative A.

Impacts Resulting from Alternatives B and C

Although there are several differences in construction between Alternatives A and C, and routing between Alternatives A and B, there is no change of potential impacts to known paleontological resources in the 2.5-mile area of potential effect between alternatives.

Impacts Resulting from Alternative D: No Action

Under Alternative D, the GMT2 Project and associated infrastructure would not be permitted, leaving the current uses of the land in the project area unchanged. No ground-disturbing activities associated with the proposed project would occur and there would be no concomitant adverse effects to known paleontological sites located in the study area. Therefore, no adverse effects or impacts to paleontological resources are anticipated under Alternative D.

Mitigation

Use of practical and reasonable mitigation measures would reduce impacts to paleontological resources from implementation of the proposed action and alternatives. Specific measures to protect paleontological resources can be implemented by best management practices. The implementation of best management practices and potential mitigation measures that were described in the NPR-A Integrated Activity Plan Record of Decision for the protection of paleontological resources could also reduce the cumulative effects to paleontological resource from oil and gas, and non-oil and gas activities in the GMT2 Project area. Potential impacts to paleontological resources from the GMT2 Project can also be mitigated by design, construction procedures, and operational features.

Avoidance and Minimization

BMP E-13 from the NPR-A Integrated Activity Plan Record of Decision states that “Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity including ice roads. Upon finding any potential cultural or paleontological resource, the lessee or their designated representative shall notify the authorized officer and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer” (BLM 2013). See Appendix J for further information.

Conclusion

Direct impacts to paleontological resources are uniform across the three action alternatives. Under each alternative, no paleontological sites are known to exist in the direct footprint. Under Alternatives A, B, and C, only one known site (HAR-00067) could potentially be impacted by the ice road construction, as the road passes within 0.25 mile of this site. However, by each alternative, the increased access to this location will be temporary and minimal, lasting for only two winters and then being removed thereafter. Further, the snow-covered and frozen conditions will hinder surface visibility and soil erodibility and penetrability, thus limiting the likelihood of illegal collection, subsidence, and erosion due to increased access to an area.

4.2.1.6 Wildland Fire

This section describes the proposed action and project alternatives impacts to wildland fire in the project area.

Alternatives A, B, and C

The area around the GMT2 Project is not prone to frequent wildfire. The risk of a loss of infrastructure from wildfire would increase because infrastructure would be added to an area with none. The risk of a human-caused fire would increase because people would be onsite during warm, dry weather conditions when the vegetation would be prone to wildfire. The effect would be difficult to measure as the fire history database has only two fires recorded, both in 2012, within a few miles of the proposed action.

Alternative D: No Action Alternative

A no-action alternative would not affect fire management in the project area.

4.2.2 Water Resources

The water resources evaluated in this section include the available quantity, quality, and use of groundwater and surface water (lakes/ponds, streams/rivers, estuaries, and near shore environments [Map 4.2-1], and the hydrologic regime.

This analysis is an evaluation of the potential direct and indirect impacts to water resources within the project area. The potential project-related impacts on water resources were evaluated in BLM (2004a, Section 4F2.2) for the proposed activities in the project area. In addition, BLM (2012, Section 4.3.4) provides a recent and thorough update of the potential impacts of oil and gas development on water resources, as does the Point Thomson Final EIS (U.S. Army Corps of Engineers 2012a, Section 5.6).

Potential impacts to surface water quality are described in BLM (2012, Section 4.5.4.2) and BLM (2004a, Section 4F.2.2.2). Hydrology and surface water quality are closely linked, and the discussion regarding potential impacts to water resources is combined in this section. Project development activities that have the potential to impact water resources include:

- Gravel mining
- Placement of gravel fill for infrastructure (e.g., roads, pads, airstrip)
- Installation of culvert(s)
- Construction of pipeline
- Construction of ice roads and pads
- Extraction of water supply from local lakes (for ice roads, construction, drilling, and operation)

Potential impacts are generally categorized as follows (BLM 2004a, Section 4F.2.2):

- Shoreline disturbances and thermokarst
- Blockage or convergence of natural drainage
- Increased stages and velocities of floodwater
- Increased channel scour
- Increased bank erosion
- Increased sedimentation
- Increased potential for overbank flooding
- Removal or compaction of surface soils and gravel, and changes in recharge potential
- Produced-water spills
- Petroleum hydrocarbon spills
- Demand for water supply

Major areas of concern for surface water impact are described in BLM (2004a, Section 4F.2.2.2) and BLM (2012, Section 4.5.4.2).

Avoidance or reduction of potential impacts to water resources would be provided through siting and design and mitigation. In addition to the BLM stipulations and best management practices, project activities that could impact water resources will be subject to federal, state, and local permit requirements. As a result, impacts to water resources are expected to be minor and within the range described in BLM (2004a).

4.2.2.1 Methodology

The methodology of analysis of impacts for water resources in these documents was adopted from the analysis performed in BLM (2004a and 2012) and U.S. Army Corps of Engineers (2012a). This methodology involves examining the type of impact expected to occur with GMT2, including changes to natural drainage patterns, stream water levels and streamflow, erosion or sedimentation, and lake levels and the duration of the impact. Hydrologic resources evaluated in this section include lakes, streams, and shallow groundwater which may provide hydrologic connections between lakes and streams. Surface waters (streams, lakes, and drainage basins) were identified using the National Hydrology Dataset and Watershed Boundary Dataset, at a nominal scale of 1:24,000-scale (U.S. Geological Survey 2015a). Impacts to hydrology and the existing hydrologic regime were evaluated by using the GMT2 Project area and defined impact areas within the project area, consisting of the proposed infrastructure development. Impacts are evaluated qualitatively, and include an evaluation of short- and long-term potential impacts on water resources. Impacts were evaluated by reviewing those water resources within the proposed development footprint along with direct discharges and water withdrawals outside of the development footprint. Potential impacts to drainage that may be caused by the GMT1–GMT2 Access Road were evaluated using a snowmelt water equivalent inundation analysis.

Criteria used to analyze potential impacts to hydrology and surface water quality from project alternatives are presented in Table 4.2-3.

Table 4.2-3. Impact criteria; water resources

Impact Category	Magnitude	Definition
Intensity	High	Changes to the hydrologic regime are measureable and require rehabilitation or cannot be rehabilitated to maintain pre-project hydrologic function. Changes in water quality such that protected water use classes are violated to the extent that mitigation measures would not be effective and remediation measures would be necessary, or changes in water quality that result in a new environment in which new water classes are achieved.
	Medium	Changes to the hydrologic regime are measurable, yet do not require rehabilitation to maintain pre-project hydrologic function. Examples per type of impact: ■ Drainage patterns change, yet impoundment and draining are similar to annual flooding and seasonal inundation extents. ■ Streamflow or stage changes, yet seasonal and annual base flow and peak events are preserved, and flood inundation limits are similar. ■ Stream velocity changes, but erosional and depositional characteristics are preserved and increases are not compounded. ■ Lake levels change seasonally but recharge annually. ■ Changes in water quality based on protected water use classes predicted but can be mitigated.
	Low	Slight changes to the hydrologic regime that are not measurable. Slight changes in water quality that do not violate protected water use classes.
Duration	Long-term	Impact to hydrologic regime would exceed 4 years. OR Impact to water quality would exceed the life of the project.
	Interim	Impact to hydrologic regime would last beyond a season but less than 4 years. Impact to water quality would last the life of the project.
	Temporary	Impact to hydrologic regime would be seasonal and associated with only the construction or drilling phases. Impact to water quality would last a short period during a phase of the project.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.

Impact Category	Magnitude	Definition
Geographic Extent	Regional	Changes to hydrologic regime extend beyond the immediate water body affected, or affect a large portion of an individual water body of great size or critical value. Impacts beyond the immediate water body are due to hydrologic connections such as downstream, upstream, lakes feeding stream, stream feeding lakes, and shallow groundwater connections between lakes and other lakes or streams. Water quality changes occur in the water bodies adjacent to project component footprint and associated waters that are hydraulically connected to those resources across a large portion of the project study area.
	Local	Changes to hydrologic regime are limited to areas without stream connections or water bodies of great size or critical value that are discernible from either aerial photographic interpretation or a GIS hydrography dataset. Water quality changes are confined to the area within and around a project component footprint and the water bodies directly surrounding the project component.
	Limited	Changes to hydrologic regime are limited to areas without lakes or stream connections that are discernible from either aerial photographic interpretation or a GIS hydrography dataset. The area of water quality changes is small and could be easily contained from moving downstream or throughout a water body for mitigation purposes.

4.2.2.2 Construction

Several activities during construction have the potential to impact water resources. These activities are described below and include gravel mining, placement of gravel fill for infrastructure (e.g., roads, pads, airstrip), installation of culvert(s), construction of pipeline, and water supply extraction. Oil spills during construction could impact water resources and are addressed in Section 4.5.

Gravel Mining

The preferred source of gravel for the GMT2 Project is the existing Arctic Slope Regional Corporation Mine site. The footprint of impact would vary according to the gravel demand for each alternative.

Approximately 23, 26 and 32 acres will be disturbed as part of gravel extraction for Alternatives A, B and C, respectively.

During gravel mining, it is probable that shallow taliks and supra-permafrost water zones would be temporarily eliminated in the immediate vicinity of the gravel mine. However, the effect of this loss on water resources would be negligible, because the area of impact would be localized and supra-permafrost water zones would re-establish over time, after the mine pit fills with water. The subsurface water-bearing zone would be permanently eliminated in the immediate footprint of the mine, but would be replaced by surface water that is connected to the shallow groundwater.

Removal of gravel from areas near (or within) streams and lakes can result in changes to stream or lake configurations, stream-flow hydraulics, lake shoreline flow patterns, erosion, sedimentation, and ice damming (National Research Council [NRC] 2003). Gravel extraction could produce sedimentation as discussed in BLM (2012, Section 4.5.4.2, pages 12 and 13). The proposed gravel source, the Arctic Slope Regional Corporation Mine site, is located in the vicinity of the Colville River and several lakes. Gravel mining from the Arctic Slope Regional Corporation Mine site will be performed in accordance with relevant permits. No gravel will be extracted from streams or lakes within the NPR-A.

Groundwater impacts associated with gravel mining are likely to be moderate to major, but limited in area and temporary, only extending for the period of use and rehabilitation. Long-term impacts of gravel extraction from the Arctic Slope Regional Corporation Mine site on the drainage pattern would be medium intensity and local extent. The water in the flooded pit would likely remain unfrozen near the bottom, altering the thermal regime, and creating a thaw bulb around and beneath the pit, potentially resulting in localized thermokarst. The steep side slopes of the excavation will likely slough as they thaw, becoming more gradual over time, and causing slight infilling. A reclamation plan is in place for the Arctic Slope Regional Corporation Mine site for the areas mined under Phase 1 and Phase 2.

Construction of Infrastructure

Construction associated with the action alternatives (e.g., the placement and construction of gravel pads, roads, air access facilities, and culvert[s]) could affect natural drainage patterns (creation of new channels, inundation of dry area and starving wetlands on the downstream side of the road), stream stage (water level) and streamflow (volume), stream velocity (which influences erosion and sedimentation rates), groundwater flow, and lake levels. Modification of the natural surface water drainage patterns may result from blockage or redirection of flow. Disruption of streambeds and stream banks can also remove protective shoreline vegetation and lead to channel erosion and sedimentation, formation of meltwater gullies, plunge pools from perched culverts, and formation of alluvial fans in streams and lakes (BLM 2012, 4.4.4.2, page 377).

A few examples of construction activities that could impact hydrology include displacement of a lake or pond by fill or placing fill (such as for an airstrip or road) transversely across grade, thereby blocking the natural drainage of sheet flow runoff, shallow groundwater, stream input, or rain catchment. Placing fill transversely across grade would also change snow accumulation patterns, which, in turn, would change drainage patterns once the snow melts. Placing fill transversely across grade or the predominant wind direction may also change snow accumulated patterns, which, in turn, may change drainage patterns once the snow melts.

Impacts to drainage patterns may result in increased inundation (flooding) or drying of affected areas. Increased inundation may in turn increase thermokarst action in the affected area.

Gravel fill on tundra could potentially change recharge potential, block natural drainage and change existing hydrologic regime; erosion of roads and pads could increase sedimentation into waterways. During construction, sediments and dust could be disturbed and deposited on snow and ice during the winter or on tundra and open water during the summer. The sediments and dust could be introduced into the water column, causing an increase in turbidity. Snow roads, ice roads, and ice pads are temporary structures and impacts, if any, are expected to be minor and short term. Details related to erosion and sedimentation during the construction phase is provided in BLM (2004a, Section 4F.2.2.2).

Where gravel fill is placed in wet areas to construct a road, pad, or airstrip, the receiving waters could temporarily have higher suspended solids concentrations and greater turbidity. Fugitive dust which enters surface water bodies can also increase turbidity. Further information regarding turbidity during the construction phase is provided in BLM (2004a, Section 4F.2.2.2).

A road or airstrip aligned perpendicular to stream channels and the direction of sheet flow have a greater potential to impound sheet flow and shallow groundwater, than a road or airstrip aligned generally parallel to existing drainage patterns. The 8.2-mile GMT1–GMT2 Access Road (Alternative A) is routed west of and within 1.5 miles of the hydraulic divide between the Tiŋmiaqsiġvik (Ublutuoch) River hydrologic drainage basin and the Outlet Fish Creek hydrologic drainage basin (Map 4.2-2). The 9.3-mile GMT1–GMT2 Access Road (Alternative B) is routed along the hydraulic divide between the Tiŋmiaqsiġvik (Ublutuoch) River hydrologic drainage basin and the Outlet Fish Creek hydrologic drainage basin (Map 4.2-3).Both roads are parallel to the predominate northeast surface water gradient for both of these hydrologic basins. Both roads avoid crossing any of the larger primary creeks or rivers within these drainage basins and they are not situated in lowlands potentially prone to flooding such as in the Colville River Delta. The Alternative A route includes a culvert crossing over the small unnamed beaded stream pool outlet draining from Lake M9925. The road route transverses the localized hydraulic gradient within the larger hydraulic drainage basin in those areas where relatively small surface water flow is generated by contributing surface area located above the elevation of the road and potentially could result in localized increased inundation (flooding) upgradient of the road, and decreased inundation downgradient of the road as discussed in BLM (2012, Section 4.3.4). These localized inundation effects would be small in comparison to the potential inundation effects if the road alignment were instead routed transverse to the overall northeast surface flow gradient for the hydrologic drainage basin. In Alternative C, the airstrip and Airstrip Access Road are predominantly situated directly upon the local high ground between the two adjoining hydrologic drainage basins with minimal potential for localized cross-gradient flow impoundment and inundation. Prolonged inundation could impact ground cover and result in thermokarst.

A direct impact from winter road and pipeline construction is the potential disturbance of tundra soils and vegetation (Sections 4.2.1 and 4.3.1, respectively). Disturbed and exposed soils are more susceptible to erosion and subsequent sedimentation during spring breakup than non-impacted areas. Fugitive dust from construction can also be deposited on snow and ice during the winter. When melting occurs, this dust can enter surface water bodies, increasing turbidity.

The proposed pad(s), airstrip, and road (depending on alternative) have been designed to account for thermal criteria (minimum thickness to prevent permafrost degradation) and hydrologic criteria for minimal impact to the surrounding tundra. However, the construction of permanent gravel roads and pads will compact underlying soil, potentially impact thaw depths, and reduce infiltration. Locally, this may result in inundation of previously dry areas during breakup, changes in stream flow, and potential lake recharge. The configuration of gravel fill also affects impacts. For example, a linear road running perpendicular to the hydraulic gradient will result in a larger extent of hydrological impacts than a consolidated, square pad of similar acreage. The duration of impacts will be long term because the roads and pads will remain during the period of operation.

Increased or decreased stream velocities could result in increased erosion or sedimentation. Flow constrictions such as through culverts would most likely lead to increased stream velocity, which may increase erosion. Similarly, flow blockages or other obstructions can lead to decreased velocity, potentially resulting in inundation and potentially increased sedimentation. Diversions may also affect erosion and sedimentation. The impacts that could be caused by the construction and continued presence of a road (through the project life) are addressed together in this section.

Potential impacts to drainage that may be caused by the GMT2 proposed infrastructure for each alternative were evaluated using a snowmelt water equivalent inundation analysis. This assumes the greatest runoff occurs during the spring breakup process. For Alternatives A and B, the GTM1-GMT2 Access Road and pad were analyzed (Maps 4.2-2 and 4.2-3). The airstrip, gravel pad, and Airstrip Access Road were analyzed for Alternative C (Map 4.2-4). In the analysis (modeling), snowmelt hydrographs were used to estimate the maximum headwater depth and associated area of inundation using the following methodology.

An estimate of the amount of water contained within a snowpack, the snow water equivalent was determined by reviewing measurements of snow studies in the NPR-A and East of Colville River Delta in 2011 (Michael Baker Jr. Inc. 2015). The average snow depth in 2011 was estimated to be equivalent to a 2-year recurrence interval (Q2) based on comparisons to historical snow depth measurements and regional regression equations. An average value of 4 inches was used to represent the amount of snow water equivalent on the surface of the contributing basins at the beginning of the snowmelt runoff. This value is assumed to be consistent over the entire contributing basin. To account for losses due to lakes, ponds and tundra, a factor of 0.67 is applied to the snow water equivalent, resulting in a total runoff depth of 2.68 inches.

The overland flow areas intercepted by the road and pad were delineated using U.S. Geological Survey HUC 12 boundaries and contour lines extracted from the National Elevation Dataset (U.S. Geological Survey 2015b). For Alternative A, three basins were identified along the road and pad. The basin located closest to GMT1 was subsequently delineated into three subbasins so that inundation along the road could be modeled effectively. For Alternative B, seven basins were identified, with two subbasins. Because the southern routes for Alternatives A and B were identical, Basin A-3 was identical to Basin B-7. For Alternative C, two basins contribute runoff to the airstrip, gravel pads, and Airstrip Access Road. The area of each basin and subbasin is multiplied by the effective snow water equivalent of 2.68 inches to estimate the volume of runoff that will reach the infrastructure.

To estimate the time it takes for the snow to melt, the average number of days of snowmelt runoff is estimated by analyzing hydrograph data from U.S. Geological Survey stream gage 15798700 (Nunavak C NR Utqiagvik [formerly Barrow] AK), which is located approximately 120 miles west of GMT2. The gage's historical data indicate that typical duration of snowmelt runoff is 7 days in the region, with a peak occurring at approximately 3.5 days after the start of runoff. It is assumed that the duration of snowmelt runoff at the U.S. Geological Survey gage is applicable to conditions along the GMT2 Road.

The volume of runoff in each basin is assumed to melt over the 7 day period with equal time and a steady pace on both the rising and falling limb with the peak at occurring at 3.5 days. This results in a hydrograph with discharge as the y-axes and time as the x-axis with the area under the triangle being equal to the volume of snowmelt runoff. A summary of the estimates are shown in Table 4.2-4 for Alternative A and Table 4.2-6 for Alternative B.

Table 4.2-4. Summary of discharge estimates for Alternative A

Basin	Subbasin	Peak Inflow (cfs)	Runoff Volume (cubic feet)
A-1	A-1-1	42.4	12,825,000
	A-1-2	32.1	9,707,000
	A-1-3	17.6	5,318,000
A-2	--	15.5	4,676,000
A-3	--	2.7	739,300

Note: (--) cells indicate that no subbasin was identified as part of impact analysis.

For the conveyance of runoff under the road, culverts are assumed to be 2 feet in diameter and spaced at 1,000 foot intervals. The hydrographs for each basin are modeled through the culverts using PondPack, a detention pond analysis and design software. Results of the analyses for Alternatives A and B are summarized in Table 4.2-5 and Table 4.2-7.

For Alternative C, the same methodology was followed with the exception of modeling conveyance by culverts which are not included in the airstrip design. The expected inundation at the airstrip, gravel pad, and Airstrip Access Road was determined by estimating the volume of runoff for each basin. The elevation of the inundation is determined by creating area-elevation and elevation-volume curves for each basin and determining the elevation which corresponds to the volume of snowmelt. Two basins contribute flow to the infrastructure with Alternative C. The basins are generally small due to the proposed location of the infrastructure on local high ground. Results of the inundation analysis for Alternative C are shown in Table 4.2-8..

Table 4.2-5. Potential altered inundation area by new infrastructure for Alternative A

Basin	Subbasin	Peak Inflow (cfs)	Peak Outflow (cfs)	Contributing Basin Area (acres)	Area of Potential Increased Stage (ponding) Upstream of Gravel Infrastructure (acres)	Area of Potential Decreased Stage (Drying) Downstream of Gravel Infrastructure (acres)
A-1	A-1-1	42.4	21.1	1,187	16.3	12.2
	A-1-2	32.1	7.6	860	74.2	7.7
	A-1-3	17.6	11.2	529	66.7	21.0
A-2	--	15.5	10.4	455	3.4	27.7
A-3	--	2.7	2.1	76	7.9	9.6
			Totals:	3,107	168.5	78.2

Note: (--) cells indicate that no subbasin was identified as part of impact analysis

Table 4.2-6. Summary of discharge estimates for Alternative B

Basin	Subbasin	Peak Inflow (cfs)	Runoff Volume (cubic feet)
B-1	--	2.8	1,224,000
B-2	--	1.8	788,100
B-3	--	0.3	114,700
B-4	--	1.3	551.100
B-5	--	0.2	72,100
B-6	B-6A	2.0	848,200
	B-6B	11.4	4,903,600
B-7	--	2.7	739,300

Note: (--) cells indicate that no subbasin was identified as part of impact analysis.

Table 4.2-7. Potential altered inundation area by new infrastructure for Alternative B

Basin	Subbasins	Peak Inflow (cfs)	Peak Outflow (cfs)	Contributing Basin Area (acres)	Area of Potential Increased Stage (ponding) Upstream of Gravel Infrastructure (acres)	Area of Potential Decreased Stage (drying) Downstream of Gravel Infrastructure (acres)
B-1	--	2.8	1.8	126	10.0	10.0
B-2	--	1.8	1.1	81	4.6	7.3
B-3	--	0.3	0.3	12	0.1	0.8
B-4	--	1.3	0.9	57	3.1	3.1
B-5	--	0.2	0.2	7	0.8	1.9
B-6	B-6A	2.0	0.9	87	18.2	7.3
	B-6B	11.4	10.5	504	7.6	5.8
B-7	--	2.7	2.1	76	7.9	9.6
			Totals	950	52.3	45.7

Note: (--) cells indicate that no subbasin was identified as part of impact analysis.

Table 4.2-8. Potential altered inundation area by new infrastructure for Alternative C

Basin	Contributing Basin Area (acres)	Area of Potential Increased Stage (ponding) Upstream of Gravel Infrastructure (acres)	Area of Potential Decreased State (drying) Downstream of Gravel Infrastructure a (acres)
C1-2	40	21.1	55.3
C1-3	56	33.8	60.2

The extent of downstream indirect impacts for Alternatives A and B were calculated by assuming a typical hydraulic expansion angle of 3:1 from each culvert and spacing between culverts of 1,000 feet. The 3:1 ratio results in a downstream impact zone of 167 feet. In this zone, the area directly downstream of the culvert would potentially be inundated with flow while the area between culverts, downstream of the road embankment, would receive less flow and be somewhat drier. The extent of downstream indirect impacts for Alternative C was estimated by assuming an area equal to the length of the infrastructure multiplied by a downstream projection of 500 feet. It is not possible to determine an amount or percentage of how much wetter or drier the areas would be without a detailed modeling exercise.

Based on these methods and assumptions, the potential upstream inundation area for Alternative A was calculated to be approximately 168.5 acres (Table 4.2-5) as shown on Map 4.2-2. Alternative B was calculated to be approximately 52.3 acres (Table 4.2-7) as shown on Map 4.2-3. The potential upstream inundation area for Alternative C was calculated to be approximately 54.9 acres (Note: (-) cells indicate that no subbasin was identified as part of impact analysis.

Table 4.2-8) as shown on Map 4.2-4. These values are considered typical potential inundation scenarios for the purpose of comparing the infrastructure alternatives under typical conditions.

Pipeline construction within the project area could have minor impacts on water resources related to the ice road construction and associated water withdrawals from local lakes. Narrow drainages would be crossed using elevated pipelines on suspension spans. Pipelines would be routed to avoid lakes. Once installed, above-ground pipelines would have no impact on water flow characteristics, but would have the potential to impact water resources in the event of an oil spill. The proposed GMT1–GMT2 Access Road (Alternative A) is orientated west and northwest of the pipeline route which would allow the road to act as a barrier to protect water in the event of a potential pipeline spill where the road is downgradient of the pipeline (generally eastern half of the GMT1–GMT2 Access Road (see Map 4.2-2).

Buried pipelines are not included in the project designs for the GMT2 to GMT1 pipeline segment. However, there are existing buried road crossings as part of the CD5 to CD4N pipeline segment, and a new 20-inch produced fluid pipeline would be installed on this existing pipeline system as part of GMT2. The three existing pipeline road crossing locations have crossing casings to allow for installation of new pipelines without significant ground disturbance as noted in Appendix A, Sheets 28 and 29.

Water Withdrawal and Ice Road Construction

Water withdrawal to support components of each alternative (e.g., winter ice roads and camp water use) could affect the water levels of lakes used as water sources, and any connected water body, such as streams or wetlands. Only permitted lakes, rivers, or reservoirs (under Alaska Department of Natural Resources Temporary Water Use Authorizations and if required, Alaska Department of Fish and Game Fish Habitat Permits) would serve as water sources. Excessive water withdrawal could result in a reduction of volume and change in water quality (e.g., dissolved oxygen). Water withdrawals under permitted conditions could result in minor, temporary impacts to groundwater levels (shallow or deep), surface water levels, or drainage patterns associated with groundwater withdrawals during the summer season. Lakes would be the principal supply for fresh water during construction. Summaries of water demand for each alternative are listed in Table 2.5-2, Table 2.6-6, and Table 2.7-6; detailed water use information is provided in Appendix B.

Ice roads and ice pads would be used extensively during the winter season for access. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads, or ice bridges as discussed in BLM (2012, Section 4.5.4.2, pages 12–13).

Ice road construction over lakes that do not freeze to the bottom could affect dissolved oxygen concentrations. An ice road across such an intermediate-depth lake could freeze the entire water column below the road, isolating portions of the lake basin and restricting circulation. With mixing thus reduced, isolated water pools with low oxygen could result. Details related to dissolved oxygen concentrations during ice road construction are provided in BLM (2004a, Section 4F.2.2.2).

Ice roads built over creek and river crossings have the potential to restrict fish passage, resulting in mortality or redirection of fish. Water withdrawal and ice roads would support construction activities, and impact would therefore be temporary for all action alternatives. However, Alternative C requires annual ice roads to provide vehicle access to GMT2 throughout life of the project (see also Section 4.2.2.3, “Drilling and Operation”). Under Alternative C, an annual ice road would be necessary for 33 years to support construction and drilling, with additional roads required annually through the period of operation. Treatment of surface water is required prior to use as a potable water source. A potable water treatment or domestic wastewater treatment system must undergo Alaska Department of Environmental Conservation plan review and approval before use. Further information regarding drinking water sources during the construction phase is provided in BLM (2004a, Section 4F.2.2.2).

The discussion in BLM (2004a, Section 3.2.2.2) and BLM (2012, Section 3.2.10.2) regarding alkalinity and pH indicates that freshwater within the project area is only weakly buffered with low alkalinities in ponds and lakes. Details related to how construction, and domestic needs could affect water quality, and specifically alkalinity and pH is discussed in BLM (2004a, Section 4F.2.2.2).

During the construction phase, temporary camps would be used. It is expected that sewage and all solid waste would be transported to CD1 for disposal in existing systems. Discharges of treated domestic wastewater to tundra, if needed, will be in accordance with the Alaska Pollutant Discharge Elimination System permit as discussed in BLM (2004a, Section 4F.2.2.2, pages 1086–and 1087). This applies for all action alternatives and will not be analyzed further in this document.

No injection of wastes is proposed during the construction phase; any waste injection would be offsite, at a permitted Ukpeaġvik Iñupiat Corporation facility, with associated impacts to the deep aquifer expected to be negligible to minor.

4.2.2.3 Drilling and Operation

Impacts to hydrology associated with construction of gravel pads, roads, and airstrip and ice roads would persist through the life of the project, including: natural drainage patterns, stream stage and streamflow, stream velocity, groundwater flow, and lake levels as described for the construction phase. The duration of impacts would be long-term because the gravel structures would remain during the period of operation.

Ice roads and ice pads would be used extensively for seasonal vehicle access for Alternative C; no post-construction ice roads are required for Alternatives A and B. Ice roads may require breaching at stream crossings if fish passage is a concern during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads, or ice bridges as discussed in BLM (2012, Section 4.5.4.2, pages 12–13).

The Alternative A route crosses a small, unnamed, beaded-stream-pool outlet draining from Lake M9925. There are no additional new stream or river crossings proposed for the GMT2 Project, although smaller, periodic drainages may be crossed. These smaller drainages are not well defined in the area. There are no known areas affected by the proposed GMT2 Project infrastructure where channelized flow occurs with a 50-year reoccurrence interval of 500 cubic feet per second or greater (see BLM 2004a, Section 2.3.9.1). No bridges would be required.

Culverts are considered appropriate for GMT1–GMT2 Access Road water crossings. The design criteria for all culverts is such that they will prevent raising the water level on the upstream side of the crossings by more than 6 inches (compared to the down gradient side) for more than 1 week after peak discharge. Culverts will be installed at regularly spaced intervals to mitigate the risk of sheet flow interruption and thermokarst action. Final design of the culverts for the GMT1–GMT2 Access Road will also depend on breakup characteristics for those drainages that could affect the roads (BLM 2004a, Section 4F.2.2.1). At this time, such crossings are not expected to present technical challenges beyond what is currently practiced for the region.

For preliminary permit drawings, only the more evident culvert locations will be identified from aerial photographs. During the preliminary road alignment, a field reconnaissance will be conducted to identify and mark as many obvious culvert locations as possible. With the combined ground survey of the road alignment, collected field data, and aerial photography, cross-drainage culverts will be identified and placed in the design drawings. After the road centerline has been staked, a final field visit will be conducted and additional cross-drainage culverts will be located as required. Thus far, detailed information regarding culvert placement and design has not yet been gathered, but will be accomplished during final road alignment. In conjunction with culverts placed in specific drainage locations, cross-drainage culverts will be placed under the road approximately every 500 to 1,000 feet. Cross-drainage culverts may be up to 48 inches in diameter (BLM 2004a, Section 2.3.9.1).

The impacts of increased stream velocities through culverts during flooding events were addressed in BLM (2004a, Section 4F.2.2.1). Constricting flows can result in increased stream velocities and a higher potential for ice jams, scour, and stream bank erosion. Impeding flows can result in a higher potential for bank overflows and floodplain inundation. These potential impacts need to be minimized by incorporating design features to protect the structural integrity of the road- and pipeline-crossing structures to accommodate all but the rarer flood events. The GMT1–GMT2 Access Road crosses relatively dry terrain with numerous small drainages and no major streams, only crossing a small, unnamed, beaded-stream-pool outlet draining from Lake M9925 (Alternative A only). Once installed, above-ground pipelines would have no effect on stream and water flow characteristics.

Water withdrawal to support components of each alternative could affect the water levels of lakes used as water sources, and any connected water body, such as streams or wetlands. Only permitted lakes, rivers, or reservoirs (under Alaska Department of Natural Resources Temporary Water Use Authorizations and if required, Alaska Department of Fish and Game Fish Habitat Permits) would serve as water sources. Water withdrawal in the summer from lakes could also result in a temporary lowering of the shallow groundwater in adjacent wetlands as the lakes recharge. The impacted area would be localized around the perimeter of the lakes. Lakes could supply fresh water for (1) the seasonal construction of ice roads and pads; (2) drilling; (3) hydrostatic testing; (4) dust abatement on roads, pads, and airstrips during summer; (5) potable water; and (6) fire suppression and maintenance activities.

Water use for Alternatives A and B would be approximately 395 million gallons each. For Alternative C, water withdrawals to support annual ice road construction would be necessary during drilling and throughout operations, resulting in a total estimated water use of 691 million gallons. A 2-inch water line would be constructed from CD1 to GMT2 in Alternative C. Details related to water withdrawal from lakes during the operation period is provided in BLM (2004a, Section 4F.2.2.2).

Drilling wastes (muds and cuttings) would be disposed of through annular disposal onsite and/or transported to an approved disposal well offsite. No GMT2 disposal well is planned.

As discussed in BLM (2004a, Section 4F.2.2.2), discharges to tundra of treated domestic wastewater in the drilling and operation period could occur in accordance with Alaska Pollutant Discharge Elimination System permit requirements. This applies to all the action alternatives.

As stated in BLM (2004a, Section 4F.2.2.2), the following changes to water quality may occur during the drilling and operations phase of the project:

- Increased turbidity of water bodies in the project area may result from dust fallout, flooding, erosion, or bank failure.
- Water withdrawals for drilling and/or operations may have short-term (lasting only one season) impacts on alkalinity, pH, or oxygen content in the water source. Typically water for drilling and operations will be provided by CD1, using permitted sources.
- Only treated (secondary treatment) domestic wastewater would be discharged to water bodies/wetlands in the project area; and therefore, it is not anticipated that there would be an increase in fecal coliform counts over the naturally occurring concentrations.
- Pipelines on vertical support members over streams and drainages should have no effect on stream habitat and flow characteristics provided these are elevated sufficiently to avoid flooding (BLM 2012, Section 4.3.7.2, page 154). Pipelines will be installed 7 feet above tundra, which should provide sufficient clearance from stream flow.

Oil spills could occur from pipelines; storage tanks; production facilities/infrastructure; drill rigs; and vehicles during drilling and operation phase. Spills occurring from pipelines or leaving pads and roadbeds could enter water sources reaching tundra ponds, lakes, creeks, or rivers.

Spills can occur at any time during the year. The potential impacts from oil spills are described in BLM (2012, Section 4.3.4.2) and in Section 4.5 of this document.

4.2.2.4 Comparison of Alternatives

A major difference between the action alternatives is proposed access (i.e., with or without the GMT1–GMT2 Access Road). In general, the GMT1–GMT2 Access Road (Alternatives A and B) could cause direct impacts to hydrology and water resources. Alternative C impacts would be more focused around GMT2 pad and air access facilities. The Alternative A route includes a culvert crossing over the small, unnamed, beaded-stream-pool outlet draining from Lake M9925. There are no major stream or river crossings proposed under any of the alternatives.

The impacts to drainage basins under Alternative C would be less than those for Alternatives A and B. The 0.9-mile gravel access road (Alternative C) that would be constructed from GMT2 pad to the occupied structure pad and air access facilities would be relatively short and, for the most part, situated on topographically higher ground. It does not traverse any major drainages and would therefore, cause relatively minor impacts to the drainage patterns and associated ephemeral stream or sheet flow. To the extent there are impacts to drainage patterns, they would be localized.

For Alternatives A and B, culverts are considered at all water crossings. Alternatives A and B would potentially require an estimated 46 culverts and 50 culverts, respectively (Table 4.2-9). Alternative C would have a 0.9-mile Airstrip Access Road, which could require an estimated five culverts. Discussion of water crossings is included in Section 4.2.2.3.

In Alternatives A and B, year-round vehicle traffic (described in Section 2.5.4.2) along the GMT1–GMT2 Access Road would cause impacts resulting from gravel spray/dust deposition onto adjacent water bodies. There would be some road gravel spray/dust deposition associated with Alternative C, but it would be less because the areas available for vehicle traffic are less and traffic would travel slower than along the major GMT1–GMT2 Access Road. There would be gravel spray/dust generated by aircraft during takeoff and landing at the GMT2 airstrip (as well as the airstrip of origin, if unpaved).

Alternative C would require more years of major access ice roads than Alternatives A and B. Ice roads would be constructed within the same general footprint each year and impacts may be additive, although there is limited documentation of this occurring (U.S. Army Corps of Engineers 2012a, page 5–149), and a BLM best management practice is in place (C-2[e]) as a protective measure to reduce or avoid such impacts. The ice roads could the alter drainage during spring breakup because the ice would melt more slowly than the surrounding tundra and streams. Blockage of streamflow and increased stream stage could occur over more years with Alternative C.

Under Alternatives A and B, no ice roads are planned during drilling and operations to support resupply and transport of heavy equipment for the project; however, it is possible that they may be required.

Due to reliance on an ice road for access to GMT2, the degree of ice road construction and water usage for ice road construction, drilling and camp use is greater in Alternative C than in Alternatives A and B. There are also more ice road miles during the construction phase under Alternative C. Alternative C would require the most water withdrawal because this alternative requires the most years of project operation. Therefore, the impacts of ice roads under Alternative C could be greater and of longer duration compared to Alternative A.

Table 4.2-5 and Table 4.2-7 and Maps 4.2-2 and 4.2.3 show potentially altered inundation areas caused by the proposed GMT1–GMT2 Access Road and pads for Alternatives A and B. Note: (-) cells indicate that no subbasin was identified as part of impact analysis.

Table 4.2-8 and Map 4.2-4 show potentially altered inundation areas caused by the proposed 0.9-mile Airstrip Access Road connecting GMT2 pad and the occupied structure pad and air access facilities in Alternative C.

Alternative A potential upstream inundation area was calculated to be approximately 168.5 acres of upstream inundation across the tundra along the road route and approximately 78.2 acres of drying area downstream of the road. Potential upstream inundation areas for Alternative B was calculated to be approximately 52.3 acres of upstream inundation across the tundra along the road route and approximately 45.7 acres of drying area downstream of the road. Alternative C was calculated to be 54.9 acres inundated; drying area was calculated to be 115.5 acres. These inundation areas are summarized in Table 4.2-9.

Alternative A and B will result in impacts from gravel extraction of 671,300 and 747,300 cubic yards, respectively. Alternative C would result in impacts from gravel extraction of 930,000 cubic yards. While the levels of impacts are different due to the amount of gravel required for each alternative, the types of impacts are expected to be similar.

The remainder of this section addresses the specific impacts for each alternative and describes the level of impact on water resources for each alternative. Major project components with potential for hydrologic impact are shown for each alternative in Table 4.2-9.

Table 4.2-9. Summary of major components potentially impacting hydrology[a]

Alternative	Total Gravel Fill Footprint (acres) [b]	Total Length of New Roads (miles)	Estimated Number of Culverts [c]	Area of Potential Increased Stage (ponding) Upstream of Gravel Infrastructure (acres)	Area of Potential Decreased Stage (drying) Downstream of Gravel Infrastructure (acres
A	78.0	8.2	46	168.5	78.2
B	87.2	9.3	50	52.3	45.7
C	92.0	0.9	5	54.9	115.5

[a] All values are estimates subject to change in final design.

[b] Total gravel footprint acreage does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

[c] Culvert would be installed along gravel roads to maintain surface flow. The number of potential culverts to be installed assumes one culvert per 1,000 linear feet of new road. More may be necessary for drainage depending on local conditions, and placement would be determined during road layout to coincide with low areas to maximize drainage.

Project activities under Alternative C that could impact the hydrologic regime are similar to Alternatives A and B, and include placement of gravel infrastructure for pads and access facilities, pipeline construction, gravel extraction, and water withdrawal from area lakes and reservoirs for construction of temporary ice infrastructure.

The differences in the size, location, and construction of infrastructure among the action alternatives generally correlate with impacts. The stipulations and design requirements, described in Section 4.2.2.5, “Mitigation,” and more comprehensively (for all resources) in Section 4.7, “Mitigation Measures and Monitoring,” specify measures to protect natural flow characteristics and water quality.

As described in BLM (2004a, Section 4F.2.2.1), adequate monitoring and adherence to withdrawal regulations would limit potential impacts on lake water levels to short-term duration. Long-term (longer than 1 year) potential impacts on lake water levels are likely to be minor because natural annual recharge processes are sufficient to fully recharge the lakes each year BLM (2004a, Section 4F.2.2.1). Thus potential impacts on lake water levels would be short term and low intensity.

All action alternatives have the potential for spills to water resources including tundra ponds, lakes, and creeks resulting from pipelines; storage tanks; production facilities/infrastructure; drill rigs; vehicles; and/or vessels. Because the location and length of oil transit pipelines under the action alternatives are similar, the potential risk to water resources from a pipeline spill is also expected to be similar. Alternative C would require a diesel pipeline to provide fuel to the GMT2 pad in addition to other pipelines, which would pose additional spill risk along the pipeline system.

However, we expect greater differences in the risk to the surrounding environment regarding spill response capabilities as discussed in Section 2.9.3. A portion of the Alternative A GMT1- GMT2 Access Road lies downgradient from the pipeline, and would act as a barrier to spill migration. The GMT1–GMT2 Access Road would also be used for pipeline inspections and spill response. Because Alternative C is roadless and relies upon air support and yearly ice road construction for incident response, risks to water resources from an oil spill are increased throughout the life of the project. Spills are discussed further in Section 4.5.

For Alternative C, the 5,000-foot airstrip and associated GMT2 drill pad and occupied structure pad would not cross any major drainages or streams. The airstrip and pads would have minor impacts to the localized drainage pattern due to the acreage of impact. To minimize surface water runoff from precipitation and snow melt that could cause ponding adjacent to the gravel embankments, the gravel surface may need to be contoured to direct surface water runoff to the down-gradient edges of the pad. The width of the pads and airstrip are too large to traverse with culverting. If ponds develop, additional mitigation may be needed (e.g., route runoff along the edges of the airstrip). Over the compacted gravel surface there will be less infiltration of precipitation, however, this impact is expected to be localized and of low intensity.

Ice roads and pads could alter the drainage pattern during spring breakup because the ice would melt more slowly than the surrounding tundra and streams. Blockage of streamflow and increased stream stage could occur due to ice roads that are not adequately slotted or breached.

The types of impacts to lakes and ponds would be the same for Alternative C as discussed for Alternatives A and B. However, there would be considerably more water usage over the life of the project due to the annual ice roads required for Alternative C, as described in Section 4.2.2.3. Alternative C water usage would be almost twice as much than that of Alternatives A and B. The major difference occurs during operations, due to the annual requirement for an ice road in Alternative C. However adequate monitoring and adherence to water withdrawal regulations would limit potential impacts on lake water levels to minor and of short-term duration. In addition, Alternative C requires approximately 24 percent to 39 percent more gravel mined than Alternatives A and B, with associated increase in related impacts.

Potential water quality impacts under Alternative C could result from construction and operation of the project in a manner similar to Alternatives A and B. The primary difference is absence of the GMT1–GMT2 Access Roads, which reduce the opportunity for associated water quality impacts (e.g., dust and gravel spray). However, there would be a comparable amount of gravel discharged onto the tundra surface for construction of an airstrip and additional pad space for living quarters and storage (occupied structure pad), and there would be associated impacts (e.g., dust and gravel spray from aircraft landing/takeoff). The additional facilities required for project development under Alternative C would increase the required gravel footprint. Gravel transport from its source to its final location also has the potential for gravel spillage onto the frozen tundra, and if not thoroughly cleaned up, could result in an increase in turbidity when tundra wetlands and water bodies thaw.

In comparison to Alternatives A and B, Alternative C may result in higher spill risk due to increased activity with aircraft operations, year-round living accommodations, and potential delayed spill response when air access is restricted during periods of adverse weather. Spills are discussed further in Section 4.5.

4.2.2.5 Mitigation

All roads would be designed and constructed to provide adequate cross flow to prevent raising the water level on the upstream side of roads by more than 6 inches compared to that for the downstream side for more than 1 week after peak discharge (BLM 2004a, Section 2.4.6.1, page 103).

Potential impacts and associated mitigation measures for the proposed project are listed in Table 4.2-10.

Table 4.2-10. Summary of potential impact to water resources and mitigation measures [a]

Resource	Activities	Potential Impact	Mitigation
Groundwater and Shallow Lakes	Construction of the GMT2 gravel pad and access road	Compaction of surface soils or removal of gravels and changes in recharge potential	The GMT2 pad and access roads are designed to limit acreage of fill and to prevent changes in recharge
Groundwater	Underground disposal (via injection) of non-hazardous waste	Contamination of groundwater (*note:* groundwater is not typically a potable water source on the North Slope); change(s) of groundwater flow patterns.	Underground injection will be performed in accordance with applicable permits to prevent impacts to groundwater resources

Resource	Activities	Potential Impact	Mitigation
Lakes and Ponds	Construction of gravel access road and ice roads [a]	Increased bank erosion and sedimentation	Gravel roads will have culverts installed to maintain surface flow; gravel roads and pads will have erosion control mechanisms as well as Stormwater Pollution Prevention Plans in place for construction and operations
Lakes and Ponds	Construction and use of road and pads	Dust fallout on ice and snow which melts in spring, or direct fallout on water bodies in summer, resulting in increasing turbidity	Traffic and dust control measures for roads and construction areas to avoid impacts of dust on nearby water bodies
Lakes	Ice road construction, camp use, and drilling activities	Water withdrawals from lakes; impacts to fish	Water withdrawn only from permitted lakes, with only permitted amount of water withdrawn, using methods required by permit
Streams	Construction of the gravel access road, pipeline, and culverts	Blockage of natural drainage (channels and sheet flow); increased stages and velocities of floodwater, channel scour, bank erosion, sedimentation, and potential for over-bank flooding	Road, pipeline, and water crossings will be designed to maintain existing hydrology including during flood periods; gravel roads and culverts, will be designed to have erosion control mechanisms and will follow the Alpine Processing Facility Erosion Control Plan
Streams	Construction of ice roads	Blockage of natural drainage and increased floodwaters	Ice bridges across rivers will be removed, slotted, or scored prior to spring breakup

[a] No gravel GMT1–GMT2 Access Road in Alternative C.

Specific measures to protect water resources are provided in BLM (2008a and 2013a: A-1 through A-7, B-1, B-2, C-2, C-3, C-4, E-2, E-3, E-4, E-6, E-8, K-1, and K-2). For example, impacts to water resources will be mitigated by:

- BMP A-6: Requires all cuttings and drilling mud to be disposed of by injection, allowing on-pad temporary storage of muds and cuttings, as approved by Alaska Department of Environmental Conservation. Freshwater aquifers are protected by surface casing installed and cemented in place at varying depths. EPA establishes aquifer exemption depths for certain disposal well classes. BLM and Alaska Oil and Gas Conservation Commission both authorize casing setting depths for protection of fresh water aquifers on federal leases.
- BMP B-2: Provides standards for water and ice removal from lakes.
- BMP C-2: Provides standards for cross country travel (e.g., snow trails, ice roads, seismic activity).
- BMP E-2: Prohibits construction camps from being placed on frozen lakes or water ice.
- BMP E-6: Requires that stream and marsh crossings be designed and constructed to ensure free passage of fish, reduce erosion, maintain natural drainage, and minimize adverse impacts to natural stream flow.
- Lease Stipulation E-2: Requires that permanent oil and gas facilities and infrastructure be more than 500 feet from lakes, with essential pipeline and road crossings evaluated on a case-by-case basis; limits pipelines within 500 feet of fish- bearing waters and crossing of lakes; restricts discharge of pollutants from vehicle and equipment use, personnel camps, and produced fluids. *Note:* BLM authorized a deviation from this stipulation (BLM 2004b).

- Lease Stipulation K-1: Establishes setbacks from major rivers, including Fish Creek, Tiŋmiaqsiġvik (Ublutuoch River), and the Colville River in the project area, with exceptions for essential road and pipeline crossings allowed. *Note:* BLM authorized a deviation from this stipulation (BLM 2004b).
- Lease Stipulation K-2: Establishes a 0.25-mile development setback from deep water lakes, defined as those greater than 13 feet, except essential road and pipeline crossings considered on a case-by-case basis.

With adherence to best management practices, permit requirements, and lease stipulations, impacts to water resources are possible, but likely to be localized in extent and temporary in duration.

In addition to BLM lease stipulations and best management practices, project activities that could impact water resources will be subject to federal, state, and local permit requirements, which provide additional resource protections. In particular, the U.S. Army Corps of Engineers has an obligation under the Clean Water Act (Section 404(b)(1) guidelines) to focus on impacts to the "aquatic ecosystem."

4.2.2.6 Conclusions

The likelihood of impacts to the water resources identified in this analysis can be separated into reasonably foreseeable and potential (Table 4.2-11). No evaluated effects were determined to have impacts.

Table 4.2-11. Likelihood of impacts; water resources

Reasonably Foreseeable	Potential/Speculative Impacts	Impact Anticipated
Temporary elimination of shallow taliks and supra-permafrost water zones in the immediate vicinity of the gravel mine from mining activities	Contamination from spills. Changes in water quality from ice road construction over lakes, streams, and periodic drainages.	None
Changes to groundwater from gravel mining activities	Increased sedimentation and turbidity from mining activities, gravel fill on tundra, and operation of vehicles on gravel infrastructure (roads, pads, and airstrip). Changes to natural drainage patterns, stream stage, streamflow, stream velocity, groundwater flow, and lake water levels from placement and construction of gravel infrastructure and culverts and changes in snow accumulation patterns. Changes in surface water levels and water quality, and related lowering of nearby shallow groundwater, from water withdrawal	None

In general, all action alternatives have the potential for long-term impacts to local water resources resulting from the placement of new infrastructure. Most impacts are related to changes in the drainage pattern, and to a lesser degree stream flow. There also would be short-term, temporary impacts from ice infrastructure (e.g., roads and pads). These impacts tend to be proportional to the amount of area impacted by infrastructure and the configuration of gravel placement, with modifications due to specific activities and locations. However, for all action alternatives the intensity of impacts would be minor and localized.

Potential surface water quality impacts may be categorized as follows, and discussed in BLM (2004a, Section 4F.2.2.2, pages 1092–1093):

- Accidental release of fuels and other substances
- Reductions in dissolved oxygen and changes in ion concentrations in lakes
- Increases in turbidity and suspended solids

Impacts on hydrology from Alternatives A and B would result primarily from construction of gravel infrastructure (e.g., roads and pads), which could modify drainage patterns and streamflow. These impacts would be long term, localized, and of low intensity. Ice roads and ice pads could seasonally affect natural drainage patterns and streamflow during spring breakup. However, this impact would be limited to the construction phase, and thus temporary. Water withdrawal for ice roads, drilling, and camp use has the potential to temporarily lower lake levels. The overall hydrological impacts of ice roads and the associated water usage is negligible; the impacts of roads and pads are characterized as minor due to the longer duration. Erosion and sedimentation associated with road and pad building could increase sedimentation into waterways. However, based on previous studies, no measurable effect on water quality is expected, as reported in MJM Research (2007d) and Michael Baker Jr. Inc. (2009b, 2010).

Because gravel fill construction would take place over winter when most water bodies are frozen, impacts on water quality would be limited. Discharges of treated wastewater could occur to tundra in accordance with Alaska Pollutant Discharge Elimination System permit requirements, so it is not expected that there would be an increase in fecal coliform counts over the naturally occurring concentrations. As stated in BLM (2004a, Section 4F.2.2.2, page 1091), increased turbidity of water bodies in the project area would result from dust fallout, flooding, erosion and sedimentation, or bank failure. It is not expected that alkalinity and pH of surface water bodies would be affected beyond the snowmelt period. Adherence to federal and state operational guidelines and permit requirements, safety practices, planning requirements, lease stipulations, and best management practices would all serve to reduce impacts from these activities. The overall degree of impact for Alternatives A and B to the hydrology and water quality is considered minor.

Impacts on hydrology from Alternative C would be of similar type as described for Alternatives A and B, but the intensity, duration, and geographic extent of impacts varies with the configuration of the gravel placement. In general, the impacts to the drainage pattern would be of a greater intensity, but would be more localized. Impacts on water level in lakes would be of similar magnitude as Alternatives A and B, but could occur for more seasons due to the annual withdrawals to support ice road construction. Alternative C would have a larger gravel footprint than Alternatives A and B and require more gravel mining, with an increased risk of gravel spillage in water bodies, and an associated impact to water quality (e.g., increased turbidity). Greater use of lake water would increase the potential for dissolved oxygen depletion at the source lake(s) if not carefully monitored. Dust fallout, erosion, and sedimentation could potentially affect the turbidity of smaller water bodies in the vicinity of the airstrip and new infrastructure. Overall, Alternative C would have less impact than Alternatives A and B, but impacts to hydrology and water quality still considered minor.

Global climate change could have unpredictable impacts on winter temperatures, water balance, water availability, and timing and magnitude of spring floods (BLM 2012, Section 4.2.4.4). These changes could alter the impacts discussed for each alternative. A longer and warmer growing season could result in increased potential evapotranspiration reducing available water in lakes. Premature melting of ice roads could occur with sudden spring melts, requiring emergency demobilization in order to protect the tundra, and potentially leave less time for proper abandonment of ice bridges. Increased snowfall combined with late summer rainfall could increase the magnitude of spring peak flows above the normal range of flows, causing increased erosion and sedimentation. All alternatives under consideration would be affected, although impacts under Alternative C may be greater due to a greater reliance on ice roads for operation.

4.2.3 Atmospheric Environment

4.2.3.1 Climate and Meteorology

A potential contributor to changes in climate and meteorology is the impacts from changes in greenhouse gas emissions. Changes in greenhouse gas emissions, in recent decades, have been driven by anthropogenic forces. The concentrations of greenhouse gases in the atmosphere are chemically stable and can stay in the atmosphere for 10 to 100 years before chemically breaking down or being absorbed by the hydrosphere or vegetation. Significant research has shown a positive correlation between an increase in GHG emissions to the atmosphere and atmospheric temperature increases. GMT2 Project greenhouse gas emissions under all four proposed alternatives are tabulated below and summarized in the emission inventory reports submitted to the BLM (Kleinfelder and Ramboll Environ 2017a, 2017b, 2017c) except for Alternative D, the no-action alternative. Note that emissions of carbon dioxide equivalent (CO_2e) account for certain pollutants global warming potentials. A global warming potential is a GHG's potency relative to carbon dioxide (CO_2) taking into account residence time in the atmosphere. The global warming potential is a factor that is multiplied to a certain greenhouse gas pollutant's emissions to determine the emissions of CO_2e. The *Federal Register* has published a global warming potential factor for CO_2 of 1, for methane (CH_4) of 25, and for nitrous oxide (N_2O) of 298.

Table 4.2-12. Summary of greenhouse gas emissions for GMT2 Project alternatives in carbon dioxide equivalents (tons per year)

GMT2 Project Alternative	Year 1 (CO_2e tons per year)	Year 2 (CO_2e tons per year)	Year 3 (CO_2e tons per year)	Year 4–10 (CO_2e tons per year)	Year 11 on (CO_2e tons per year)
Alternative A	2,617	27,030	41,545	32,276	5,687
Alternative B	2,673	28,667	43,110	32,593	5,705
Alternative C	2,795	32,595	56,851	38,087	10,406
Alternative D	0	0	0	0	0

The project year of maximum GHG emissions under each of the alternatives is Year 3, where operations are primarily from construction and developmental drilling, and are temporary. Routine GHG emissions, shown in Year 11, from the GMT2 Project are an order of five to seven times lower and will have a smaller, less consistent impact. GHG emissions from the GMT2 Project are similar in magnitude to other projects in the area such as CPAI's Greater Mooses Tooth 1 (GMT1) (BLM 2014) and Armstrong Energy LLC's Nanushuk Project (SLR International Corporation 2017b). A detailed analysis of GMT2 Project impacts are discussed in Section 4.2.4, "Project Effects on Climate Change."

4.2.3.2 Air Quality

The BLM Arctic Field Office in Fairbanks, Alaska, published the Notice of Intent to prepare a Supplemental Environmental Impact Statement (EIS) for the GMT2 Project in July 2016 (BLM 2016). As air quality was one of the key areas identified by the BLM that will require analysis in the supplemental EIS, BLM requested assistance with the air quality analysis. Under the June 23, 2011, Memorandum of Understanding between the U.S. Department of Agriculture, U.S. Department of the Interior (USDOI), and EPA Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act (NEPA), an air quality technical working group including the BLM, EPA, U.S. Fish and Wildlife Service (USFWS), National Park Service, U.S. Forest Service, and Alaska Department of Environmental Conservation was created to review and comment on the potential near-field and far-field air quality impacts through modeling.

The BLM contracted Kleinfelder, Inc. and Ramboll Environ to conduct the near-field and far-field modeling of the GMT2 Project which began with the development of emission inventories for Alternatives A, B, and C. An emission inventory was not completed for Alternative D, because it is the no-action alternative with no direct project emissions, and thus, no impacts. From the completed emission inventories, near-field modeling was conducted for ambient air impacts, and far-field modeling was conducted for ambient air, visibility, and deposition impacts at Class II areas. The emissions inventories, near-field modeling air quality impacts analysis, and far-field modeling air quality impact analysis were reviewed by the Air Quality Technical Working Group.

As detailed in the following discussion, the GMT2 Project under any of the proposed alternatives has estimated emissions of the listed criteria, hazardous air, and greenhouse gas pollutants below major source thresholds for state permitting requirements. Exact air quality permitting requirements shall be determined upon an application for a permit.

Federal air quality regulations may apply to the GMT2 Project considering it is expected to use diesel-fired equipment and hydraulically fracture oil wells, and has the potential to emit greenhouse gas pollutants. Exact federal regulation applicability and requirements will be determined at the time of permitting the GMT2 Pad. Regulations under 40 CFR Part 60, 40 CFR Part 61, 40 CFR Part 63, and 40 CFR Part 98 should be evaluated upon equipment installation and operation for applicability to GMT2 operations.

Emission inventories were prepared for Alternatives A, B, and C, assuming Construction Schedule 1, described in Section 2.4.1 of this document. Construction Schedule 1 was determined to be the more conservative construction schedule in terms of air emissions because Construction Schedule 1 has activities compacted into 2 years, rather than Construction Schedule 2 which is spread across 3 years. Each emission inventory was prepared using the information provided in Sections 2.4 for all alternatives, 2.5 for Alternative A-specific project parameters, 2.6 for Alternative B-specific project parameters, and 2.7 for Alternative C-specific project parameters, of this document.

Each alternative would utilize ice roads during construction, although the length of the ice roads would vary depending on the alternative. Likewise, the drilling schedule would be the same under each alternative, as would the first date of production from the wells. Drilling would commence in May of Year 3 of the project and occur year-round for each alternative until all planned wells are drilled. The date of first production is expected in December of Year 3.

The emissions inventories are divided into four categories and include the following:

- Construction,
- Developmental drilling,
- Infill drilling, and
- Routine operations.

Emissions from construction, developmental drilling, and infill drilling are short term and temporary. Construction emission sources include camp generators, aircraft activity, non-mobile support equipment for pipeline, powerline, fiber optic line and vertical support member installations, gravel roads, ice roads, and pad construction, facilities installation at GMT2, Alpine Central Processing Facility, and CD5, tailpipe and dust emissions from truck traffic, and fugitive dust from construction. Construction would take place from late Year 1 through Year 3 of the project during Construction Schedule 1. Drilling emissions, within the developmental and infill emission inventory categories, result from drilling and well intervention sources such as drill rigs, well intervention rigs, tailpipe and dust emissions from truck traffic, well flowback flaring, and non-mobile support equipment including heaters, welders, and generators. Developmental drilling would take place during Year 3, and infill drilling would take place from Years 4 through 10 of the GMT2 Project.

Emissions from routine operations are long term and permanent for the life of the wells. Emissions from routine operations will begin in December of Year 3 and will continue through the life of the GMT2 Project. Therefore, routine operation emissions will coincide with drilling and well intervention activities starting December of Year 3 through Year 10 of the GMT2 Project. Sources of emissions during routine operations include a line heater, venting from pigging operations, fugitive component leaks, an emergency generator, aircraft activity, tailpipe and dust from truck traffic, and wind erosion.

Each of the above emission categories is further divided into subcategories based on the equipment and processes described and generally includes emissions associated with the following:

- Fuel combustion emissions from non-mobile sources,
- On-road tailpipe emissions from vehicle traffic,
- Non-road equipment tailpipe emissions,
- Fugitive dust emissions, and
- Aircraft emissions.

For each category, emissions were estimated for criteria, hazardous air, and greenhouse gas pollutants, as applicable. Criteria pollutants include NO_x, CO, SO_2, VOC, PM_{10}, and $PM_{2.5}$. Hazardous air pollutants include benzene, toluene, ethylbenzene, xylenes, n-hexane, and formaldehyde. Greenhouse gas pollutants include CO_2, CH_4, and N_2O reported as CO_2e. In all cases, CH_4 and N_2O are converted to CO_2e using the global warming potential factors found in 40 CFR Part 98, Subpart A, Table A-1 of 25 and 298, respectively.

In general, emissions were calculated on both a short-term and a long-term basis to support hourly, daily, and annual average modeling for comparison to the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards. Emissions were also summarized on a monthly basis based on the GMT2 Project schedule to identify the time periods when emissions would be highest to help define near field modeling scenarios. Details and the short-term and long-term emission rates used in the near-field and far-field modeling are included in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d) and far-field air quality impacts analysis (Ramboll Environ and Kleinfelder 2017).

From the emission inventories, near-field modeling scenarios were defined in order to model dispersion effects of criteria and toxic pollutants. For the near-field, AERMOD version 16216r, the EPA regulatory air dispersion model, was used to determine potential impacts of the GMT2 Project. Based on the emissions, three modeling scenarios were created:

- Construction,
- Developmental drilling, and
- Infill drilling.

The construction modeling scenario included sources and potential emissions expected to occur during Year 2 of the GMT2 Project. The developmental drilling modeling scenario included sources and potential emissions expected to occur during Year 3 of the GMT2 Project, and the infill drilling modeling scenario included sources and potential emissions expected to occur during Year 4 of the GMT2 Project. As discussed previously, the emissions from routine operations occurs simultaneously with infill drilling operations, and therefore in the near field model, emission sources related to routine operations were included in the infill drilling modeling scenario. The equipment modeled in each of the modeling scenarios along with their hourly, daily, and annual emission rates are detailed in the near field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d).

Meteorological data from the Nuiqsut Monitoring Station from years 2011 through 2015 were processed in version 16216 of AERMET to be compatible for use in AERMOD. The single, final background concentrations in Table 3.2-6 were added to the GMT2 modeled impacts for all modeling scenarios except for the NO_2 and PM_{10} models. For the NO_2 and PM_{10} models (1-hour NO_2, annual NO_2, and 24-hour PM_{10}), a seasonally varying background value was applied to account for the natural variability of pollutant background concentrations. No background values exist for hazardous air pollutants and were therefore not added to the modeled impacts. A detailed methodology of the near field analysis including background data is included in the near-field air quality impact analysis (Kleinfelder and Ramboll Environ 2017d).

For major sources or major modifications, a prevention of significant deterioration analysis is required in order to determine air quality impacts on Class I and Class II areas as described in Chapter 3. Similar to the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards, prevention of significant deterioration increments exist for comparison of air quality impacts from a project. These values are used as a comparison of consistent, continuous project impacts (e.g., routine operations) without considering background concentrations. For projects that are not major sources or major modifications, project impacts to prevention of significant deterioration increments are used to inform state and federal agencies of the potential for increment consumption. Referenced from 40 CFR Part 52 Subpart A, the prevention of significant deterioration increments for Class II areas are shown in Table 4.2-13 below. The infill drilling scenario was used for a comparison for prevention of significant deterioration increments, as it is the only modeling scenario that includes regular routine operation emissions and would be conservative because it also includes temporary emissions from drilling and well interventions. A prevention of significant deterioration analysis is most appropriate at sensitive receptors such as the town of Nuiqsut when there are no Class I or Class II areas in the near field. Therefore, the prevention of significant deterioration increment analysis was conducted at the Nuiqsut community. Class I area prevention of significant deterioration increments are not shown, as the nearest Class I area is over 600 kilometers away.

Table 4.2-13. Prevention of significant deterioration increments for Class II areas

Pollutant	Average Time	Class II Increment
NO_2	Annual	25 µg/m^3
SO_2	3-hour	512 µg/m^3
SO_2	24-hour	91 µg/m^3
SO_2	Annual	20 µg/m^3
PM_{10}	24-hour	30 µg/m^3
$PM_{2.5}$	24-hour	9 µg/m^3
$PM_{2.5}$	Annual	4 µg/m^3

Hazardous air pollutants have the potential to cause adverse health impacts depending on the level and duration of exposure. The acute reference exposure limits or the immediately dangerous to life or health values were used as a comparison for short-term or 1-hour GMT2 Project impacts and non-cancer reference concentrations for chronic inhalation were used as a comparison for GMT2 Project annual impacts. The immediately dangerous to life or health value was used if a reference exposure limit was not available. The acute reference exposure limits and non-cancer reference concentrations for chronic inhalation used in the comparison are listed in Table 4.2-14 below and in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d), as well as in each of the alternative sections below.

Some hazardous air pollutants from the GMT2 Project are also known to cause potential cancer risk; results of the modeling showed pollutant levels well below threshold levels. Cancer inhalation risk was calculated at the Nuiqsut receptor since that location is the closest nearby occupied residency. The hazardous air pollutants from the GMT2 Project that have a potential to cause cancer are benzene, ethylbenzene, and formaldehyde. Two exposure scenarios to determine the potential cancer risk at the Nuiqsut community were considered: the maximum exposed individual and the most likely exposure. The annual model result of benzene, ethylbenzene, and formaldehyde at the Nuiqsut receptor was modeled by the pollutant's cancer unit risk factor (shown in Table 4.2-14) and the exposure adjustment factor (0.43 based on a 30-year project life and 70-year exposure). Assuming most residents of Nuiqsut would stay in the area long term, the most likely exposure used the same cancer unit risk factor and exposure adjustment factor as the maximum exposed individual. The calculated potential cancer risk is the sum of the benzene, ethylbenzene, and formaldehyde cancer risks at the Nuiqsut receptor and was compared to a risk range of 1 to 100 in 1 million (EPA 2006). A detailed methodology of calculating the cancer risk is included in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d).

Table 4.2-14. Acute, chronic, and cancer risk thresholds for hazardous air pollutants

Pollutant	Acute RELs (µg/m3)[1]	Non-cancer Chronic RfC (µg/m3)[2]	Cancer Unit Risk Factors (1/(µg/m3))[2]
Benzene	1,300	30	7.8E-06
Toluene	37,000	5,000	N/A
Ethylbenzene	350,000[3]	1,000	2.5E-06
Xylenes	22,000	100	N/A
n-hexane	390,000[3]	700	N/A

The purpose of the GMT2 far-field air quality analyses are to assess the impact of air emissions from GMT2 Project sources and other potential future regional emissions sources on National Ambient Air Quality Standards and Air Quality Related Values, namely, visibility and deposition. The impacts were assessed at two sensitive Class II areas within 300 kilometers of the project: the Gates of the Arctic National Park and Preserve, and the Arctic National Wildlife Refuge, that were previously identified by federal cooperating agencies for the GMT1 far-field analysis following the 2011 memorandum of understanding between the U.S. Department of Agriculture, USDOI, and EPA on procedures for assessing air quality impacts due to on-land oil and gas development activities on Federal lands under NEPA (U.S. Department of Agriculture 2011). There are no Class I areas (i.e., areas with higher air quality protections than Class II areas) within 300 kilometers of the GMT2 Project area; the nearest one is the Denali National Park which is over 600 kilometers away. A map presenting the location of the GMT2 Project in relation to the two sensitive Class II areas is shown in Figure 4.2-3 and listed in Table 4.2-15.

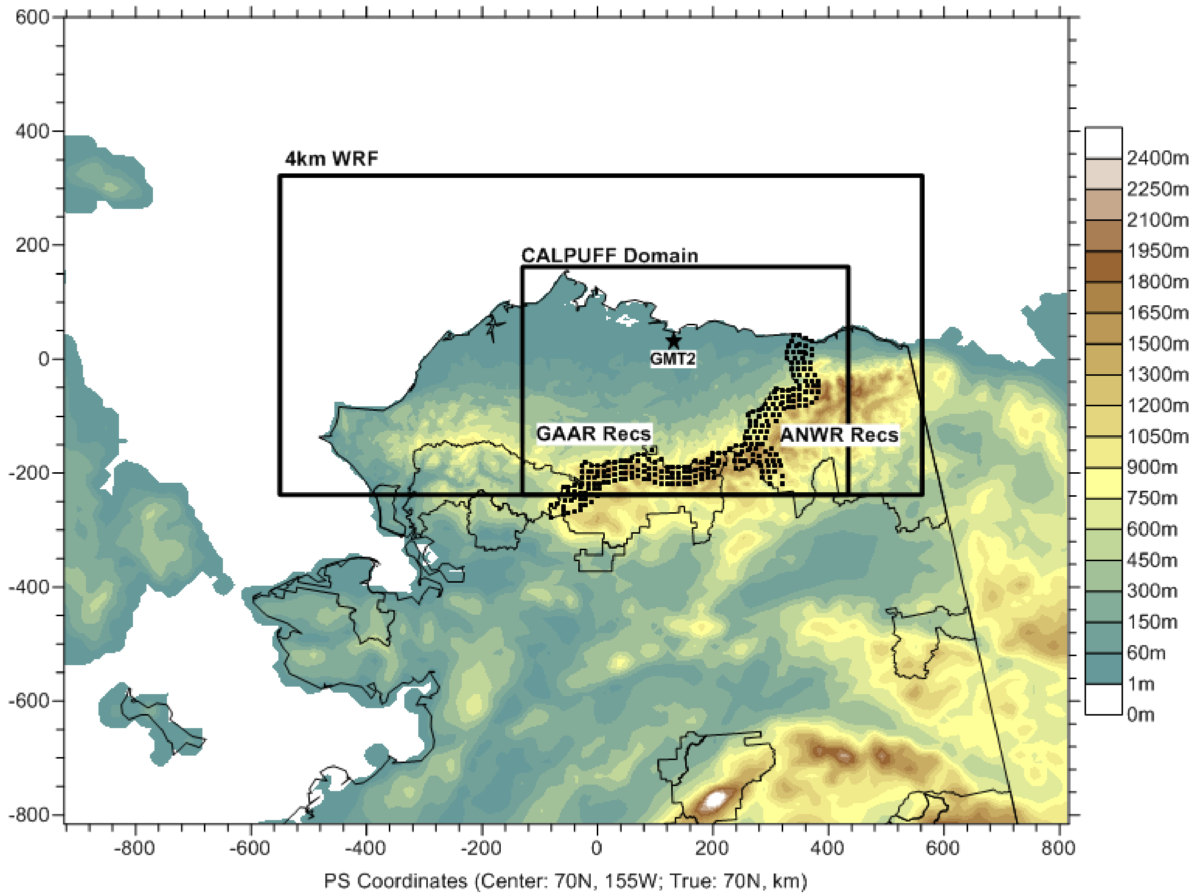

Figure 4.2-1. GMT2 Project Location (Black Star), Gates of the Arctic National Park and Preserve Receptors, Arctic National Wildlife Refuge Receptors, Meteorological Data Region (4km Weather Research and Forecast), Far-Field Air Modeling Region (CALPUFF Domain)

Table 4.2-15. Class II areas of concern

Area of Concern	Managing Agency	PSD Classification
Gates of the Arctic National Park	National Park Service	Class II
Alaska National Wildlife Refuge	USFWS	Class II

To assess far-field air quality and air quality-related values impacts, the air dispersion model CALPUFF was used. Details on CALPUFF's regulatory status, the model version utilized, and additional pre-processing and post-processing performed may be found in the GMT2 far-field air quality modeling report (Ramboll Environ and Kleinfelder 2017). The modeling procedures followed the Federal Land Managers' Air Quality Related Values Work Group and Interagency Workgroup on Air Quality Modeling recommendations—in particular, Federal Land Managers' Air Quality Related Values Work Group (2000, revised October 2010) and Interagency Workgroup on Air Quality Modeling (1998) guidance documents.

The CALPUFF model options used are described in detail in the far-field modeling air quality impacts analysis report (Ramboll Environ and Kleinfelder 2017) and are summarized here:

- **Regulatory Options:** CALPUFF was run in the regulatory mode (MREG =1).
- **Modeling Period:** Five years were modeled (2009–2013) using 4 kilometer horizontal resolution meteorology driven by the Weather Research and Forecast meteorological model.
- **Downwash:** Downwash effects were not considered, because they have little effect at source-receptor distances greater than 50 kilometers.
- **Background Ammonia:** CALPUFF runs performed for GMT2 used 1.0 ppb ammonia concentration, appropriate for the remote area with little agriculture.
- **Background Ozone:** Hourly surface ozone is measured at the Nuiqsut Monitoring Station. These hourly observed ozone concentrations were used in the CALPUFF modeling, with the maximum value over the 5-year modeling period (59.8 ppb) used for the 758 missing hours.
- **Visibility Impact Assessment:** Visibility impacts were calculated using the recommended Method 8 included as the default option in CALPOST (Federal Land Managers' Workgroup 2010). The annual average natural conditions tables for monthly species background concentrations and relative humidity adjustment factors for the closest Class I area, Denali National Park, were used (Federal Land Managers' Workgroup 2010).

To be protective of the environment, and for the sake of simplicity, the far-field modeling conservatively used the maximum of the short-term and long-term emission rates for each pollutant. That is, the 1-hour NO_x emission rate was used for the both visibility (normally a 24-hour emission rate) and deposition (normally an annual emission rate) portions of the air quality related value analysis, and for both the 1-hour and annual NO_2 concentrations for the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and Class II prevention of significant deterioration increment analysis. Most emission sources were assumed to operate 24 hours per day, 7 days per week, and 52 weeks per year, regardless of whether the potential for emissions to occur during a certain period is present due to operating schedules or environmental conditions. Moreover, even though fugitive dust would not occur during winter months, PM_{10} and $PM_{2.5}$ emission rates were held constant at their maximum emission rate. A detailed methodology into the model set up for the far field analysis is included in the far field air quality impact analysis (Ramboll Environ and Kleinfelder 2017).

The following sections outline the air quality impact analysis for each GMT2 alternative. Emissions and methodologies for each alternative, other than the no-action alternative, were calculated and analyzed and were presented in separate reports (Kleinfelder and Ramboll Environ 2017a, 2017b, 2017c). The approved final emission inventories for each alternative were utilized for the air quality impact analysis in the near-field and far-field modeling analyses. The potential cumulative impacts of GMT2 Project sources and reasonably foreseeable developments are presented in Section 4.6.5, "Cumulative Impacts to Air Quality."

Alternative A

The emission inventory for Alternative A was prepared for the BLM in order to begin the modeling process to compare predicted air quality impacts to the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and prevention of significant deterioration increments in the near field and National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and Air Quality Related Values in the far-field. For the far-field, the only locations for analysis were the Gates of the Arctic National Park and Preserve and the Arctic National Wildlife Refuge which are Class II areas. There are no Class I areas within 300 kilometers of the GMT2 Project area.

Emission Inventory

A detailed report was prepared describing the calculation methodologies, assumptions, and data sources for the Alternative A emission inventory (Kleinfelder and Ramboll Environ 2017a). Considering the similarities between the recently approved GMT1 Project and the proposed GMT2 Project, the same basic equipment was assumed for GMT2 as GMT1, but was scaled as necessary based on GMT2 Project-specific data. For example, GMT2 will have a larger gravel pad than GMT1, so the equipment for pad construction was scaled based on the increased pad acreage. In general, emissions were determined using published emission factors, information from Chapter 2 of this document, and equipment specifics found in GMT1 (BLM 2013), unless updated based on information from ConocoPhillips for GMT2. The Alternative A project year totals for each of the criteria pollutants (NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_2) and speciated hazardous air pollutants (benzene, toluene, ethylbenzene, xylenes, n-Hexane, and formaldehyde) emissions are presented in Table 4.2-16 (Kleinfelder and Ramboll Environ 2017a). The table also details the month with the highest emissions of the specified pollutant.

Table 4.2-16. GMT2 Project Alternative A criteria and hazardous air pollutant emissions summary

GMT2 Project Alternative A	Year 1	Year 2	Year 3	Year 4–10	Year 11 on	Maximum Month of Emissions[a]
NO_x (tons per year)	12.8	89.0	119.0	87.2	8.9	Year 2 Month 2
CO (tons per year)	5.2	45.4	77.5	63.7	6.4	Year 2 Month 2
VOC (tons per year)	1.6	15.1	20.9	16.2	8.0	Year 2 Month 2
PM_{10} (tons per year)	0.75	193.0	116.0	58.8	5.3	Year 2 Month 7
$PM_{2.5}$ (tons per year)	0.58	23.7	17.8	10.6	1.2	Year 2 Month 7
SO_2 (tons per year)	0.02	0.19	0.34	0.45	0.21	Year 3 Month 12
Benzene (tons per year)	0.02	0.18	0.16	0.06	0.006	Year 2 Month 2
Toluene (tons per year)	0.02	0.17	0.12	0.04	0.01	Year 2 Month 2
Ethylbenzene (tons per year)	0.005	0.04	0.02	0.01	0.01	Year 2 Month 2
Xylenes (tons per year)	0.02	0.15	0.10	0.04	0.02	Year 2 Month 2
n-Hexane (tons per year)	0.003	0.02	0.04	0.23	0.23	Year 3 Month 12
Formaldehyde (tons per year)	0.19	1.4	0.97	0.20	0.005	Year 2 Month 2

[a] Year 3 Month 6 is not the month of maximum month of emissions for NO_x, CO, and VOC. Well interventions were conservatively assumed to occur in the span of 1 month for purposes of the emission inventory and to avoid underestimating short-term emissions for the modeling (Kleinfelder and Ramboll Environ 2017a).

The construction phase, while having high short-term emissions, is temporary and does not translate to the consistent, permanent emissions from the routine operations beginning in Year 4. Maximum annual emissions would occur during the construction and drilling phases (Years 2 and 3), and once construction and drilling are complete and emissions are from routine operations alone (Year 11 on), emissions are approximately 10 times less.

Impacts Analysis

Alternative A was modeled as it is ConocoPhillips' proposed alternative. The methodology briefly described above, and detailed in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d) was followed using modeled results from AERMOD to compare GMT2 Project Alternative A impacts to the applicable National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards for criteria pollutants and reference exposure limits and reference concentrations for chronic inhalation for hazardous air pollutants. The results of the near-field modeling for Alternative A are presented in Table 4.2-17 for criteria pollutants and Table 4.2-19 for hazardous air pollutants. The results shown include impacts from Alternative A operations, ambient background concentrations, and impacts from cumulative sources.

Table 4.2-17a. GMT2 Project Alternative A near-field criteria pollutants impacts summary (μg/m^3)

Criteria Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	NAAQS/ AAAQS	Percent of Standard
CO	1-hour	1,375	1,600	1,492	1,600	40,000	4%
CO	8-hour	1,299	1,400	1,396	1,400	10,000	14%
NO_2	1-hour	165.6	166.2	148.0	166.2	188	88%
NO_2	Annual	25.1	35.9	33.4	35.9	100	36%
SO_2	1-hour	34.2	34.2	34.2	34.2	196	17%
SO_2	3-hour	39.1	39.1	39.1	39.1	1,300	3%
SO_2	24-hour	22.1	22.1	22.1	22.1	365	6%
SO_2	Annual	0.74	0.74	0.75	0.75	80	1%
PM_{10}	24-hour	64.3	121.0	109.7	121.0	150	81%
$PM_{2.5}$	24-hour	25.9	25.9	25.9	25.9	35	74%
$PM_{2.5}$	Annual	2.9	4.1	4.0	4.1	12	35%

For each of the criteria pollutant models, the GMT2 Project impacts, including background concentrations, are less than 90 percent of their respective National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards. The potential impacts at the Nuiqsut community modeled below 36 percent of their respective increments (shown below in Table 4.2-17b).

Table 4.2-17b. GMT2 Project Alternative A Near Field Criteria Pollutants Impacts Summary at the Nuiqsut Community Receptor (μg/m^3)

Criteria Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	NAAQS/ AAAQS	Percent of Standard
CO	1-hour	1,237	1,240	1,236	1,240	40,000	3%
CO	8-hour	1,231	1,231	1,231	1,231	10,000	12%
NO_2	1-hour	63.6	63.6	63.6	63.6	188	34%
NO_2	Annual	17.3	17.3	17.2	17.3	100	17%
SO_2	1-hour	10.9	10.9	10.9	10.9	196	6%
SO_2	3-hour	9.74	9.74	9.74	9.74	1,300	1%
SO_2	24-hour	6.03	6.03	6.03	6.03	365	2%
SO_2	Annual	0.090	0.090	0.090	0.090	80	0.1%
PM_{10}	24-hour	41.4	41.4	41.4	41.4	150	28%
$PM_{2.5}$	24-hour	10.5	10.5	10.5	10.5	35	30%
$PM_{2.5}$	Annual	2.13	2.13	2.13	2.13	12	18%

As detailed in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d), a number of conservative assumptions were used in these models including a dust control efficiency of 50 percent for watering of gravel pads and roads where GMT1 used 75 percent for some dust control efficiencies via watering (AECOM 2013a). Also, it was assumed that drilling, construction, and well interventions would all occur during the same 1-hour period for short-term impacts where the likelihood of that occurring is minimal for safety and practical purposes. Lastly, a conservative assumption worked into the near-field model was monthly averages for vehicle truck traffic where it is known vehicle traffic will vary month to month, especially during construction where activities are not evenly spread. Best management practices for dust control are discussed later in this section.

Table 4.2-18. GMT2 Project Alternative A prevention of significant deterioration increments for Class II Areas

Pollutant	Average Time	Nuiqsut Receptor	Class II Increment
NO_2	Annual	8.61 μg/m^3	25 μg/m^3
SO_2	3-hour	3.54 μg/m^3	512 μg/m^3
SO_2	24-hour	1.23 μg/m^3	91 μg/m^3
SO_2	Annual	0.087 μg/m^3	20 μg/m^3
PM_{10}	24-hour	1.41 μg/m^3	30 μg/m^3
$PM_{2.5}$	24-hour	3.16 μg/m^3	9 μg/m^3
$PM_{2.5}$	Annual	0.026 μg/m^3	4 μg/m^3

There is also a prevention of significant deterioration increment for annual PM_{10} of 17 μg/m^3. Since the short-term impact at the Nuiqsut receptor for 24-hour PM_{10} is also below the annual increment, it can also be concluded the annual increment for PM_{10} will model below its increment.

Table 4.2-19a. GMT2 Project Alternative A near-field hazardous air pollutant impacts summary (μg/m^3)

Hazardous Air Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	Threshold Level
Benzene	1-hour	64.07	54.09	47.34	64.07	1,300
Benzene	Annual	0.33	1.29	0.99	1.29	30
Toluene	1-hour	61.94	48.26	53.24	61.94	37,000
Toluene	Annual	0.32	0.99	0.64	0.99	5,000
Ethylbenzene	1-hour	13.49	9.33	17.01	17.01	350,000
Ethylbenzene	Annual	0.064	0.19	0.18	0.19	1,000
Xylenes	1-hour	56.25	40.12	27.78	56.25	22,000
Xylenes	Annual	0.27	0.81	0.55	0.81	100
n-Hexane	1-hour	6.74	65.59	1,335	1,335	390,000
n-Hexane	Annual	0.035	0.31	3.54	3.54	700
Formaldehyde	1-hour	10.29	10.39	1.17	10.39	55
Formaldehyde	Annual	0.24	0.30	0.046	0.30	9.8
Cancer Risk at Nuiqsut Receptor	-	8.5E-09	1.2E-08	3.0E-09	1.2E-08	1.0E-06

Table 4.2-19b. GMT2 Project Alternative A Near Field Hazardous Air Pollutant Impacts Summary at the Nuiqsut Community Receptor (μg/m^3)

Hazardous Air Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	Threshold Level
Benzene	1-hour	1.43	1.02	0.95	1.43	1,300
Benzene	Annual	0.0015	0.0024	0.00078	0.0024	30
Toluene	1-hour	1.38	0.91	1.07	1.38	37,000
Toluene	Annual	0.0015	0.0018	0.00050	0.0018	5,000
Ethylbenzene	1-hour	0.30	0.18	0.34	0.34	350,000
Ethylbenzene	Annual	0.00030	0.00034	0.00014	0.00034	1,000
Xylenes	1-hour	1.25	0.76	0.56	1.25	22,000
Xylenes	Annual	0.0013	0.0015	0.00043	0.0015	100
n-Hexane	1-hour	0.15	1.24	26.8	26.8	390,000
n-Hexane	Annual	0.00016	0.00058	0.0028	0.0028	700
Formaldehyde	1-hour	0.30	0.12	0.024	0.30	55
Formaldehyde	Annual	0.00054	0.00056	0.000040	0.00056	9.8
Cancer Risk	-	8.5E-09	1.2E-08	3.0E-09	1.2E-08	1.0E-06

The maximum 1-hour and annual hazardous air pollutant impacts for GMT2 Alternative A are considerably lower than their respective reference exposure limits and reference concentrations for chronic inhalation. For all hazardous air pollutants, except formaldehyde, a conservative unitized run was conducted, as described in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d). Based on the near-field modeling, the sum of the cancer risks of benzene, ethylbenzene, and formaldehyde based on the methodology discussed above (i.e., the potential cancer risk) at the Nuiqsut community was determined to be considerably below the minimum cancer risk threshold of 1 in 1 million (EPA 2006).

Far-field air quality modeling was conducted for Alternative A, because it is ConocoPhillips' proposed action alternative. To calculate the worst-case emissions scenario for CALPUFF modeling, for each year of the life of the project, emissions were estimated for each of the activity categories (e.g. Construction, Development Drilling, etc.) and the year with highest total emissions for each pollutant was selected. The highest emitting activity category for the worst-case emissions scenario for most pollutants was developmental drilling, but other emitting activities were occurring simultaneously. For Alternative A, the highest $PM_{2.5}$ emissions were due to construction. A detailed description of emission rates used in the CALPUFF National Ambient Air Quality Standards modeling to estimate project impacts is provided in the far-field air quality impacts analysis (Ramboll Environ and Kleinfelder 2017).

Table 4.2-20 and Table 4.2-21 summarize the predicted GMT2 Project-specific maximum concentrations for Alternative A at the Arctic National Wildlife Refuge and the Gates of the Arctic National Park, respectively. The tables indicate predicted concentrations are all less than 50 percent of the relevant National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and increments.

Table 4.2-20. GMT2 Project Alternative A air quality impacts at the Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	Over Increment?	Ambient Back-ground ($\mu g/m^3$)	Total Concen-tration ($\mu g/m^3$)	NAAQS/ AAAQS ($\mu g/m^3$)
NO_2	1-hour	0.151	--	--	41.9	42.1	188
NO_2	Annual	0.00171	25	No	3.8	3.8	100
SO_2	1-hour	0.0014	--	--	5.9	5.9	196
SO_2	3-hour	0.0011	512	No	6.2	6.2	1,300
SO_2	24-hour	4.00E-04	91	No	4.8	4.8	365
SO_2	Annual	1.68E-05	20	No	0.003	0.003	80
PM_{10}	24-hour	0.0612	30	No	45.2	45.3	150
$PM_{2.5}$	24-hour	0.0185	9	No	7.3	7.3	35
$PM_{2.5}$	Annual	8.00E-04	4	No	2.1	2.1	12

Table 4.2-21. GMT2 Project Alternative A air quality impacts at Gates of the Arctic National Park and Preserve

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	Over Increment?	Ambient Back-ground ($\mu g/m^3$)	Total Concen-tration ($\mu g/m^3$)	NAAQS/ AAAQS ($\mu g/m^3$)
NO_2	1-hour	0.0385	--	--	41.9	41.9	188
NO_2	Annual	8.34E-04	25	No	3.8	3.8	100
SO_2	1-hour	4.00E-04	--	--	5.9	5.9	196
SO_2	3-hour	4.00E-04	512	No	6.2	6.2	1,300
SO_2	24-hour	2.00E-04	91	No	4.8	4.8	365
SO_2	Annual	8.26E-06	20	No	0.003	0.003	80
PM_{10}	24-hour	0.03	30	No	45.2	45.2	150
$PM_{2.5}$	24-hour	0.009	9	No	7.3	7.3	35
$PM_{2.5}$	Annual	4.00E-04	4	No	2.1	2.1	12

The deposition analysis results are shown in Table 4.2-22 and indicate that GMT2 Project-specific maximum nitrogen and sulfur deposition fluxes are well below the deposition analysis threshold in both sensitive Class II areas.

Table 4.2-22. GMT2 Project Alternative A deposition impacts

Class II Area	Pollutant	Averaging Period	Maximum Impact (kg/ha-yr)	Deposition Analysis Threshold (kg/ha-yr)	% of Deposition Analysis Threshold	Meteorological Year of Maximum Impact
Arctic National Wildlife Refuge	Nitrogen	Annual	0.0001	0.005	2	2012
Gates of the Arctic National Park and Preserve	Nitrogen	Annual	0.0001	0.005	2	2010
Arctic National Wildlife Refuge	Sulfur	Annual	3.90E-06	0.005	0.076	2012
Gates of the Arctic National Park and Preserve	Sulfur	Annual	2.00E-06	0.005	0.04	2010

Table 4.2-23 summarizes the predicted change in visibility at each sensitive Class II area for each modeled year. As indicated in Table 4.2-23, the highest 98th percentile change in delta-deciviews is well below the 0.5 Δdv threshold for project-specific impacts established by the Federal Land Managers for each year. Thus, GMT2 Project impacts on visibility at the two Class II areas would be minimal in Alternative A.

Table 4.2-23. GMT2 Project Alternative A visibility impacts

Class II Area	Days Exceed-ing 1.0 Δdv	Days Exceed-ing 0.5 Δdv	98th Percentile Δdv 2009	98th Percentile Δdv 2010	98th Percentile Δdv 2011	98th Percentile Δdv 2012	98th Percentile Δdv 2013
Arctic National Wildlife Refuge	0	0	0.054	0.045	0.052	0.039	0.034
Gates of the Arctic National Park and Preserve	0	0	0.030	0.022	0.024	0.022	0.023

Alternative B

The GMT2 Project Alternative B completed an emissions inventory based on alternative specifics (Kleinfelder and Ramboll Environ 2017b). From the emissions inventory, and comparison of Alternative B to Alternative A, it was determined that near-field and far-field modeling analyses were not required for Alternative B, as the impacts analysis from Alternative A would be representative of the impacts of Alternative B.

Alternative B differs from Alternative A only in the GMT2 to GMT1 gravel access road and pipeline alignment and length. The access road and pipeline in Alternative B would be longer than in Alternative A. From an air emission perspective, this difference translates to slightly more emissions from construction activities for Alternative B, as detailed below and at the end of this section (Table 4.2-39). Drilling and operation emissions would be the same between the two alternatives except for increased emissions from truck traffic on the longer Alternative B access road (Table 4.2-40 through Table 4.2-41). Therefore, due to the similarity in emissions between Alternative A and Alternative B, the Alternative B near-field and far-field impacts for the GMT2 Project are expected to be similar to those of Alternative A.

Emission Inventory

Considering the similarities between Alternative B and Alternative A, a letter was prepared outlining the differences between the two alternatives and how that resulted in emission differences (Kleinfelder and Ramboll Environ 2017b). As mentioned, Alternative B has a larger gravel access road and pipeline length that follows the watershed boundary to the south. The letter for the emissions inventory for Alternative B details that truck traffic and fugitive dust emissions related to travel and construction are expected to be higher in Alternative B compared to Alternative A. The Alternative B project year totals for each of the criteria pollutants (NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_2) and speciated hazardous air pollutant (benzene, toluene, ethylbenzene, xylenes, n-Hexane, and formaldehyde) emissions are presented in Table 4.2-24 (Kleinfelder and Ramboll Environ 2017b). The table also details the month with the highest emissions of the specified pollutant.

Table 4.2-24. GMT2 Project Alternative B criteria and hazardous air pollutant emissions summary

GMT2 Project Alternative B	Year 1	Year 2	Year 3	Year 4–10	Year 11 on	Maximum Month of Emissions[a]
NO_x (tons per year)	13.0	93.3	121.0	87.2	8.9	Year 2 Month 2
CO (tons per year)	5.3	47.1	78.3	64.4	7.1	Year 2 Month 2
VOC (tons per year)	1.6	15.5	21.0	16.4	8.1	Year 2 Month 2
PM_{10} (tons per year)	0.77	212.0	119.0	62.4	6.2	Year 2 Month 7
$PM_{2.5}$ (tons per year)	0.60	25.9	18.2	11.0	1.2	Year 2 Month 7
SO_2 (tons per year)	0.02	0.20	0.34	0.46	0.21	Year 3 Month 12
Benzene (tons per year)	0.02	0.19	0.16	0.07	0.008	Year 2 Month 2
Toluene (tons per year)	0.02	0.19	0.13	0.04	0.01	Year 2 Month 2
Ethylbenzene (tons per year)	0.005	0.04	0.02	0.01	0.01	Year 2 Month 2
Xylenes (tons per year)	0.02	0.16	0.10	0.04	0.02	Year 2 Month 2
n-Hexane (tons per year)	0.004	0.02	0.04	0.23	0.23	Year 3 Month 12
Formaldehyde (tons per year)	0.19	1.5	1.0	0.22	0.03	Year 2 Month 2

[a] Year 3 Month 6 is not the maximum month of emissions for NO_x, CO, and VOC and Year 4 Month 6 is not the maximum month of emission for SO_2. Well interventions were conservatively assumed to occur in the span of 1 month for purposes of the emission inventory and to avoid underestimating short-term emissions for the modeling (Kleinfelder and Ramboll Environ 2017b).

Alternative B emission totals for criteria and hazardous air pollutants are slightly higher than that of Alternative A. The construction phase, while having high short-term emissions, are temporary and do not translate to the consistent, permanent emissions from the routine operations beginning in Year 4. Maximum annual emissions would occur during the construction and drilling phases (Years 2 and 3), and once construction and drilling are complete and emissions are from routine operations alone (Year 11 on), emissions are approximately 10 times less.

Impacts Analysis

An impacts analysis for Alternative B was not conducted because it was determined that the potential impacts in the near-field and far-field for Alternative A would be representative of Alternative B. As shown in the final emissions reports (Kleinfelder and Ramboll Environ 2017a, 2017b) and in Tables 4.2-19 and 4.2-24, emissions between Alternative A and B are slightly higher in Alternative B due to increased construction, road mileage, and pipeline length as detailed in Section 2.6. Also, the pad size and road alignment nearest the GMT2 Pad is the same between the two alternatives; therefore, emission source locations are also similar. The sources on the GMT2 Pad in Alternatives A and B are the same and the differences exist for pipeline construction due to the longer pipeline length, road construction due to the longer road length, and truck traffic from travelling on a longer road. While overall higher emissions from truck traffic and road construction would result from the longer road and higher emissions would result from pipeline construction from the longer pipeline, the emissions per road segment, per pipeline segment, or emissions per mile, would be the same as the equipment or trucks used in Alternative A would be the same for Alternative B. The size of the GMT2 Pad and the road access is the same between the two alternatives, and the highest project impacts occur near or on the fenceline of the GMT2 Pad. Therefore, with the similarities between Alternative A and B in emission source location and emissions per mile (either road or pipeline), Alternative B was not modeled as enough similarities exist between Alternative A and B that impacts would also be similar.

Alternative C

The GMT2 Project Alternative C completed an emissions inventory based on the project parameters detailed in Chapter 2, Section 2.7 of this document. Enough differences exist between Alternative A and Alternative C that a separate report was created (Kleinfelder and Ramboll Environ 2017c) detailing the additional emission sources not covered in the Alternative A report. Considering these differences, it was determined that near field and far field modeling analyses would be required for Alternative C.

Alternative C differs from Alternative A in that Alternative C would not have a GMT2 to GMT1 Access Road, but would rather have an airstrip and support pad near the proposed GMT2 drill pad. A short access road would connect the proposed GMT2 Drill pad and airstrip and support pad. Pad construction emissions would increase due to the extra support pad and air strip in Alternative C; however, the access road construction emissions would decrease in Alternative C. While emissions from drilling and well intervention engines and heaters will be the same in Alternatives C and A, the emissions from operations that support drilling and well intervention will vary between the two alternatives. The most prominent difference stems from Alternative C having limited offsite access resulting in increased onsite aircraft and truck traffic during drilling and well intervention phases due to the onsite airstrip and higher onsite truck mileage. Lastly, emissions from routine operations will vary between Alternatives A and C because Alternative C will have a greater amount of activity occurring at the GMT2 drill and support pads rather than remotely as in Alternative A.

Emission Inventory

A detailed report was prepared describing the additional calculation methodologies, assumptions, and data sources for the Alternative C emission inventory (Kleinfelder and Ramboll Environ 2017c). A majority of the same sources exist between Alternative A and Alternative C; however, the level of activity varied. The additional emission sources in Alternative C include a waste incinerator at the occupied structure pad for onsite waste processing, an emergency generator at the occupied structure pad for additional backup power generation, and onsite aircraft activity from the GMT2 airstrip. Since Alternative C would require more onsite activities, truck traffic from other locations would be limited.

Similar to Alternative A, the same basic equipment was assumed for Alternative C, but was scaled as necessary based on the alternative specific data. Alternative C will have a larger gravel pad along with additional construction for the airstrip and occupied structure pad, so the equipment for pad construction was scaled based on the acreage between the two alternatives. In general, emissions for the additional Alternative C sources were determined using published emission factors, information from Chapter 2 of this document, and equipment specifics found in GMT1 for their Alternative D1 (BLM 2013), unless updated based on information from ConocoPhillips for GMT2. The Alternative C project year totals for each of the criteria pollutants (NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_2) and speciated hazardous air pollutant (benzene, toluene, ethylbenzene, xylenes, n-Hexane, and formaldehyde) emissions are presented in Table 4.2-25 (Kleinfelder and Ramboll Environ 2017c). The table also details the month with the highest emissions of the specified pollutant.

Table 4.2-25. GMT2 Project Alternative C criteria and hazardous air pollutant emissions summary

GMT2 Project Alternative C	Year 1	Year 2	Year 3	Year 4–10	Year 11 on	Maximum Month of Emissions[a]
NO_x (tons per year)	13.2	104.0	145.0	97.6	17.6	Year 2 Month 4
CO (tons per year)	5.4	54.8	123.0	109.0	17.0	Year 3 Month 5
VOC (tons per year)	1.7	18.3	27.3	22.1	11.2	Year 2 Month 4
PM_{10} (tons per year)	0.82	290.0	74.4	57.9	26.9	Year 2 Month 8
$PM_{2.5}$ (tons per year)	0.62	34.7	18.0	14.7	7.1	Year 2 Month 8
SO_2 (tons per year)	0.02	0.22	0.66	0.79	0.31	Year 3 Month 8
Benzene (tons per year)	0.02	0.21	0.27	0.13	0.02	Year 2 Month 4
Toluene (tons per year)	0.02	0.20	0.20	0.08	0.02	Year 2 Month 4
Ethylbenzene (tons per year)	0.006	0.04	0.04	0.02	0.01	Year 2 Month 4
Xylenes (tons per year)	0.02	0.17	0.16	0.06	0.03	Year 2 Month 4
n-Hexane (tons per year)	0.004	0.02	0.05	0.18	0.18	Year 4 Month 6
Formaldehyde (tons per year)	0.20	1.67	1.83	0.71	0.12	Year 2 Month 4

[a] Year 3 Month 6 is not the maximum month of emissions for NO_x, CO, VOC, and SO_2. Well interventions were conservatively assumed to occur in the span of 1 month for purposes of the emission inventory and to avoid underestimating short-term emissions for the modeling (Kleinfelder and Ramboll Environ 2017c).

Both the construction and drilling phases, while having high short-term emissions, are temporary and do not translate to the consistent, permanent emissions from the routine operations beginning in Year 4. Maximum annual emissions would occur during the construction and drilling phases (Years 2 and 3), and are higher than Alternative A totals for the same year and pollutants. Emissions are from routine operations alone (Year 11 on), emissions are approximately 8 times less.

Impacts Analysis

Alternative C was explicitly modeled as operations and construction differ from Alternative A due to the extra support pad and airstrip. Alternative C is the only alternative with an onsite airstrip; therefore, onsite aircraft emissions were modeled for Alternative C only. Also, due to the location of emission sources and the fact that there are additional Alternative C emission sources and construction activities compared to Alternative A, Alternative C was modeled.

The methodology briefly described at the beginning of this section, and detailed in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d) was followed using AERMOD to compare GMT2 Project Alternative C impacts to the applicable National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards for criteria pollutants and reference exposure limits and reference concentrations for chronic inhalation for hazardous air pollutants. The results of the near-field modeling for Alternative C are presented in Table 4.2-26 for criteria pollutants and Table 4.2-28 for hazardous air pollutants below. The results shown include potential impacts from Alternative C operations, ambient background concentrations, and impacts from cumulative sources.

Table 4.2-26a. GMT2 Project Alternative C near-field criteria pollutants impacts summary (μg/m³)

Criteria Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	NAAQS/ AAAQS	Percent of Standard
CO	1-hour	1,497	1,772	1,651	1,772	40,000	4%
CO	8-hour	1,315	1,458	1,503	1,503	10,000	15%
NO_2	1-hour	161.9	170.5	179.0	179.0	188	95%
NO_2	Annual	25.3	34.7	37.4	37.4	100	37%
SO_2	1-hour	48.1	48.1	48.1	48.1	196	25%
SO_2	3-hour	88.3	88.3	88.3	88.3	1,300	7%
SO_2	24-hour	36.2	36.2	36.2	36.2	365	10%
SO_2	Annual	0.75	0.75	0.75	0.75	80	1%
PM_{10}	24-hour	91.7	122.8	129.8	129.8	150	87%
$PM_{2.5}$	24-hour	25.9	25.9	25.9	25.9	35	74%
$PM_{2.5}$	Annual	3.4	4.6	5.1	5.1	12	42%

Table 4.2-26b. GMT2 Project Alternative C Near Field Criteria Pollutants Impacts Summary at the Nuiqsut Community Receptor (μg/m³)

Criteria Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	NAAQS/ AAAQS	Percent of Standard
CO	1-hour	1,241	1,240	1,238	1,241	40,000	3%
CO	8-hour	1,231	1,232	1,231	1,232	10,000	12%
NO_2	1-hour	63.6	63.6	63.6	63.6	188	34%
NO_2	Annual	17.3	17.3	17.3	17.3	100	17%
SO_2	1-hour	10.9	10.9	10.9	10.9	196	6%
SO_2	3-hour	9.74	9.74	9.74	9.74	1,300	1%
SO_2	24-hour	6.03	6.03	6.03	6.03	365	2%
SO_2	Annual	0.090	0.090	0.090	0.090	80	0.1%
PM_{10}	24-hour	41.3	41.3	41.3	41.3	150	28%
$PM_{2.5}$	24-hour	10.5	10.5	10.5	10.5	35	30%
$PM_{2.5}$	Annual	2.13	2.13	2.13	2.13	12	18%

For each of the criteria pollutant models, the GMT2 Project impacts including background concentrations are less than their respective National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards. The potential impacts at the Nuiqsut community modeled below 36 percent of their respective increments. As detailed in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d), a number of conservative assumptions were used in these models including a dust control efficiency of 50 percent for watering of gravel pads and roads where GMT1 used 75 percent for some dust control efficiencies via watering (AECOM 2013). Also, it was assumed that drilling, construction, and well interventions would all occur during the same 1-hour period for short-term impacts where the likelihood of that occurring is minimal for safety and practical purposes. Lastly, a conservative assumption worked into the near-field model was monthly averages for vehicle truck traffic where it is known vehicle traffic will vary month to month especially during construction where activities are not evenly spread. Best management practices for dust control are discussed later in this section.

The prevention of significant deterioration increments for Class II areas are shown in Table 4.2-27 below along with the modeled impacts for GMT2 Alternative C's infill drilling scenario. The infill drilling scenario was used for a comparison for prevention of significant deterioration increments, because it is the only modeling scenario that includes regular routine operation emissions and would be conservative because it also includes temporary emissions from drilling and well interventions.

Table 4.2-27. GMT2 Project Alternative C prevention of significant deterioration increments for Class II Areas

Pollutant	Average Time	Nuiqsut Receptor	Class II Increment
NO_2	Annual	8.65 µg/m^3	25 µg/m^3
SO_2	3-hour	3.54 µg/m^3	512 µg/m^3
SO_2	24-hour	1.23 µg/m^3	91 µg/m^3
SO_2	Annual	0.087 µg/m^3	20 µg/m^3
PM_{10}	24-hour	1.35 µg/m^3	30 µg/m^3
$PM_{2.5}$	24-hour	3.16 µg/m^3	9 µg/m^3
$PM_{2.5}$	Annual	0.027 µg/m^3	4 µg/m^3

There is also a prevention of significant deterioration increment for annual PM10 of 17 µg/m3. Since the short-term impact at the Nuiqsut receptor for 24-hour PM10 is also below the annual increment, it can also be concluded the annual increment for PM10 will model below its increment.

Table 4.2-28a. GMT2 Project Alternative C near-field hazardous air pollutant impacts summary (µg/m^3)

Hazardous Air Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	Threshold Level
Benzene	1-hour	86.33	410.3	107.7	410.3	1,300
Benzene	Annual	0.73	1.37	1.74	1.74	30
Toluene	1-hour	83.39	222.5	112.3	222.5	37,000
Toluene	Annual	0.69	1.00	0.98	1.00	5,000
Ethylbenzene	1-hour	16.36	50.39	57.02	57.02	350,000
Ethylbenzene	Annual	0.14	0.21	0.26	0.26	1,000
Xylenes	1-hour	75.49	54.30	101.0	101.0	22,000
Xylenes	Annual	0.59	0.82	0.80	0.82	100
n-Hexane	1-hour	9.11	29.76	1,642	1,642	390,000
n-Hexane	Annual	0.075	0.28	2.37	2.37	700
Formaldehyde	1-hour	25.40	12.06	2.29	25.40	55
Formaldehyde	Annual	0.23	0.32	0.051	0.32	9.8
Cancer Risk at Nuiqsut Receptor	-	7.6E-09	1.6E-08	7.2E-09	1.6E-08	1.0E-06

Table 4.2-28b. GMT2 Project Alternative C Near Field Hazardous Air Pollutant Impacts Summary at the Nuiqsut Community Receptor (μg/m³)

Hazardous Air Pollutant	Averaging Period	Construction	Developmental Drilling	Infill Drilling	Maximum Scenario	Threshold Level
Benzene	1-hour	3.84	7.71	3.30	7.71	1,300
Benzene	Annual	0.0013	0.0035	0.0018	0.0035	30
Toluene	1-hour	3.71	4.18	3.44	4.18	37,000
Toluene	Annual	0.0013	0.0026	0.00099	0.0026	5,000
Ethylbenzene	1-hour	0.73	0.95	1.75	1.75	350,000
Ethylbenzene	Annual	0.00025	0.00053	0.00027	0.00053	1,000
Xylenes	1-hour	3.36	1.02	3.09	3.36	22,000
Xylenes	Annual	0.0011	0.0021	0.00081	0.0021	100
n-Hexane	1-hour	0.41	0.56	50.3	50.3	390,000
n-Hexane	Annual	0.00014	0.00072	0.0024	0.0024	700
Formaldehyde	1-hour	1.44	0.30	0.061	1.44	55
Formaldehyde	Annual	0.00050	0.00070	0.00018	0.00070	9.8
Cancer Risk	-	7.6E-09	1.6E-08	7.2E-09	1.6E-08	1.0E-06

The maximum 1-hour and annual hazardous air pollutant impacts for GMT2 Alternative C are considerably lower than their respective reference exposure limits and reference concentrations for chronic inhalation. For all hazardous air pollutants, except formaldehyde, a conservative unitized run was conducted, as described in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d). Based on the near-field modeling, the sum of the cancer risks of benzene, ethylbenzene, and formaldehyde based on the methodology discussed above (i.e., the potential cancer risk) at the Nuiqsut receptor was also determined to be considerably below the cancer risk threshold of 1 in 1 million (EPA 2006).

Far-field air quality modeling was conducted for GMT2 Alternative C, the roadless alternative. Alternative C was explicitly modeled because operations and construction differ from Alternative A due to the extra support pad and airstrip resulting in different air emissions. To calculate the worst-case emissions scenario for CALPUFF modeling, for each year of the life of the project, emissions were estimated for each of the activity categories (e.g. construction, development drilling, etc.) and the year with highest total emissions for each pollutant was selected. The highest emitting activity category for the worst-case emissions scenario for most pollutants was developmental drilling, but other emitting activities were occurring simultaneously. For Alternative C, the highest PM_{10} emissions were due to infill drilling. A summary of emission rates used in the CALPUFF National Ambient Air Quality Standards modeling to estimate project impacts is provided in the far-field air quality impacts analysis (Ramboll Environ and Kleinfelder 2017).

Table 4.2-29 and Table 4.2-30 summarize the predicted maximum concentrations for Alternative C at Arctic National Wildlife Refuge and Gates of the Arctic National Park and Preserve, respectively. The modeling results indicate that predicted concentrations are all less than 50 percent of the relevant National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and increments.

Table 4.2-29. GMT2 Project Alternative C air quality impacts at the Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m3)	Class II Increment (µg/m3)	Over Increment?	Ambient Back-ground (µg/m3)	Total Concentration (µg/m3)	NAAQS/ AAAQS (µg/m3)
NO_2	1-hour	0.218	--	--	41.9	42.1	188
NO_2	Annual	0.00247	25	No	3.8	3.8	100
SO_2	1-hour	0.0018	--	--	5.9	5.9	196
SO_2	3-hour	0.0014	512	No	6.2	6.2	1,300
SO_2	24-hour	5.00E-04	91	No	4.8	4.8	365
SO_2	Annual	2.57E-05	20	No	0.003	0.003	80
PM_{10}	24-hour	0.0446	30	No	45.2	45.3	150
$PM_{2.5}$	24-hour	0.0127	9	No	7.3	7.3	35
$PM_{2.5}$	Annual	8.00E-04	4	No	2.1	2.1	12

Table 4.2-30. GMT2 Project Alternative C air quality impacts at Gates of the Arctic National Park and Preserve

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Class II Increment (µg/m^3)	Over Increment?	Ambient Back-ground (µg/m^3)	Total Concentration (µg/m^3)	NAAQS/ AAAQS (µg/m^3)
NO_2	1-hour	0.0556	--	--	41.9	41.9	188
NO_2	Annual	0.00121	25	No	3.8	3.8	100
SO_2	1-hour	5.00E-04	--	--	5.9	5.9	196
SO_2	3-hour	5.00E-04	512	No	6.2	6.2	1,300
SO_2	24-hour	3.00E-04	91	No	4.8	4.8	365
SO_2	Annual	1.26E-05	20	No	0.003	0.003	80
PM_{10}	24-hour	0.0222	30	No	45.2	45.2	150
$PM_{2.5}$	24-hour	0.0062	9	No	7.3	7.3	35
$PM_{2.5}$	Annual	0.0003	4	No	2.1	2.1	12

The deposition analysis results are shown in Table 4.2-31. CALPUFF-predicted maximum nitrogen and sulfur deposition fluxes are well below the deposition analysis threshold at both sensitive Class II areas.

Table 4.2-31. GMT2 Project Alternative C deposition impacts

Class II Area	Pollutant	Averaging Period	Maximum Impact (kg/ha-yr)	Deposition Analysis Threshold (kg/ha-yr)	% of Deposition Analysis Threshold	Meteorological Year of Maximum Impact
Arctic National Wildlife Refuge	Nitrogen	Annual	0.0001	0.005	2	2012
Gates of the Arctic National Park and Preserve	Nitrogen	Annual	0.0001	0.005	2	2010
Arctic National Wildlife Refuge	Sulfur	Annual	6.60E-06	0.005	0.142	2012
Gates of the Arctic National Park and Preserve	Sulfur	Annual	3.20E-06	0.005	0.074	2010

Table 4.2-32 summarizes the 98^{th} percentile predicted change in visibility at each sensitive Class II area for each modeled year. As shown, the highest 98^{th} percentile change in extinction is well below the 0.5 Δdv (~5 percent threshold) established by the Federal Land Managers for each year. Thus, GMT2 Project impacts on visibility at the two Class II areas would be minimal in Alternative C.

Table 4.2-32. GMT2 Project Alternative C visibility impacts

Class II Area	Days Exceeding 1.0 Δdv	Days Exceeding 0.5 Δdv	98th Percentile Δdv 2009	98th Percentile Δdv 2010	98th Percentile Δdv 2011	98th Percentile Δdv 2012	98th Percentile Δdv 2013
Arctic National Wildlife Refuge	0	0	0.077	0.064	0.074	0.057	0.050
Gates of the Arctic National Park and Preserve	0	0	0.043	0.033	0.035	0.031	0.031

Alternative D

Alternative D is the no-action alternative and no pollutant air emissions would occur from the GMT2 Project. Therefore, an emission inventory and subsequent near-field and far-field modeling were not completed for GMT2 Alternative D. No air quality impacts are expected in the No Action Alternative.

Ozone and Secondary $PM_{2.5}$

Review of the ozone hourly data at the Nuiqsut Monitoring Station shows that of the past 3 years for which data were available, the maximum 1-hour value for O_3 was 57 ppb, which is 81 percent of the current National Ambient Air Quality Standards (SLR International Corporation 2015, 2016, 2017). Therefore, these data are in agreement with the USEPA's designation that the GMT2 Project area is an attainment area for O_3. The Alaskan North Slope has minimal O_3 diurnal variation, and only slight increases in O_3 have occurred at the Barrow Monitoring Station indicating that Alaskan North Slope regional O_3 is not highly sensitive to local increases in ozone precursor emissions of NO_x and VOCs. The GMT2 Project will increase O_3 precursor emissions; however, emissions from the GMT2 Project and other reasonable foreseeable developments are also not expected to meaningfully change regional O_3 levels. A detailed discussion in existing ozone background and potential GMT2 Project impacts on regional O_3 is found in the near-field GMT2 air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d).

Secondary formation of $PM_{2.5}$ impacts are not in the same place and at the same time as primary $PM_{2.5}$ impacts, as secondary $PM_{2.5}$ impacts usually occur at a later time and at greater distances from the source than primary impacts because of the time required for complex chemical reactions to occur in the atmosphere. Accordingly, secondary $PM_{2.5}$ impacts are much less than primary impacts. As detailed in Tables 4.2-17 and 4.2-27 for the near-field and Tables 4.2-22, 4.2-23, 4.2-31, and 4.2-32 for the far-field, all $PM_{2.5}$ standards in all modeling scenarios are less than the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards under Alternative A and Alternative C. Since Alternative A impacts results are representative of Alternative B, it can also be concluded that Alternative B impacts are also below the $PM_{2.5}$ standards. Currently, all areas in the Alaskan North Slope are in attainment for $PM_{2.5}$. Therefore, secondary $PM_{2.5}$ impacts will be less than primary impacts that are not modeled to exceed current thresholds. NO_x is also a known precursor for secondary $PM_{2.5}$. EPA notes that in the Alaskan North Slope, actual NO_x emissions from facilities near Deadhorse are on the order of magnitude of 65,000 tons per year and yet primary and secondary $PM_{2.5}$ concentrations are low (AECOM 2013). Since the total of GMT2 Project onsite project sources, offsite project sources, and non-project cumulative sources will result in NO_x emissions well below 65,000 tons per year, it can be concluded that the GMT2 Project will also have minimal, if any, impacts on secondary $PM_{2.5}$ formation. A detailed discussion in existing $PM_{2.5}$ background and potential GMT2 Project impacts on secondary $PM_{2.5}$ formation is found in the near-field air quality impacts analysis (Kleinfelder and Ramboll Environ 2017d).

Best Management Practices and Best Available Control Technology

Best management practices and best available control technology will be implemented by ConocoPhillips for GMT2 construction, drilling, and routine operations in order to reduce project-related emissions and therefore impacts on the GMT2 Project area. Below are a list of best management practices and best available control technology that are proven emission reduction strategies and technologies that should be evaluated by ConocoPhillips.

Best Management Practices

- **Electrification:** Under all GMT2 Alternatives, it is expected that grid power will be available for electric support at the GMT2 drill pad. The onsite pad generator is expected to be used for emergency purposes only when grid power is not available. Powerlines will be installed between GMT2 and nearby power generation facilities and should be relied upon in place of fossil-fuel combustion equipment. Electrification of the GMT2 pad will result in no onsite emissions and therefore less onsite impacts.
- **Use of alternative fuels:** As part of the emissions inventories for Alternatives A, B, and C, diesel-fired equipment and trucks were assumed except for the natural gas-fired heater used for routine operations. As a minimum, ultra-low sulfur diesel will be used for any and all diesel-fired equipment. Natural gas and gasoline generally results in lower emissions for criteria, hazardous air pollutant, and greenhouse gas emissions. Alternative fuel usage will be evaluated as technology becomes available in accordance with Supplemental BMP 1: Air Quality of the GMT1 Record of Decision (BLM 2015). Natural gas, gasoline, and other fuel mixtures producing less CO_2, SO_2 and PM will be incorporated if and when practicable.
- **Leak detection and repair:** For federal compliance and as a best management practice, ConocoPhillips shall implement a leak detection and repair program in order to conduct preventative maintenance. Using either a Method 21 instrument such as a photo ionization detector or flame ionization detector or an optical gas imaging instrument such as a FLIR camera, inspections shall be conducted on a regular schedule to identify leaks and the need for repairs. As an additional measure of preventative maintenance, there should also be regular auditory, visual, and olfactory inspections. These preventative maintenance procedures will reduce the potential for hydrocarbon emissions such as VOC, hazardous air pollutants, and CH_4.
- **Fugitive dust control, watering:** It is expected that the GMT2 pad and road under Alternatives A, B, and C, and ancillary pads under Alternative C, will undergo regular watering to reduce fugitive dust emissions and impacts. Other fugitive dust control options include avoiding construction during high wind events, use of chemical suppressant on the pads and dirt road, and covering of stockpiled material. Fugitive dust generally occurs during the months of June through September when the ground is not frozen; however, depending on climate and meteorology, watering may be required beyond those months. Per the 2004 Alpine Satellite Development Project Record of Decision, ConocoPhillips must implement a plan approved by the authorized officer for limiting fugitive dust (BLM 2004).
- **Fugitive dust control, enforce speed limits on gravel pad and roads:** To reduce fugitive dust pluming from truck traffic on the GMT2 pad and access road, there should be a speed limit. ConocoPhillips should post signs noting the maximum speed allowable on the access road and on the GMT2 Pad. As part of the emissions inventory, an access road speed of 20 mph and an onsite speed of 5 mph was assumed as a conservative estimate for fugitive dust emissions; therefore, vehicle speeds should not exceed these limits. Higher speeds would result in excess dust in the atmosphere.

- **Continuous monitoring systems:** To get real-time and site-specific data, ConocoPhillips should implement a telemetry monitoring system to provide effective management of production exceptions, while reducing the number of vehicle trips and miles traveled. In addition to the current ConocoPhillips-operated Nuiqsut Monitoring Station, other monitoring systems include supervisory control and data acquisition to monitor for malfunctioning equipment and production exceptions. These types of continuous monitoring systems would reduce the need for regular site inspections, reducing onsite truck traffic, and would alert field personnel of emission exception events in real-time therefore reducing emissions to the atmosphere that otherwise would have gone unnoticed.
- **Air quality monitoring:** Due to the concern over ambient air in the GMT2 Project area and near Nuiqsut, and in line with the NPR-A Final Record of Decision BMP A-10 (BLM 2013a) to reduce unnecessary and undue degradation of the land and protect health, additional air quality monitoring should be considered so as to receive site-specific data on or near the GMT2 pad. Currently, the Nuiqsut Monitoring Station operated by ConocoPhillips has been used as a best management practice, and future review and oversight by BLM and other agencies over the monitoring data should continue.

Best Available Control Technology

- **Tier 4 engines:** When possible, the use of Tier 4 diesel engines instead of Tier 2 or Tier 3 engines should be operated in the field for drill rigs, completion rigs, generators, and other diesel-fired engines. For the emission inventories for Alternative A, B, and C, Tier 2 standards were assumed for all diesel-fired engines except for the routine operations emergency generator which was noted by ConocoPhillips to be a Tier 4 unit. Tier 4 engines have lower emission standards for NO_x and PM, therefore resulting in less impacts from those pollutants.
- **Selective and non-selective catalytic reduction devices:** For engines, heaters, and other combustion devices, selective and non-selective catalytic reduction devices should be used to reduce criteria and hazardous air pollutant emissions such as NO_x, CO, VOC, and formaldehyde, when feasible. Some selective catalytic reduction devices inject ammonia into the exhaust to reduce NO_x emissions; however, these types of devices should be avoided to prevent ammonia emissions.
- **Flaring or closed-loop systems:** CH_4, a greenhouse gas, is the primary constituent of natural gas. Instead of venting natural gas during hydraulic fracturing or pigging operations, flaring will reduce VOC, hazardous air pollutant, and CH_4 emissions. Combustion emissions from flaring, in result, increase pollutant levels of NO_x, CO, and CO_2. Overall greenhouse gas impacts would go down since the global warming potential of CH_4 is 25 times greater than CO_2. The hydrocarbon destruction efficiency of most flares is upwards of 95 percent. Also, a closed-loop system with 100 percent capture by re-routing gas from hydraulic fracturing or pigging operations to a sales line or onsite process results in no additional emissions to the atmosphere.
- **Use of no-bleed or low-bleed pneumatic devices:** In place of high-bleed or intermittent-bleed pneumatic devices for pressure, temperature, or liquid level control, no-bleed and low-bleed pneumatic devices should be installed, if feasible. No-bleed and low-bleed pneumatic devices will reduce hydrocarbon emissions, such as those of VOC, hazardous air pollutant, and CH_4 pollutants. Low-bleed pneumatic devices are classified as those with a bleed rate less than 6 standard cubic feet per hour (scfh). No-bleed pneumatic devices are those that are mechanically driven or solar-powered instead of powered by natural gas.

Impact Criteria and Analysis

As part of the supplemental EIS, the impacts are analyzed further to assess their significance. The criteria presented in Table 4.2-33 below were used to evaluate the GMT2 Project for each of the proposed alternatives.

Table 4.2-33. Air quality impact criteria

Criteria	Definition
Significant	1. Modeled pollutant concentrations greater than or equal to the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards; 2. Modeled pollutant concentrations at the town of Nuiqsut greater than or equal to prevention of significant deterioration increment; 3. Modeled project impacts exceeded visibility thresholds listed in National Park Service Federal Land Managers' Workgroup guidance, perceptible visibility impacts will occur and be visible from many areas, occur many days over the course of a year, or be visible to a majority of people on the days they occur; and/or 4. Nitrogen and sulfur deposition loading levels exceeded screening thresholds listed in National Park Service deposition analysis threshold guidance, and available scientific information indicates deposition may harm the integrity of resources.
Not Significant	1. Modeled pollutant concentrations less than 100% of the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards; 2. Modeled pollutant concentrations at town of Nuiqsut less than 100% of prevention of significant deterioration increment; 3. Modeled project impacts exceeded visibility thresholds listed in National Park Service Federal Land Managers' Workgroup guidance, perceptible visibility impacts will occur and be visible from many areas, occur between one and several days per year, or be visible to many people on the days they occur; and/or 4. Nitrogen and sulfur deposition loading levels exceeded screening thresholds listed in National Park Service deposition analysis threshold guidance, and available scientific information indicates that deposition will not, or is not, harming integrity of resources.

The potential impacts of each GMT2 Project alternative were evaluated against the criteria in the table above and the assessment is below in Table 4.2-34 through Table for the near-field and far-field. For the near-field, each alternative is broken out into specific project operations including construction, developmental drilling, infill drilling, and routine operations.

Table 4.2-34. Near- and far-field impact analysis for GMT2 Alternative A

Activity	Impact
Construction	Not significant
Developmental Drilling	Not significant
Infill Drilling	Not significant
Routine Operations	Not significant
Overall	Not significant

Table 4.2-35. Near- and far-field impact analysis for GMT2 Alternative B

Activity	Impact
Construction	Not significant
Developmental Drilling	Not significant
Infill Drilling	Not significant
Routine Operations	Not significant
Overall	Not significant

Table 4.2-36. Near- and far-field impact analysis for GMT2 Alternative C

Activity	Impact
Construction	Not significant
Developmental Drilling	Not significant
Infill Drilling	Not significant
Routine Operations	Not significant
Overall	Not significant

Table 4.2-37. Near- and far-field impact analysis for GMT2 Alternative D

Activity	Impact
Construction	Not significant
Developmental Drilling	Not significant
Infill Drilling	Not significant
Routine Operations	Not significant
Overall	Not significant

Conclusions

The emissions and impacts analysis discussed above detail the methodology, procedures, and results of the GMT2 Project impacts in the near-field and far-field. The following conclusions were drawn from the emissions and modeling analysis as it relates to the GMT2 Project.

- The GMT2 Project criteria pollutant emissions for Alternatives A, B, and C, except for PM_{10} and $PM_{2.5}$, are highest during its developmental drilling phase (Year 3 of the Project). PM_{10} and $PM_{2.5}$ show highest annual emissions during Year 2 of the project, the construction phase.
- GMT2 Project routine operations emissions are calculated to be below major source thresholds, making GMT2 a minor source under the Clean Air Act.
- Construction Schedule 1 would result in higher impacts than Construction Schedule 2, because the activities are compacted into 2 years compared to 3 years under Construction Schedule 2. Therefore, the dispersion modeling analysis was done on Construction Schedule 1 and is a conservative estimate of Construction Schedule 2.
- Near-field modeling demonstrates GMT2 Project impacts below the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards for all criteria pollutants and averaging periods for all Alternative A and C modeling scenarios.
- Alternative A near- and far-field impacts are considered representative of Alternative B, as their location, operations, and emissions are similar.
- Near-field modeling demonstrates GMT2 Project maximum impacts are below the reference exposure limit and reference concentration for chronic inhalation thresholds for hazardous air pollutants for all alternatives' modeling scenarios.
- Near-field modeling demonstrates GMT2 Project impacts will not cause a cancer risk above the 1 in 1 million threshold at the Nuiqsut community.
- Far-field modeling demonstrates potential impacts from the GMT2 Project are minimal at the nearest Class II areas: Gates of the Arctic National Park and Preserve and the Arctic National Wildlife Refuge. All potential impacts were much less than 50 percent of the applicable evaluation thresholds of the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards, prevention of significant deterioration Class II increments, and air quality related values.

For a direct comparison between GMT2 Alternatives, summary Tables 4.2-38 through 4.2-41 show the comparison of criteria pollutants, total hazardous air pollutants, and greenhouse gas pollutant emissions in CO_2e for each emission inventory category of the GMT2 Project. As detailed in the tables, Alternative B emissions for each of the pollutants are slightly higher or equal to Alternative A. This is largely due to the longer access road resulting in additional construction (Table 4.2-38) and increased truck travel for drilling and operational activities (Tables 4.2-39 through 4.2-41). For Alternative C, emissions are higher compared to Alternatives A and B, since more operations will take place on or near the GMT2 Pad. Additional emissions would result from the construction of the occupied structure pad and airstrip. Since waste processing and air travel will be onsite along with additional ice road travel during drilling and routine operations, combustion emissions during developmental drilling, infill drilling, and routine operations are higher in comparison to other alternatives. Despite the shorter access road in Alternative C compared to Alternatives A and B, the increased acreage of the GMT2 Project area results in higher PM emissions during routine operations. Alternative D, as the no-action alternative, will result in no project emissions.

Comparing routine operations emissions (Table 4.2-38) of GMT2 Alternatives A, B, and C, Alternative A has the lowest consistent, regular criteria, hazardous air, and greenhouse gas pollutant emissions. Alternative B's emissions are slightly higher due to the additional truck mileage to travel to the GMT2 Pad compared to Alternative A. Alternative C's emissions are roughly two to six times higher than Alternative A due to more ice road travel, waste processing, air travel, and wind erosion.

Table 4.2-38. Maximum construction emissions for each GMT2 Alternative (Year 2)

Pollutant	Alternative A	Alternative B	Alternative C	Alternative D
NO_x (tons per year)	89.0	93.3	104.0	0.0
CO (tons per year)	45.4	47.1	54.8	0.0
VOC (tons per year)	15.1	15.5	18.3	0.0
PM_{10} (tons per year)	193.0	212.0	290.0	0.0
$PM_{2.5}$ (tons per year)	23.7	25.9	34.7	0.0
SO_2 (tons per year)	0.19	0.20	0.22	0.0
Total hazardous air pollutants (tons per year)	2.0	2.1	2.3	0.0
Greenhouse Gases in CO_2e (tons per year)	27,030	28,667	32,595	0.0

Table 4.2-39. Maximum developmental drilling emissions for each GMT2 Alternative (Year 3)

Pollutant	Alternative A	Alternative B	Alternative C	Alternative D
NO_x (tons per year)	119.0	121.0	145.0	0.0
CO (tons per year)	77.5	78.3	123.0	0.0
VOC (tons per year)	20.9	21.0	27.3	0.0
PM_{10} (tons per year)	116.0	119.0	74.4	0.0
$PM_{2.5}$ (tons per year)	17.8	18.2	18.0	0.0
SO_2 (tons per year)	0.34	0.34	0.66	0.0
Total hazardous air pollutants (tons per year)	1.4	1.4	2.5	0.0
Greenhouse Gases in CO_2e (tons per year)	41,545	42,739	56,851	0.0

Table 4.2-40. Maximum infill drilling emissions for each GMT2 Alternative (Year 4)

Pollutant	Alternative A	Alternative B	Alternative C	Alternative D
NOx (tons per year)	87.2	87.2	97.6	0.0
CO (tons per year)	63.7	64.4	109.0	0.0
VOC (tons per year)	16.2	16.4	22.1	0.0
PM_{10} (tons per year)	58.8	62.4	57.9	0.0
$PM_{2.5}$ (tons per year)	10.6	11.0	14.7	0.0
SO_2 (tons per year)	0.45	0.46	0.79	0.0
Total hazardous air pollutants (tons per year)	0.40	0.43	0.97	0.0
Greenhouse Gases in CO_2e (tons per year)	32,276	32,222	38,087	0.0

Table 4.2-41. Maximum routine operations emissions for Each GMT2 Alternative

Pollutant	Alternative A	Alternative B	Alternative C	Alternative D
NO_x (tons per year)	8.9	8.9	17.6	0.0
CO (tons per year)	6.4	7.1	17.0	0.0
VOC (tons per year)	8.0	8.1	11.2	0.0
PM_{10} (tons per year)	5.3	6.2	26.9	0.0
$PM_{2.5}$ (tons per year)	1.2	1.2	7.1	0.0
SO_2 (tons per year)	0.21	0.21	0.31	0.0
Total hazardous air pollutants (tons per year)	0.10	0.13	0.18	0.0
Greenhouse Gases in CO_2e (tons per year)	5,687	5,705	10,406	0.0

4.2.3.3 Acoustical Environment

Potential impacts of project-related noise on the acoustical environment and noise-sensitive receptors in the project area were evaluated in BLM (2004, Section 4F.2.3.3), addressed in the recent GMT1 Supplemental EIS (BLM 2014, Section 4.2.3.3), and further addressed in resource-specific sections of those documents and for NPR-A generally in BLM (2012, Section 4.4.21.2 and other sections). The Point Thomson Final EIS (U.S. Army Corps of Engineers 2012, Appendix O) also presented a thorough modelling analysis of potential impacts of that larger development project on the acoustical environment and sensitive receptors in a similar coastal plain environment.

For the purpose of the following analysis, noise-sensitive receptors include people and wildlife that would be exposed to noise generated by project activities. Nuiqsut is the community nearest to the proposed project, located approximately 17 miles east of the proposed GMT2 pad; 15 miles east of the proposed GMT2 airstrip (Alternative C); approximately 7 miles south of the Alpine airstrip that would support project-related aviation activities; within approximately 11 (Alternative B) to 13 miles (Alternative A) of proposed new road and pipeline construction; within 1 to 3 miles of ice roads that would be used in support of the project; and approximately 4.5 miles west of the Arctic Slope Regional Corporation gravel mine where blasting and other mining activities would occur in support of the project. Local residents also travel widely throughout the project area beyond Nuiqsut, where they engage in a variety of subsistence activities. Additional information concerning noise impacts on Nuiqsut residents and subsistence users is presented in Section 4.4.5, “Subsistence.”

Project activities that have the potential to impact the acoustical environment and sensitive receptors include:

- Mining of gravel to support construction;
- Construction of gravel pads, roads, and airstrip;
- Construction of ice roads and pads;
- Construction of pipelines;
- Construction of on-site facilities;
- Drilling;
- Operation of production and processing facilities;
- Operation of trucks and other large vehicles on roads and pads for site access and transportation of personnel, equipment, and other materials;
- Operation of aircraft (including overflights, landings, and take-offs) for site access and transportation of personnel, equipment, and other materials; and
- Operation of aircraft to support monitoring, other environmental studies, and clean-up activities.

Methodology

This analysis relies on reported noise levels generated by sources and activities similar to those included in one or more of the project alternatives under consideration (Table 3.2-11). Noise and ambient sound data are very limited for the project area, so it is necessary for purposes of impact analysis to rely on relevant proxy data obtained from published reports or other sources. In selecting this proxy data, preference is given to those data which are accompanied by clear specification of the measurement distance because sound levels attenuate rapidly with increasing distance from the source, and because of the importance of attenuation for assessing potential impacts. Also, because sound levels are inherently variable in time and can be described quantitatively by a large number of acoustical metrics that in some way account for temporal variability, preference is given to those data which also are accompanied by specification of the acoustical metric and measurement period.

The analysis also relies on the simplifying assumption that noise levels generally attenuate by 6 dBA with each doubling of distance from the source, although the accuracy of this approach declines with increasing distance due to effects of meteorological conditions, land-surface characteristics, and the potential presence of acoustical barriers including structures and topographic features. Wind conditions and vertical temperature gradients may contribute to the attenuation of noise levels by up to 5 to 20 dB or may enhance noise levels by up to 1 to 5 dB (Attenborough 2014) relative to estimates based on distance alone. Greater consideration of these factors would require modelling analyses such as those conducted in support of the Point Thomson EIS (U.S. Army Corps of Engineers 2012, Appendix O).

In evaluating potential impacts of project-related noise on people and wildlife, it is necessary to consider noise levels in relation to existing ambient sound levels at the location of the receptor. Table 4.2-42 presents examples to illustrate how the effects of project-related noise on overall noise levels and the relative audibility of project noise are dependent on the ambient sound level that exists at the location of the receptor. Project noise that is 10 or more dBA below the existing ambient sound level likely would be inaudible to the human ear, and noise that is approximately equal to existing ambient would only be marginally or slightly audible, depending on the hearing capabilities of the individual receptor. If project noise is 10 dBA or greater above existing ambient, then project noise becomes the dominant element of the acoustical environment. Project noise with a level of 40 dBA would be readily audible in a setting with an existing ambient sound level of 35 dBA or less, but likely would be inaudible in a setting where the existing ambient sound level is 50 dBA or more. In reference to Table 4.2-42 and its applicability to impact analyses, it is important to note that the relative audibility of different types and levels of sound is species specific, contingent on species' sensitivity to and perception of different sound frequencies and amplitudes (Fletcher 2014). As a result, a noise that is relatively inaudible to a human receptor may be readily audible and potentially impactful to a wildlife receptor, dependent on the species and context of the noise.

Table 4.2-42. Relative audibility of project-related noise levels in relation to different ambient sound levels

Existing Ambient Sound Level (dBA)	Project-Related Noise Level (dBA)	Ambient Sound Level + Project Noise Level (dBA)	Noise Level Increase Above Ambient Sound Level (dBA)	Relative Noise Audibility
35[a]	20	35.1	0.1	Likely inaudible
35	25	35.4	0.4	Likely inaudible
35	30	36.2	1.2	Marginally audible
35	35	38.0	3.0	Slightly audible
35	40	41.2	6.2	Audible
35	45	45.4	10.4	Audible and dominant
35	50	50.1	15.1	Audible and dominant
35	55	55.0	20.0	Audible and dominant
50[b]	30	50.0	0.0	Inaudible
50	35	50.1	0.1	Likely inaudible
50	40	50.4	0.4	Likely inaudible
50	45	51.2	1.2	Marginally audible
50	50	53.0	3.0	Slightly audible
50	55	56.2	6.2	Audible
50	60	60.4	10.4	Audible and dominant
50	65	65.1	15.1	Audible and dominant
50	70	70.0	20.0	Audible and dominant

[a] Characteristic value for natural ambient sound level in the project area in the absence of high winds (see Section 3.2.3.3).

[b] Estimate for a characteristic ambient sound level in a natural setting with moderate winds or running water, or during daytime in a village setting in the absence of high noise levels attributable to other sources such as off-road vehicles, snowmobiles, aircraft, or truck traffic.

Criteria used to analyze potential noise impacts of project activities on the acoustical environment and sensitive receptors are presented in Table 4.2-43. Relative to criteria applied in previous analyses, criteria for geographic extent have been revised from “Statewide, Regional, and Local” to “Regional, Local, and Limited.” The adjusted criteria better reflect the geographic extent of sound propagation and attenuation, and the degree of acoustical disturbance that would constitute a major impact. The analysis places emphasis on those activities that have the potential to generate the greatest overall impacts on the acoustical environment and sensitive receptors due to noise intensity, duration, context, and/or geographic extent.

Table 4.2-43. Impact criteria; noise

Impact Category	Magnitude	Definition
Intensity	High	Dominates the acoustical environment
	Medium	Occasionally punctuates the acoustical environment
	Low	Calculated noise levels are comparable to periods of quietest natural sound (i.e., when no wind occurs)
Duration	Long term	Irreversible impact on acoustical environment
	Interim	Impact lasts through operational phase of project
	Temporary	Impact lasts only through project construction and/or drilling
Context	Unique	Impacts to residential communities, concentrated subsistence use areas, biological resources listed as threatened or endangered (or proposed for listing) under the Endangered Species Act and/or depleted under the Marine Mammals Protection Act, and the portion of the resource affected fills a unique ecosystem role within the locality or region
	Important	Impacts to individual residences, dispersed subsistence use areas, or depleted biological resources, within the locality or region or resources protected by legislation
	Common	Impacts to oilfield workers and usual or ordinary resources in the project study area; resource is not depleted in the locality or protected by legislation
Geographic Extent	Regional	Extending beyond the project study area
	Local	Within the project study area
	Limited	Within or adjacent to project components

Construction

Several activities during construction have the potential to generate noise that may impact the acoustical environment and noise-sensitive receptors. These include gravel mining, operation of vehicles and various other types and combinations of mechanized equipment, and aircraft operations.

The existing Arctic Slope Regional Corporation gravel mine east of the Colville River would be the source of gravel for project-related construction. The mining permit issued by the U.S. Army Corps of Engineers requires that blasting, excavation, and other high-noise activities not be conducted from 20 May through 1 August to avoid disturbances to spectacled eiders during pre-nesting and nesting seasons. Blasting to support gravel needs for the GMT2 Project would be audible in Nuiqsut (4.5 miles from mine site), with noise levels potentially as high as 110 dB depending on meteorological conditions and the size and type of charge (Table 4.2-44). Contingent on these factors, blast noise could exceed 100 dB more than 10 miles from the source and up to 4 miles into NPR-A, and potentially could be audible more than 20 miles from the source. Other excavation-related activities are not likely to be audible in Nuiqsut, as noise generated by one to five pieces of heavy equipment at the mine site would be expected to attenuate to a level less than ambient before reaching Nuiqsut 4.5 miles away (Table 4.2-44). Due to blast noise, overall impacts of gravel mining on the acoustical environment would be of high intensity and regional extent, but temporary. Noise impacts attributable to gravel mining would be expected to vary among the action alternatives, with Alternative A having the least impacts and Alternative C having the greatest impacts due to differences in total gravel requirements (Table 4.1-1).

Table 4.2-44. Estimated project-related noise levels (in dBA, unless otherwise noted) received at Nuiqsut and at distances 1 to 10 miles from the noise source[a]

Noise Source and Location	Estimated Noise Level at 1,000-ft Distance (dBA)	Distance of Source Location from Nuiqsut (mi)	Estimated Noise Level at Nuiqsut (dBA)	Estimated Noise Level, 1.0 mi from Source (dBA)	Estimated Noise Level, 2.5 mi from Source (dBA)	Estimated Noise Level, 5.0 mi from Source (dBA)	Estimated Noise Level, 7.5 mi from Source (dBA)	Estimated Noise Level, 10.0 mi from Source (dBA)
Blasting, Arctic Slope Regional Corporation gravel mine [b]	140.3 dB	4.5	112.8 dB	125.8 dB	117.9 dB	111.9 dB	108.3 dB	105.9 dB
Drill rig, GMT2 pad, maximum noise level [b]	84.4	17	45.3	69.9	62.0	56.0	52.4	50.0
Drill rig, GMT2 pad, median noise level [b]	52.4	17	13.3	37.9	30.0	24.0	20.4	18.0
C-130, Alpine airstrip [c]	76.7	7	45.3	62.2	54.3	48.3	44.7	42.3
C-130, GMT2 airstrip [c]	76.7	15	38.7	“	“	“	“	“
Helicopter, Alpine airstrip [b]	66.7	7	35.3	52.2	44.3	38.3	34.7	32.3
Helicopter, GMT2 airstrip [b]	66.7	15	28.7	“	“	“	“	“
Propeller (single & twin engine), Alpine airstrip [b]	65.2	7	33.8	50.7	42.8	36.8	33.2	30.8
Propeller (single & twin engine), GMT2 airstrip [b]	65.2	15	27.2	“	“	“	“	“
Construction or heavy vehicle traffic, 5 pieces of equipment [b]	62.0	1 (minimum distance)	47.5	47.5	39.6	33.6	30.0	27.6
Construction or heavy vehicle traffic, 3 pieces of equipment [b]	59.8	1 (minimum distance)	45.3	45.3	37.4	31.4	27.8	25.4
Construction or heavy vehicle traffic, 1 piece of equipment [b]	55.0	1 (minimum distance)	40.5	40.5	32.6	26.6	23.0	20.6

[a] Estimates assume noise attenuation of 6 dBA per doubling of distance from source and do not account for potential effects of meteorological conditions, sound barriers, and landscape characteristics.

[b] See Table 3.2-11 for noise-measurement details.

[c] Estimates presented for a C-130 are assumed to generally represent DC-6 noise levels (no DC-6 data were discovered). Noise estimates are for a C-130 in level flight at 180 knots (see Table 3.2-11 for details) and are expected to be lower than noise levels generated during take-off and landing phases at Alpine and GMT2 airstrips.

Excluding mine blasts and aircraft, noise levels generated by other construction activities would be expected to attenuate to 35 dBA or lower within 2.5 to 5 miles from the noise sources, depending on meteorological conditions and the number and specific types of heavy equipment pieces or vehicles that are operated simultaneously in close proximity. For example, maximum noise levels emitted by one typical piece of construction equipment would be estimated to attenuate to 35 dBA at a distance of 1.9 miles from the source, whereas noise generated by simultaneous operation of five pieces of heavy equipment would be estimated to attenuate to 35 dBA at a distance of 4.2 miles (Table 3.2-11). Equipment operation on the ice road proposed for construction just northwest of Nuiqsut could contribute to higher noise in the village, but the increase in noise level might only be marginally audible to residents if ambient noise levels in the village are 50 dBA or greater (compare construction noise data in Table 4.2-44 with Table 4.2-42). In close proximity to equipment operations (e.g., within 1 mile), construction noise could dominate the acoustical environment for the duration of the construction activity, assuming a natural ambient sound level of 35 dBA in the absence of construction noise. Overall impacts of construction noise on the acoustical environment would be of high intensity and local extent, but would be temporary and would attenuate to low intensity with increasing distance from the source. Potential impacts of temporary construction noise on wildlife would be expected to vary by species, timing, and behavioral context, and could result in or contribute to local avoidance and displacement, but would be unlikely to result in population-level impacts. To the degree that construction noise causes or contributes to local changes in patterns of wildlife movement and distribution, such changes would have the potential to impact subsistence users. Noise impacts attributable to construction activities would be expected to vary among the action alternatives, with Alternative A having the least impacts and Alternative C having the greatest impacts due to differences in total gravel footprint (Table 4.1-1). In addition, total vehicle trips and vehicle miles are projected to be higher for Alternative C than for Alternatives A and B, which would be expected to result in a greater overall amount of vehicle-related noise in Alternative C.

Proposed aircraft operations during the construction phase of the project include transport of cargo into the Alpine airstrip by Twin Otter (DHC6) and CASA twin-engine (2E) turboprop aircraft (Alternatives A and B), transport of cargo by DC-6 (primarily) and C-130 four-engine (4E) aircraft into the GMT2 airstrip (Alternative C), transport of personnel into GMT2 by Twin Otter/CASA aircraft and helicopters (Alternative C), and helicopter flights into the project area in support of required special studies, monitoring, and ice-road clean-up (all alternatives). Potential impacts of aircraft noise vary according to the type of aircraft, the phase of aircraft operations (i.e., take-off and landing versus level flight), the location (Alpine and GMT2 airstrips, versus pipeline and ice-road corridors, versus in-transit flight paths and dispersed locations of special studies), and timing of aircraft operations in relation to locations and activities of noise-sensitive receptors, and flight altitude above ground level. Aircraft noise generated during landing, take-off, and climb-out generally is greater than noise generated during level flight, but the following analysis assumes that noise estimates for level flight provide a reasonable basis for evaluating potential aircraft noise impacts. No noise estimates were located for DC-6 aircraft, so the analysis also assumes that estimates of C-130 noise are generally representative of DC-6 noise levels. These two are discussed together as 4E cargo aircraft.

The existing Alpine airstrip and the proposed GMT2 airstrip would be specific point sources of project-related noise generated by landing and take-off operations of 2E and 4E cargo aircraft and helicopters. Nuiqsut is approximately 7 miles from the Alpine airstrip and 15 miles from the proposed location of the GMT2 airstrip. Depending on meteorological conditions, noise generated by 4E cargo aircraft at Alpine would be expected to attenuate to approximately 45 dBA at Nuiqsut (Table 4.2-42), whereas noise generated by helicopters and 2E cargo aircraft would attenuate to approximately 34-35 dBA. Assuming an ambient noise level of 50 dBA in Nuiqsut, noise from 4E aircraft at Alpine could be marginally audible in the village, but noise from helicopters and 2E aircraft likely would be inaudible under most conditions. Depending on meteorological conditions and the ambient noise level at the time, noise generated by 4E aircraft operations at Alpine and GMT2 airstrips could temporarily dominate the acoustical environment for a distance of 5 to 7.5 miles from the airstrips, and noise generated by helicopters and 2E aircraft could temporarily dominate the acoustical environment for a distance of 1 to 2.5 miles.

During transit flights, the intensity of aircraft noise received by a receptor on the ground is affected by the aircraft's flight altitude above ground level as well as by the distance from the ground trace of the aircraft's flight path to the location of the receptor[6] . Flight altitudes relevant to project-related aircraft operations are less than 3,000 feet. At these relatively low flight altitudes, altitude is a strong determinant of aircraft noise levels only within a distance of about 0.5 miles from the ground trace of the flight path. For example, the ground-level noise from an aircraft flying directly overhead at 3,000-foot altitude is estimated to be 21.5 dBA less than noise from an aircraft flying overhead at 250-foot altitude, independent of the type of aircraft and not accounting for meteorological conditions (Table 4.2-43). But at a distance of 0.5 miles from the ground trace, the corresponding difference in noise levels due to flight altitude is only 3.5 dBA, a difference which would be only marginally detectable. This pattern has implications for assessment and mitigation of aircraft noise impacts.

Table 4.2-43 presents estimates for levels of aircraft noise received at the ground surface as a function of aircraft type, flight altitude, and distance of receptor from the aircraft's ground trace. Noise generated by 4E aircraft in transit could temporarily dominate the acoustical landscape for a distance of about 5 to 7.5 miles from the ground trace and could be audible for more than 10 miles from the ground trace, assuming an ambient sound level of approximately 35 dBA. Noise generated by helicopters and 2E aircraft could temporarily dominate the acoustical environment for a distance of about 1 to 2.5 miles from the ground trace and could be audible up to 5 miles from the ground trace. Within about 0.5 miles of the ground trace, aircraft noise levels and impact intensity would increase significantly with decreasing flight altitude. Project-related aircraft activity during the construction phase also would be expected to increase the frequency and total number of aircraft noise events for locations within 5 to 7.5 miles of ground traces of 4E cargo aircraft and within 1 to 2.5 miles of ground traces of helicopters and 2E cargo aircraft.

Overall impacts of aircraft noise on the acoustical environment would be of high intensity and regional extent, but would be temporary and would attenuate to low intensity with increasing distance from the source. This would be the case for concentrated locations of aircraft activity (Alpine airstrip and proposed GMT2 airstrip), for dispersed landing sites, and for linear zones of audible aircraft noise centered along ground traces of aircraft flight paths.

As with noise generally, wildlife responses to aircraft noise vary among species and can depend on several non-acoustical factors. Caribou have been found to be relatively sensitive to low-altitude (less than 300 feet) helicopters (Harrington and Veitch 1991) and fixed-wing aircraft (Valkenburg and Davis 1983), with evidence that noise and visual stimuli both affect the way in which caribou respond to the aircraft (literature cited by Anderson [2007]). Snow geese, black brant, and greater white-fronted geese also have been found to respond to low-altitude aircraft (literature cited by Anderson [2007]). Disturbance by aircraft noise has the potential to cause or contribute to local changes in movement and distributional patterns of caribou, waterfowl, and other wildlife, but would be unlikely to result in population-level impacts. To the degree that aircraft noise does trigger wildlife responses, altered patterns of movement and distribution would have the potential to impact subsistence users. Noise impacts attributable to aircraft operations during the construction phase would be greater for Alternative C than for Alternatives A and B due to much higher levels of aircraft use in the absence of gravel access roads in Alternative C.

[6] Geometrically, flight altitude and distance to ground trace can be conceptualized as two perpendicular sides of a right triangle, with the hypotenuse of the right triangle formed by a line representing the line-of-sight distance from the noise receptor to the airborne aircraft, referred to as slant distance. Slant distance is the distance used to estimate attenuation of noise from airborne aircraft.

Drilling and Operation

During drilling and operations phases of the project, activities that would generate noise and have the potential to impact the acoustical environment and sensitive receptors include drilling, operation of vehicles and various other types and combinations of mechanized equipment (including production and processing facilities), and aircraft operations. Findings of the recent Point Thomson EIS (U.S. Army Corps of Engineers 2012) were that drilling and aviation would have the greatest noise impacts during the drilling and operations phases of that project.

Table 4.2-45. Estimated levels of aircraft noise (dBA) received at the ground surface at distances 0 to 10 miles from the ground trace of the flight path [a]

Aircraft Noise Source	Flight Altitude (ft)	Estimated Noise Level, 0.0 mi from Ground Trace (dBA)	Estimated Noise Level, 0.25 mi from Ground Trace (dBA)	Estimated Noise Level, 0.5 mi from Ground Trace (dBA)	Estimated Noise Level, 0.75 mi from Ground Trace (dBA)	Estimated Noise Level, 1.0 mi from Ground Trace (dBA)	Estimated Noise Level, 2.5 mi from Ground Trace (dBA)	Estimated Noise Level, 5.0 mi from Ground Trace (dBA)	Estimated Noise Level, 7.5 mi from Ground Trace (dBA)	Estimated Noise Level, 10.0 mi from Ground Trace (dBA)
C-130 [b]	3,000	67.2	66.4	64.7	62.8	61.0	54.1	48.2	44.7	42.2
	2,000	70.7	69.1	66.3	63.8	61.7	54.2	48.2	44.7	42.2
	1,000	76.7	72.3	67.7	64.5	62.1	54.3	48.3	44.8	42.3
	500	82.7	73.7	68.1	64.7	62.2	54.3	48.3	44.8	42.3
	250	88.7	74.1	68.2	64.7	62.2	54.3	48.3	44.8	42.3
	Range [c] (dBA)	**21.5**	**7.7**	**3.5**	**1.9**	**1.2**	**0.2**	**0.1**	**0.1**	**0.1**
Helicopter [d]	3,000	57.2	56.4	54.7	52.8	51.0	44.1	38.2	34.7	32.2
	2,000	60.7	59.1	56.3	53.8	51.7	44.2	38.2	34.7	32.2
	1,000	66.7	62.3	57.7	54.5	52.1	44.3	38.3	34.8	32.3
	500	72.7	63.7	58.1	54.7	52.2	44.3	38.3	34.8	32.3
	250	78.7	64.1	58.2	54.7	52.2	44.3	38.3	34.8	32.3
	Range [c] (dBA)	**21.5**	**7.7**	**3.5**	**1.9**	**1.2**	**0.2**	**0.1**	**0.1**	**0.1**
Propeller [e] (Single & Twin Engine)	3,000	55.7	54.9	53.2	51.3	49.5	42.6	36.7	33.2	30.7
	2,000	59.2	57.6	54.8	52.3	50.2	42.7	36.7	33.2	30.7
	1,000	65.2	60.8	56.2	53.0	50.6	42.8	36.8	33.3	30.8
	500	71.2	62.2	56.6	53.2	50.7	42.8	36.8	33.3	30.8
	250	77.2	62.6	56.7	53.2	50.7	42.8	36.8	33.3	30.8
	Range [c] (dBA)	**21.5**	**7.7**	**3.5**	**1.9**	**1.2**	**0.2**	**0.1**	**0.1**	**0.1**

[a] Estimates assume noise attenuation of 6 dBA per doubling of distance from source and do not account for potential effects of meteorological conditions, sound barriers, and landscape characteristics. Noise estimates are provided for three classes of aircraft at flight altitudes 250 to 3,000 feet above ground level.

[b] Aircraft at 180 knots in level flight, with maximum 1-second noise level estimated for 1,000-foot distance using the U.S. Air Force OMEGA10R noise model (U.S. Army Corps of Engineers 2004, Appendix H).

[c] Range of estimated noise levels (dBA) at the ground due to the 250 to 3,000-foot range in aircraft flight altitude.

[d] B206 helicopter at 160 knots in level flight, with maximum 1-sec noise level estimated for 1,000-foot distance using the Federal Aviation Administration's Integrated Noise Model (Miller et al. 2003).

[e] C207 and DHC6 propeller aircraft at 160 knots in level flight, with maximum 1-sec noise level estimated for 1,000-foot distance using the Federal Aviation Administration's Integrated Noise Model (Miller et al. 2003).

Other than aircraft activities, drilling itself would be expected to generate the highest noise levels during the drilling and operations phases. Maximum noise levels generated by drilling could be up to 84.4 dBA at 1,000 feet (Table 4.2-44) (Ambrose and Florian 2014). This level of noise would be expected to attenuate to approximately 45 dBA at Nuiqsut, located approximately 17 miles from the proposed GMT2 pad where drilling would occur. Assuming the ambient noise level in Nuiqsut is approximately 50 dBA, this maximum level of drilling noise would be marginally audible. But median noise levels (52.4 dBA at 1,000 feet, Table 4.2-44) would be expected to attenuate to approximately 13 dBA at Nuiqsut, well below the likely level of audibility. Maximum noise attributable to drilling likely would be very intermittent and would occur only during a small percentage of the time, but it could occasionally dominate the acoustical environment for more than 10 miles away (Table 4.2-44), estimated noise level 50 dBA at 10 miles, in relation to potential natural ambient of 35 dBA). In contrast, median sound levels attributable to drilling would be expected to attenuate to ambient levels at approximately 1.9 miles from the source, would be only be slightly audible at 1 miles from the source, and would only dominate the natural acoustical environment for a distance of approximately 0.4 miles from the source, assuming a natural ambient sound level of 35 dBA and without accounting for effects of meteorological conditions. Overall impacts of drilling noise on the acoustical environment would be of high intensity and regional extent for maximum noise levels, but median noise levels would be expected to be of high intensity to a limited extent. In both cases, impacts would be temporary and would attenuate to low intensity with increasing distance from the source. Drilling noise could contribute to local avoidance of infrastructure by wildlife, but would be unlikely to result in population-level impacts. Noise impacts attributable to drilling itself would not be expected to vary among the action alternatives under consideration.

Other than drilling and aircraft noise, other project-related noise and associated impacts during the drilling and operations phases would be similar to or lower than noise levels and impacts described above for construction activities excluding mine blasting and aircraft operations. Impacts would be of high intensity and local extent, but would be of interim duration due to their occurrence through the entire operational phase of the project.

Most of the aircraft operations proposed for the drilling and operations phases would occur under Alternative C, but not under Alternatives A and B. The exceptions would be helicopter flights into the project area in support of required special studies, monitoring, and ice-road clean-up (all alternatives). Under Alternative C (no gravel road access), flight activities also would include transport of cargo by 4E aircraft into and out of the GMT2 airstrip, and transport of personnel and cargo into and of GMT2 by 2E aircraft. Aircraft noise levels and associated impacts generally would be similar to those described above for the construction phase. Noise impacts would be of high intensity and regional extent, but would be of interim duration due to their occurrence through the entire operational phase of the project. Impacts of aircraft noise would be the same under Alternatives A and B, and would be greatest under Alternative C.

Comparison of Alternatives

Table 4.2-46 summarizes the major project components that have the potential to impact the acoustical environment and noise-sensitive receptors. The major design factor that determines the degree to which potential noise impacts would vary among alternatives is proposed access to GMT2. In Alternatives A and B, access to the GMT2 pad would be via vehicle travel on seasonal ice roads during the construction phase, and year-around on a gravel road between GMT1 and GMT2 during subsequent project phases. Under Alternative C, the gravel road between GMT1 and GMT2 would not be constructed, with year-round access by aircraft and seasonal access via vehicle travel on ice roads for the entire duration of the project. To support aircraft access under Alternative C, an airstrip and operations camp would be constructed at GMT2, thus resulting in greater gravel requirements and a greater overall gravel infrastructure footprint relative to Alternatives A and B. The greater gravel requirements would be expected to result in a higher total number of blast-noise events associated with gravel mining under

Alternative C. The greater infrastructure footprint associated with Alternative C also could result in a greater total amount of construction-related noise relative to Alternatives A and B.

With respect to potential noise impacts, the greatest factor that distinguishes Alternative C from Alternatives A and B is the reliance on aircraft for transport of personnel and cargo under Alternative C. As described above, aircraft noise is louder and therefore would be expected to result in noise impacts to the acoustical environment and sensitive receptors within a much greater geographic area than would be expected with vehicle use on roads under Alternatives A and B.

Mitigation

Several best management practices related to facility design and construction were specified in the 2013 NPR-A Record of Decision for the purpose of mitigating potential noise-related impacts on wildlife and subsistence users. These include BMP E-1 (protection of subsistence use, access, and wildlife generally), E-11 (protection of federally protected and BLM special status species), and E-18 (protection of federally protected species).

In addition, BMP F-1 directly addresses use of aircraft for permitted activities, with the objective of minimizing the effects of low-flying aircraft on wildlife, sensitive activities, and local communities. In general, this best management practice specifies seasonal buffers, spatial buffers, and/or minimum flight altitudes designed to protect noise-sensitive resources. Specified minimum flight altitudes range from 1000 to 3000 feet, with requirement that flight operations associated with permitted activities remain at or above the specified altitude unless doing so would endanger human life or violate safe flying practices.

Table 4.2-46. Summary of major components potentially impacting the acoustical environment and noise-sensitive receptors [a]

Alternative & Phase	Total Gravel Requirement (cy) [b]	Total Gravel Footprint (acres) [c]	Total Vehicle Trips	Total Vehicle Miles [d]	Total Otter/CASA/DC-6 Flights into Alpine	Total Otter/CASA Flights into GMT2	Total DC-6/C-130 Flights into GMT2	Total Helicopter Flights into NPR-A
A: Construction	671,300	78.0	166,100	1,339,700	270	0	0	1,032
A: Drilling	-	-	63,100	1,569,800	0	0	0	540
A: Operations	-	-	161,000	287,500	0	0	0	2,070
A: Total	671,300	78.0	390,200	3,197,000	270	0	0	3,642
B: Construction	747,300	87.2	166,100	1,339,700	270	0	0	1,032
B: Drilling	-	-	63,100	1,569,800	0	0	0	540
B: Operations	-	-	161,000	287,500	0	0	0	2,070
B: Total	747,300	87.2	390,200	3,197,000	270	0	0	3,642
C: Construction	930,000	92.0	181,800	1,692,500	274	865	193	1,060
C: Drilling	-	-	182,500	1,295,300	0	6,126	1,399	858
C: Operations	-	-	501,400	1,616,900	0	5,281	974	3,289
C: Total	930,000	92.0	865,700	4,604,700	274	12,272	2,566	5,207

[a] All values are estimates subject to change in final design.

[b] Values are assumed to be roughly proportional to noise attributable to gravel mining.

[c] Values are assumed to be roughly proportional to noise attributable to infrastructure construction, excluding vehicle trips and aircraft activity.

[d] Values are assumed to be roughly proportional to noise attributable to vehicle use.

Given the known frequent occurrence of low cloud ceilings below minimum specified flight altitudes in the project area, as well as the observation that differences in estimated levels of aircraft noise due to differences in altitude are small beyond about 0.5 miles from the ground trace (Table 4.2-45), minimum flight altitudes and spatial buffers currently specified in F-1 may warrant reconsideration by appropriate resource specialists and stakeholders. An alternative approach could be to work with resource specialists and stakeholders to develop and recommend preferred low-altitude flight corridors that specifically are designed to avoid and protect noise-sensitive resources while recognizing and accommodating the frequent need for low-altitude flight due to environmental conditions. If such an approach were to be developed, an effectiveness monitoring program could be designed to collect pertinent data on aircraft noise levels and resource (wildlife) responses to aircraft noise events at specific sensitive locations before and after implementation of the flight corridors.

As indicated above, blast noise associated with gravel mining is likely to be the loudest noise generated by project-related activities. Acoustical data that accurately characterizes the frequency, timing, and level of blast noise in proximity to Nuiqsut are necessary for determining the need for mitigation measures.

Conclusion

Under all of the action alternatives, noise generated by a wide range of project-related activities would have reasonably foreseeable impacts on the acoustical environment. In addition, project-related noise would have the potential to impact noise-sensitive receptors including people and wildlife that would be exposed to elevated noise levels during all project phases. All impacts on the acoustical environment would be of high intensity, but the geographic extent would vary from limited (median noise levels during drilling and operations, excluding aircraft noise), to local (construction noise), and to regional (blast noise, maximum noise levels during drilling, and aircraft noise). Impacts attributable to individual noise events would be temporary. But persistent noise from production facilities and generators, as well as the frequent recurrence of many distinct, but temporary high-intensity noise events, would be of interim duration, together lasting for the life of the project. High-intensity blast noise and aircraft noise are considered unique in context, because blast noise would impact the community of Nuiqsut, and aircraft noise would impact acoustical conditions and sensitive receptors in concentrated subsistence areas. Considering these impact criteria, overall noise impacts are considered moderate for all three action alternatives, with reasonably foreseeable noise impacts of Alternative C greater than impacts of Alternatives A and B.

4.2.4 Project Effects on Global Climate Change

This section discusses the potential impacts of the project alternatives on global climate change. The impacts of climate change on the environmental resources in the Arctic generally and the project study area specifically are addressed in Section 3.2.4, “Climate Change.”

According to the National Climate Assessment published by the U.S. Global Change Research Program, the warming trend observed over the last 50 years was driven primarily by human activity resulting in the emission of heat trapping gases, also known as greenhouse gases (U.S. Global Change Research Program 2014). Heat trapping gases produced by human activity that contribute to climate change include carbon dioxide, methane, nitrous oxides, and fluorinated gases (EPA 2017d). The primary activity causing the release of greenhouse gases to the atmosphere is the combustion of fossil fuels such as oil, natural gas, and coal (U.S. Global Change Research Program 2014). In 2009, the EPA made an endangerment finding for greenhouse gases which stated that six well mixed greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations (EPA 2009).

4.2.4.1 Methodology

Our current understanding of climate change does not allow us to relate specific sources of greenhouse gas emissions to any specific climate-related impact. While emissions from oil and gas developments contribute to the effects of climate change to some extent, it currently is not possible to associate any of these particular actions with the creation of any specific climate-related environmental effects. The tools necessary to quantify climatic impacts of single projects are presently unavailable. As a consequence, impact assessments of specific effects of anthropogenic activities cannot be determined.

Climate change is by its very nature a cumulative global problem, and no single project or action contributes a significant amount of greenhouse gases when compared to global greenhouse gas emissions. Specific thresholds for greenhouse gas emissions have not been established by the EPA, and thus there is no threshold of significance against which to compare project-level greenhouse gas emissions to determine major, moderate, or minor impacts. The methodology for evaluating the GMT2 Project's contribution to global climate change is to quantify the amount of greenhouse gas emissions that will result from the development of this project under each alternative. Under this methodology, the emissions themselves serve as a proxy for the impacts of climate change, with higher emissions equating to higher impacts. For ease of comparison, all greenhouse gases have been converted to CO_2 equivalent (CO_2e), which describes the global warming potential of each greenhouse gas in terms of the amount of CO_2 that would result in the same level of warming (EPA, Understanding Global Warming Potentials, 2016).

Indirect greenhouse gas emissions resulting from the transportation, refinement, and consumption of oil produced from the GMT2 Project were estimated using the Bureau of Ocean Energy Management's Greenhouse Gas Lifecycle Model (Wolvovsky et al. 2016). This model was developed to support the Outer Continental Shelf Oil and Gas Leasing Program: 2017–2022 PEIS, and it represents the best available resource for estimating indirect greenhouse gas emissions from petroleum products refined and consumed domestically. A full description of the model's capabilities and methodology can be found in Appendix H.

Direct emissions resulting from the construction and operation of the GMT2 Project were calculated as part of the emissions inventory developed to evaluate air quality impacts. The BLM and their contractor, Kleinfelder and Rambol Environ, worked with the project proponent to develop an inventory of all emissions sources (vehicles, aircraft, drill rigs, generators, etc.) that would be required to construct and operate GMT2 throughout the project life.

4.2.4.2 Greenhouse Gas Emissions from the Action Alternatives

The proposed action and alternatives would result in impacts to climate change through direct and indirect emissions of the heat trapping gases—carbon dioxide, methane, and nitrous oxides. The GMT2 Project will also produce small amounts of sulfur dioxide, a greenhouse gas that has an overall cooling effect; however, the countervailing effect of sulfur dioxide emissions will be negligible.

Direct emissions resulting from the GMT2 Project for each alternative include, but are not limited to, emissions from vehicle traffic, air traffic, power generation and drill rig emissions associated with the construction and operation of the GMT2 Project. Indirect emissions are the result of the transportation, refinement, and downstream consumption of the oil extracted from the GMT2 Project. Natural gas extracted from the GMT2 Project will be reinjected into the well and will not be transported for consumption. All action alternatives will produce the same amount of oil and have the same amount of indirect greenhouse gas emissions.

Table 4.2-47. Total greenhouse gas emissions for each action alternative

Greenhouse Gas Emissions (metric tons of CO_2 equivalent)	Alternative A, Proposed Action	Alternative B, Alternate Road Alignment	Alternative C, Roadless Development
Direct Emissions	457,108	457,595	651,268
Indirect Emissions	43,183,085	43,183,085	43,183,085
Total Emissions	**43,640,193**	**43,640,680**	**43,834,353**

Assumptions

Assumptions of the Greenhouse Gas Lifecycle Model and its application to the GMT2 Project are listed below:

- Although the model was developed to assess indirect greenhouse gas emissions from offshore oil production, the model can be applied to the GMT2 Project because the indirect emissions for both onshore and offshore projects occur onshore, and are therefore treated in the same manner in the model. All oil produced on Alaska's North Slope, whether onshore or offshore, is transported from Deadhorse using the Trans-Alaska Pipeline System to the Valdez tanker terminal. Alaska crude oil is then transported by tanker to the U.S. West Coast and refined and consumed domestically. Because both onshore and offshore production share this transportation, refinement, and consumption pattern, the Greenhouse Gas Lifecycle Model is also applicable to onshore North Slope oil and gas developments for the purpose of estimating indirect greenhouse gas emissions from downstream consumption.
- First oil is assumed to occur in the year 2021 for purposes of modeling.
- Greenhouse gas emissions from natural gas consumption were removed from the model to account for the fact that natural gas will be reinjected into production wells for the GMT2 Project.
- A full description of the assumptions and methodology of the base Greenhouse Gas Lifecycle Model are available in Appendix H.

4.2.4.3 Greenhouse Gas Emissions from Alternative D, the No-Action Alternative

Under Alternative D, direct and indirect greenhouse gas emissions from the GMT2 Project would be zero. However, it is important to note that global greenhouse gas emissions would not see a net reduction equivalent to the total emissions from the GMT2 Project. Under a no-action alternative, the energy that would have been produced from the GMT2 Project would be replaced by alternate energy sources, and the production and consumption of these replacement energy sources would have associated greenhouse gas emissions. In order to place the no-action alternative in an appropriate context, the BLM used the Bureau of Ocean Energy Management's Market Simulation Model (MarketSim) to predict how energy produced from the GMT2 Project would be replaced under a no-action alternative. The Greenhouse Gas Lifecycle Model was then used to predict indirect emissions from the consumption of these replacement energy sources.

The results of this analysis are not directly comparable to the emissions of the action alternatives because direct emissions for the replacement sources of energy are not available and cannot be included in the no-action alternative analysis. Despite this limitation, MarketSim and the Greenhouse Gas Lifecycle Model represent the best available data and BLM is including this information here to give the public and decision makers an idea of how the no-action alternative would impact global climate change. As with the action alternatives, greenhouse gas emissions are used as a proxy for the impacts of climate change.

Bureau of Ocean Energy Management's Market Simulation Model

The Bureau of Ocean Energy Management developed the MarketSim to calculate the energy sources that would be anticipated in the absence of new offshore oil and natural gas production from lease sales in the Outer Continental Shelf National Program. In the absence of new domestic oil and gas production, there would be a reduced supply, but very little change to domestic demand for energy. The difference between supply and demand would be met by energy market substitutes such as additional oil and gas imports, onshore oil and gas production, fuel switching (e.g., coal). Given the slight increase in price that would result from the reduced oil and gas supply, there would be a slight decline in energy consumption. The MarketSim models the changes in price and resulting changes in production to estimate the set of energy market substitutes which would replace Outer Continental Shelf production. The full MarketSim model documentation is entitled "Consumer Surplus and Energy Substitutes for OCS Oil and Gas Production: The 2017 Revised Market Simulation Model (MarketSim)".

MarketSim models oil, gas, coal, and electricity markets and is calibrated to a special run of the Energy Information Administration's National Energy Modeling System. The baseline used in the MarketSim is a modified version of the Energy Information Administration's 2016 Annual Energy Outlook reference case; the modification involves omission of new Outer Continental Shelf lease sales starting in 2017. Removing the Energy Information Administration's expectation of production from new Outer Continental Shelf leasing allows investigation of alternative new Outer Continental Shelf leasing scenarios within the Energy Information Administration's broad energy market projection using the MarketSim. MarketSim uses price elasticities derived from Energy Information Administration and other published elasticity studies to quantify the changes that would occur to prices and energy production and consumption over the time period of production.

Applicability of MarketSim to BLM Decisions

While the MarketSim is specifically designed to calculate the energy market substitutes for new offshore oil production, the basic model calculations allow for its use in modeling the substitutes for other oil and gas sources including new onshore production. Since MarketSim is designed to treat new lease offshore production as the exogenous variable, modelling substitution effects of new onshore production requires inputting the projected GMT2 production as new offshore oil production. This modelling approach results in a couple limiting assumptions, including:

- Additional onshore production from the GMT2 Project essentially generates the same types of energy market substitutes as offshore production.
- No substitution involving new lease offshore production for the new Alaska onshore production. The model does assume some substitution of existing offshore production (meaning for areas currently under lease).

Even with these limiting assumptions, the MarketSim still provides a good proxy for the energy market substitutes which would occur in the absence of the GMT2 Project. Energy substitution was calculated based on a 30-year production schedule beginning in 2021.

Results of MarketSim

Table 4.2-48 shows the energy market substitutions predicted by the MarketSim if the GMT2 Project is not approved. The table shows the volume and percent replacement each substitute source would be in the absence of GMT2.[7] For example, if the production from GMT2 did not occur, the model predicts an estimated 84 mmbbl of additional imports (replacing 84 percent of the GMT2 production). Given the slight increase in price in the absence of GMT2's production, oil demand would decrease slightly. This

[7] All changes by sector are expressed in millions of barrels of oil equivalent.

would result in a 4.1 mmbbl reduction in demand (replacing 4.1 percent of the estimated GMT2 production). These substitution factors are included in the Bureau of Ocean Energy Management's Greenhouse Gas Lifecycle Model to estimate the change in emissions generated if the GMT2 Project is not approved.

Table 4.2-48. Energy substitutions for GMT2 Project

Energy Category	Change in Sector (mmbbl) [a, b]	Change as % of Forgone
Onshore Production	6.6	6.6%
Oil	4.9	4.9%
Natural Gas	1.7	1.7%
Existing Offshore Production	1.0	1.0%
Oil	1.0	1.0%
Natural Gas	0.0	0.0%
Imports	84.2	84.0%
Oil	84.1	84.0%
Natural Gas	0.0	0.0%
Other	3.8	3.8%
Biofuels	0.3	0.3%
Other Oil	3.5	3.5%
Other Natural Gas	0.0	0.0%
Coal	0.3	0.3%
Domestic	0.3	0.3%
Imported	0.0	0.0%
Electricity	0.3	0.3%
Nuclear	0.1	0.1%
Hydro	0.0	0.0%
Solar	0.1	0.1%
Wind Onshore	0.1	0.1%
Wind Offshore	0.0	0.0%
Other Electric	0.0	0.0%
Imports	0.0	0.0%
Reduced Demand	4.1	4.1%
Oil	6.1	6.1%
Natural Gas	-1.1	-1.1%
Coal	-0.3	-0.3%
Electricity	-0.6	-0.6%
Total Substitution	100.2	100.0%

[a] All changes by sector are expressed in millions of barrels of oil equivalent.
[b] Coal, gas, and oil-fired electricity generation are not included as sub-categories under electricity because electricity produced from these fuels is reflected in the results reported for these fuels themselves.

Indirect Greenhouse Gas Emissions for Alternative D, No-Action Alternative

The BLM used the Greenhouse Gas Lifecycle Model to estimate indirect greenhouse gas emissions for Alternative D. Indirect greenhouse gas emissions for Alternative D were estimated to be 41,019,354 metric tons of CO_2 equivalent. This is approximately 2.14 million metric tons less than the indirect GHG emissions for the action alternatives (43,183,085 metric tons CO_2e).

4.2.4.4 Social Cost of Carbon

Another approach to analyzing possible climate change impacts is to calculate what is commonly known as the social cost of carbon. A social cost of carbon protocol was developed by a federal Interagency Working Group to assist agencies in addressing EO 12866, which required federal agencies to assess the cost and the benefits of intended regulations as part of their regulatory impact analyses. The social cost of carbon estimates economic damages associated with increases in carbon emissions and includes, but is not limited to, changes in net agricultural productivity, human health, and property damages associated with increased flood risks over hundreds of years. However, a recent EO titled, "Promoting Energy Independence and Economic Growth," issued March 28, 2017, directed that the Interagency Working Group be disbanded and that technical documents issued by the Interagency Working Group be withdrawn as no longer representing federal policy.

The social cost of carbon is typically expressed as the cost in dollars per metric ton of emissions, and a wide range of cost estimates are available. One factor that creates significant variation in estimates is the discount rate. In social cost of carbon estimates, the discount rate is used to estimate the present value of costs/damages that may occur far out into the future. Small differences in the discount rate can create large variations in estimated social cost of carbon. There is disagreement over which discount rate to use.

In addition, as discussed in the comprehensive technical review commissioned by the Electric Power Research Institute (Rose et al. 2014), a number of technical issues have been identified with the social cost of carbon modeling approach and estimates. Several of these issues arise from the use of three separate underlying models—with differing frameworks, assumptions, and uncertainties. The Electric Power Research Institute technical review "reveals significant variation across models in their structure, behavior, and results and identifies fundamental issues and opportunities for improvements" (Rose et al. 2014).

It should also be noted the social cost of carbon protocol does not measure the actual incremental impacts of a project on the environment and does not include all damages or benefits from carbon emissions. NEPA does not require a cost-benefit analysis (40 CFR Part 1502.23) and one has not been conducted in this supplemental EIS. Without monetized estimates of other effects, including the social benefits of energy production, inclusion of a global social cost of carbon analysis would be unbalanced and of limited use to the decision-maker. Given the uncertainties associated with assigning a specific and accurate social cost of carbon resulting from the GMT2 Project, the BLM has elected not to utilize this tool in its analysis.

4.3 Biological Environment

The following discussion regarding impacts on or by the biological environment is generally categorized and organized as it is in BLM (2014).

4.3.1 Vegetation and Wetlands

The proposed project and the action alternatives would result in impacts to vegetation and wetlands during construction, drilling, and operation. The latter two periods overlap to a considerable extent, especially in Alternative C. These impacts are described specifically for the Alpine satellites area, which include GMT1 and GMT2 (BLM 2004a), in general for the Northeast NPR-A (BLM 2008a), and even more generally for the entire NPR-A (BLM 2012). The following discussion summarizes the impacts to vegetation and wetlands.

4.3.1.1 Methodology

This analysis is an evaluation of impacts resulting from loss of, or alteration to, vegetation and wetlands within the project area (as defined in Section 3.1). The analysis is based on integrated terrain unit mapping that was done of the project area. Effects on vegetation and wetlands from project components were calculated using GIS. The footprints of project components for each alternative were overlain on the baseline integrated terrain unit mapping described in Section 3.3.1, "Vegetation and Wetlands," and the areas of each vegetation and wetland type determined.

The impact evaluation criteria used for analyses are defined in Table 4.3-1. In circumstances where more than one level (magnitude) of intensity may apply to an impact category, the most severe intensity was used for determining impact levels. An analysis of effects on aquatic resources, which may employ more detailed measures, will be conducted during the Clean Water Act Section 404 permit review process that will be performed by the U.S. Army Corps of Engineers for purposes of determining the least environmentally damaging practicable alternative.

Table 4.3-1. Impact criteria; vegetation and wetlands

Impact Category	Magnitude	Definition
Intensity	High	Impacting >25% of a vegetation or wetland type within the project area.[a]
	Medium	Impacting 5 to 25% of a vegetation or wetland type within the project area.
	Low	Impacting <5% of any vegetation or wetland type within the project area.
Duration	Long term	Impact would be permanent, rehabilitation [b] or restoration [c] not possible.
	Interim	Impact would last for the life of the project; rehabilitation possible, but restoration not possible.
	Temporary	Impact would last through project construction or would be incidental in other project phases; rehabilitation likely and restoration possible.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Regional	Extends beyond the GMT2 Project area.
	Local	Extends beyond 300 feet from project components but within the GMT2 Project area.
	Limited	Within the footprint and extending 300 feet from project components.

[a] The project area is defined as the geographic extent of all the action alternatives. The project area was selected to include all major project components of the proposed GMT2 Project and alternatives as well as where supporting activities may be located, as described in Section 3.1.1.

[b] Rehabilitation means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded (terrestrial or) aquatic resource. Rehabilitation results in a gain in resource function, but does not result in a gain in resource area.

[c] Restoration means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded (terrestrial or) aquatic resource (73 *Federal Register* 70 [April 10, 2008], page 19672).

The impacts on vegetation and wetlands may also affect related resources such as soils, hydrology, water quality, and wildlife habitat described in other parts of Chapter 4. This section focuses on the potential impacts on vegetation and wetland ecosystems that are not covered in Section 4.2.2, “Water Resources.”

4.3.1.2 Construction Activities

Gravel Placement and Pipeline Construction

Gravel placed on the tundra surface for the construction of roads, pads, and airstrips would cover the vegetation and possibly alter the natural soil horizons by compression. The areal extent of impacts from placement of gravel by vegetation type for all action alternatives is presented in Table 4.3-2. The depth of gravel would vary depending on the hydrology and topography of each specific location, but must be a minimum of 5 feet thick to maintain the integrity of the underlying permafrost. This results in a great deal of weight applied on each unit area of tundra (at about 2,750 pounds per cubic yard, a 5 foot-thick layer would weigh about 4,580 pounds per square yard applying a pressure of 3.5 pounds per square inch). Heavy vehicles using the gravel roads and pads would add to the weight.

Pipelines would alter snow accumulation and drifting patterns and partially shade vegetation. Each vertical support member installed to elevate pipelines would displace approximately 3.1 square feet of tundra. Buried, hot-oil pipelines are not included in project design, thus avoiding impacts of thermokarst and subsidence that can be associated with them. However, pipelines would cross under gravel roads at various locations along the GMT1 to CD1/Alpine Processing Facility pipeline segments. These crossings would occur along an existing pipeline route where impacts have been previously evaluated and the route permitted as described in Section 2.4.4. To ensure that the existing thermal regime (i.e., permafrost) is maintained at these pipe-road crossings, the pipelines would be installed with rigid insulation between the pipelines and existing ground surface as shown in Appendix A, Sheets 28, 29, and 30. The pipeline routes for Alternatives A and C are the same. The pipeline route for Alternative B differs from the former two where the road for Alternative B diverges from the road route in Alternative A so that the pipe remains within a similar distance of the road.

Gravel Mining

Surface vegetation and overburden would be removed during excavation of gravel (Arctic Slope Regional Corporation Mine site) and temporarily stockpiled on an adjacent ice pad. This ice pad would be built once and the gravel mined from the site would be hauled directly to the construction sites. Gravel extraction for all action alternatives is planned to occur within one season, since opening/closing a gravel cell in one season and completing rehabilitation activities would minimize the impacts to the area around the mine site.

Phase 3 expansion of the Arctic Slope Regional Corporation Mine site would result in loss of the existing Wet Sedge Meadow Tundra, Water (pond), and both Open and Closed Low Willow vegetation and wetlands within the mine footprint. Approximately 465.3 acres would be directly impacted as part of gravel extraction for mine expansion, representing approximately 1.3 percent, less than 0.1 percent and 0.3 percent of the total acreage of these three vegetation types, respectively, within the mapped project area. Although the proposed project will only use about 35 acres of the Phase 3 expansion, it is unknown exactly where that gravel will come from so in order to present the most conservative estimate of impacted habitats the entire 465.3 acres that could be disturbed by the Phase 3 expansion will be evaluated in this analysis. Mined gravel would be transported from the Arctic Slope Regional Corporation Mine site to the project area over ice roads during Year 1 of construction.

After cessation of gravel mining, the site would be closed and rehabilitated. This would include replacement of overburden, contouring, and creation of stable sidewalls. Over the course of time, natural sheet flow would fill the mine site with water and create open water habitat.

Ice Road and Pad Construction

Construction activities would require seasonal ice roads and pads. A summary of ice roads and pads is provided in Table 2.5-2 (Alternative A), Table 2.6-2 (Alternative B), and Table 2.7-2 (Alternative C). The impacts associated with ice road construction would continue during the operations period for Alternative C, the "roadless" alternative.

Compared to gravel roads and pads, seasonal ice infrastructure has less impact to tundra vegetation communities. However, seasonal ice infrastructure may still cause disturbance such as delayed plant development in spring, plant stress, freezing of plant tissues, and physical damage resulting in visible traces on the tundra surface (Felix and Raynolds 1989). Plant communities dominated by shrubs and other woody species are the most susceptible to physical damage and stress caused by construction. Flooded and wet tundra types generally exhibit little or no impact from ice road construction (Felix and Raynolds 1989; Yokel et al. 2007). The impacts to wetlands and vegetation from seasonal ice pads would be similar to those of ice roads. Generally, changes in the thermal regime or compaction of soil have not been found to result from ice road construction. A study by Yokel et al. (2007) suggests that seasonal ice roads and pads that are constructed within the same footprint each year do not have additive effects over years.

Standard ice road construction practices include preconstruction routing surveys and placement of roads to avoid tussock tundra areas, steep stream banks, and deep water holes to the extent possible. As-built data from previous years' ice roads would be considered in design and construction crews would deviate from planned alignments in the field if unexpected environmental conditions were encountered. Any impoundment of snowmelt runoff up-gradient of ice roads, caused by the ice taking longer to melt than the surrounding snow, is expected to be of such short duration each year that its impacts to tundra communities while soils are still frozen are expected to be negligible.

4.3.1.3 Drilling and Operation

Drilling activities would not have specific impacts to wetlands and vegetation different than those discussed for construction. Discussion of potential impacts to wetlands and vegetation from hydrocarbon spills or leaks that could occur during drilling is presented in Section 4.5.

Gravel Spray and Dust Deposition

During operations, there would be indirect impacts to vegetation and wetlands adjacent to gravel roads, pads, and an airstrip resulting from gravel spray and dust deposition, altered snow distribution, hydrologic impoundments, disruption of sheet flow during breakup, increased flooding and thermokarst. Maintenance of gravel roads would include periodic watering to aid in dust suppression.

The effects of these impacts would most likely occur within 300 feet (100 meters) of the gravel feature (Auerbach et al. 1997). Gravel and dust could smother vegetation and cause early snowmelt, reduced soil nutrients, increased soil pH, increased salinity, lowered soil moisture, altered soil organic horizon, higher soil bulk density, and greater depth of active layer thaw. Auerbach et al. (1997) also noted that total biomass was lower next to roads despite higher graminoid biomass near the road. Mosses were negatively affected by road presence; Sphagnum was unable to reproduce near the road due to heavy dusting and increased soil pH.

An area of indirect impact that extends 300 feet to either side of gravel infrastructure is considered a reasonable estimate for an impact zone (Auerbach et al. 1997). It is nearly double the 164 feet used previously to estimate indirect gravel impacts in the NPR-A by BLM (2012) and for the Point Thomson EIS by the U.S. Army Corps of Engineers (2012a), but less than the 328 feet used in the U.S. Army Corps of Engineers of Engineers Nanushuk Draft EIS (U.S. Army Corps of Engineers, 2017). For this analysis, as for the GMT1 analysis before it (BLM 2014), the area of indirect impact was determined by applying a 300-foot-wide buffer to the perimeter of gravel filled areas and calculating the area of each vegetation and wetland type within the impact zone using GIS. Impacts within the 600-foot zone of indirect impact for all action alternatives are presented in Table 4.3-3 and shown in Map 4.3-1.

Tundra Travel

Although not currently planned, off-road tundra travel during the snow-free season using specialized, low-ground-pressure vehicles may occur for maintenance of pipelines and other infrastructure if certain conditions are met. Impacts to vegetation may range from light impacts such as compression to more severe impacts such as displacement or removal. The degree of impacts generally depends on the vegetation type and the number of passes over the tundra (Walker et al. 1977). Several best management practices apply to off-road tundra travel to protect wetlands and vegetation. The Alaska Department of Natural Resources has tested and approved several vehicle types for tundra travel on state lands during summer (Alaska Department of Natural Resources 2015b).

Other Potential Impacts

Water impoundment often occurs where gravel roads and infrastructure with insufficient cross-drainage are constructed across areas susceptible to sheet flow during the spring snowmelt and runoff period. A site-specific analysis of potential inundation by road and project component fill is presented in Section 4.2.2, “Water Resources.” Mitigation involves culverts spaced at approximately 1,000-foot intervals along roads, or more closely as needed and/or stipulated by permit.

Equipment used to haul and place gravel fill could harbor nonnative plant seeds, and the placement of fill would create barren areas that pose the greatest risks for establishment of invasive, nonnative species. Although such establishment is unlikely at the latitude of GMT2 (Carlson et al. 2015), climate warming could eventually present conditions under which such species could become established and spread in the NPR-A within the 32-year lifetime of the GMT2 Project. This could be at the expense of other, naturally occurring plant species that may be displaced, as well as to the wildlife species that use those plants (BLM 2012). BLM (2013) has a mandatory best management practice meant to mitigate this possibility.

Table 4.3-2. Acreage of direct impacts of construction on vegetation and wetlands for action alternatives

Vegetation Type	Wetland Type (Cowardin Code) [a]	Project Area (acres) [b]	Vegetation Type as % of Total Project Area	Alternative A (acres)	Alternative A (%)	Alternative B (acres)	Alternative B (%)	Alternative C (acres)	Alternative C (%)
Barren	Us (upland)	4,766.8	3.0%	--	--	--	--	--	--
Cassiope Dwarf Shrub Tundra	PSS3B	219.8	0.1%	--	--	--	--	--	--
Closed Low Willow	PSS1B	2,615.6	1.7%	--	--	--	--	--	--
Deep Polygon Complex	PUBH, PEM2H, PEM1F, PEM1/SS1B	313.4	0.2%	--	--	--	--	--	--
Dryas Dwarf Shrub Tundra	Upland, PSS3B	215.3	0.1%	--	--	--	--	--	--
Fresh Grass Marsh	PEM1H, R2AB3H	532.6	0.3%	--	--	--	--	--	--
Fresh Sedge Marsh	PEM1H	1,993.5	1.3%	--	--	0.5	0.0%*	5.7	0.3%
Halophytic Grass Wet Meadow, Brackish	PEM1R	350.4	0.2%	--	--	--	--	--	--
Halophytic Sedge Wet Meadow, Brackish	PEM1R	253.9	0.2%	--	--	--	--	--	--
Moist Sedge-Shrub Tundra	PEM/SS1B	26,255.8	16.7%	19.8	0.1%	19.7	0.1%	10.3	0.0%*
Old Basin (Ice Rich) Wetland Complex	PEM1F, PUBH, PEM1B	10,570.2	6.7%	5.1	0.0%*	5.9	0.0%*	--	--
Open Low Willow	PSS1B	3,666.2	2.3%	--	--	--	--	--	--

Vegetation Type	Wetland Type (Cowardin Code) [a]	Project Area (acres) [b]	Vegetation Type as % of Total Project Area	Alternative A (acres)	Alternative A (%)	Alternative B (acres)	Alternative B (%)	Alternative C (acres)	Alternative C (%)
Partially Vegetated	PUSR	1,230.5	0.8%	--	--	--	--	--	--
Riverine Complex	R2UBH, R2AB3H	490.4	0.3%	a	--	--	--	--	--
Tussock Tundra	PEM/SS1B	31,414.0	20.0%	51.1	0.2%	59.1	0.2%	74.4	0.2%
Water	PUBH, R2UBH	27,711.9	17.6%	--	--	--	--	--	--
Wet Sedge Meadow Tundra	PEM1E, PEM1F, PEM1F	33,678.8	21.4%	1.8	0.0%*	2.0	0.0%*	1.7	0.0%*
Young Basin (Ice Poor) Wetland Complex	PUBH, PEM2H, PEM1H, PEM1/SS1B, PEM1B	509.6	0.3%	--	--	--	--	--	--
Unmapped Area	*No Data Available*	10,465.3	6.6%	--	--	--	--	--	--
Total Acres of Indirect Impact for Each Alternative [c]				77.9	N/A	87.2	N/A	92.0	N/A

Note: Values that are greater than zero but less than 0.1 are noted with an asterisk (0.0 percent*). (--) cells indicate the vegetation/wetland type is not present within area considered for impact analysis.

[a] Wetland types are from the Cowardin classification system used by the National Wetland Inventory (http://www.fws.gov/wetlands/; Cowardin et al. [1979]).

[b] Percent of vegetation type within the mapped vegetation portion of the project area. Note that the study area is 157,408.4 acres and that 10,465.3 acres (6.6 percent) of the project area extends outside of the vegetation map coverage.

[c] Total of Impact for Each Alternative does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

Table 4.3-3. Indirect impacts of construction on vegetation and wetlands based on a 300-foot zone of impact

Vegetation Type	Wetland Type (Cowardin Code) [a]	Project Area (acres) [b]	Vegetation Type as % of Total Project Area	Alternative A (acres)	Alternative A (%)	Alternative B (acres)	Alternative B (%)	Alternative C (acres)	Alternative C (%)
Barren	Us (upland)	4,766.8	3.0%	--	--	--	--	--	--
Cassiope Dwarf Shrub Tundra	PSS3B	219.8	0.1%	0.3	0.1%	--	--	--	--
Closed Low Willow	PSS1B	2,615.6	1.7%	--	--	--	--	--	--
Deep Polygon Complex	PUBH, PEM2H, PEM1F, PEM1/SS1B	313.4	0.2%	--	--	--	--	--	--
Dryas Dwarf Shrub Tundra	Upland, PSS3B	215.3	0.1%	--	--	--	--	--	--
Fresh Grass Marsh	PEM1H, R2AB3H	532.6	0.3%	--	--	--	--	--	--
Fresh Sedge Marsh	PEM1H	1,993.5	1.3%	7.3	0.4%	12.5	0.6%	7.1	0.4%
Halophytic Grass Wet Meadow, Brackish	PEM1R	350.4	0.2%	--	--	--	--	--	--
Halophytic Sedge Wet Meadow, Brackish	PEM1R	253.9	0.2%	--	--	--	--	--	--
Moist Sedge-Shrub Tundra	PEM/SS1B	26,255.8	16.7%	172.3	0.7%	172.3	0.7%	37.9	0.3%
Old Basin (Ice Rich) Wetland Complex	PEM1F, PUBH, PEM1B	10,570.2	6.7%	67.3	0.6%	67.8	0.6%	2.4	0.0%*
Open Low Willow	PSS1B	3,666.2	2.3%	1.4	0.0%*	--	--	--	--
Partially Vegetated	PUSR	1,230.5	0.8%	--	--	--	--	--	--
Riverine Complex	R2UBH, R2AB3H	490.4	0.3%	--	--	--	--	--	--
Tussock Tundra	PEM/SS1B	31,414.0	20.0%	349.4	1.1%	441.9	1.4%	178.2	0.6%

Vegetation Type	Wetland Type (Cowardin Code) [a]	Project Area (acres) [b]	Vegetation Type as % of Total Project Area	Alternative A (acres)	Alternative A (%)	Alternative B (acres)	Alternative B (%)	Alternative C (acres)	Alternative C (%)
Water	PUBH, R2UBH	27,711.9	17.6%	2.9	0.0%*	0.6	0.0%*	--	--
Wet Sedge Meadow Tundra	PEM1E, PEM1F, PEM1F	33,678.8	21.4%	20.6	0.1%	16.7	0.0%*	5.2	0.0%*
Young Basin Wetland Complex	PUBH, PEM2H, PEM1H, PEM1/SS1B, PEM1B	509.6	0.3%	--	--	--	--	--	--
Unmapped Area	*No Data Available*	10,465.3	6.6%	--	--	--	--	--	--
Total Acres of Impact for Alternative				621.8	N/A	711.9	N/A	230.8	N/A

Note: Values that are greater than zero but less than 0.1 are noted with an asterisk (0.0%*). (--) cells indicate the vegetation/wetland type is not present within area considered for impact analysis.

[a] Wetland types are from the Cowardin classification system used by the National Wetland Inventory (http://www.fws.gov/wetlands/; Cowardin et al. [1979]).

[b] Percent of vegetation type within the mapped vegetation portion of the project area. Note that the study area is 157,408.4 acres and that 10,465.3 acres (6.6 percent) of the project area extends outside of the vegetation map coverage.

4.3.1.4 Comparison of Alternatives

Table 4.3-2 lists the total direct impacts (area in acres) on vegetation and wetlands. The specific impacts for each alternative are addressed below.

Alternative A

Alternative A would have a direct impact to vegetation totaling 77.9 acres (excluding impacts from vertical support members), with the largest portion consisting of Tussock Tundra vegetation. The impact of vertical support members is estimated to involve only 0.1 acre of total impact. The GMT1–GMT2 Access Road and the GMT2 pad would cover parts of four different vegetation types, including tussock Tundra, Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, and Wet Sedge Meadow Tundra. The direct impacts would affect minor amounts of these and none of the other vegetation types within the project area, with the greatest relative impact being to 0.2 percent of Tussock Tundra and 0.1 percent of Moist Sedge-Shrub Tundra.

The indirect impacts of Alternative A, which would occur primarily as a result of gravel spray and dust deposition extending up to 300 feet from the edge of the gravel footprint, total 621.8 acres (Table 4.3-3). The majority of the vegetation types potentially affected includes Tussock Tundra, Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, and Wet Sedge Meadow Tundra. The area of potential indirect impacts for Alternative A would be 0.4 percent of the total project area. This area does not include more than 5 percent of any vegetation type within the project area, which is below the threshold for low intensity (Table 4.3-1).

All areas of direct and indirect impacts from Alternative A are within potential wetlands. The impacts of Alternative A to vegetation and wetlands are characterized as low intensity because less than 5 percent of any vegetation type in the project area would be impacted; long-term duration; important in context since wetlands are protected by legislation; and limited in geographic extent since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative A is rated minor for impacts to vegetation and wetlands.

A major component of Alternative A is the GMT1–GMT2 Access Road. This is an 8.2-mile linear feature that could result in impacts to vegetation due to inundation (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). These impacts would be mitigated by installation of culverts to allow maintenance of the existing hydrologic regime.

The GMT1–GMT2 Access Road allows year-round vehicle traffic (see Section 2.5.4.2 and Table 2.5-3), which would cause indirect impacts resulting from gravel spray and dust deposition onto the vegetation as discussed above. Ice roads would be required during Years 1 and 2 to support construction activities. Because ice roads take longer to melt than the surrounding snow, they have a potential to cause temporary flooding during spring break-up (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). Tundra flooding could also occur where ice roads cross streams, but this effect would be mitigated by slotting or breaching ice roads in the stream channel. The impacts on vegetation of seasonal ice roads from construction would be limited and would occur only during Years 1 and 2.

Alternative B

Alternative B would have a direct impact to vegetation totaling 87.2 acres (excluding impacts from vertical support members), with the largest portion consisting of Tussock Tundra vegetation. The impact of vertical support members is estimated to involve only 0.1 acre of total impact. The GMT1–GMT2 Access Road and the GMT2 pad would cover parts of five different vegetation types, including Tussock Tundra, Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, Wet Sedge Meadow Tundra, and Fresh Sedge Marsh. The direct impacts would affect minor amounts of these and none of the other vegetation types within the project area, with the greatest relative impact being to 0.2 percent of Tussock Tundra and 0.1 percent of Moist Sedge-Shrub Tundra.

The indirect impacts of Alternative B, which would occur primarily as a result of gravel spray and dust deposition extending up to 300 feet from the edge of the gravel footprint, total 711.9 acres (Table 4.3-3). The majority of the vegetation types potentially affected includes Tussock Tundra, Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, and Wet Sedge Meadow Tundra. The area of potential indirect impacts for Alternative A would be 0.5 percent of the total project area. This area does not include more than 5 percent of any vegetation type within the project area, which is below the threshold for medium intensity (Table 4.3-1).

All areas of direct and indirect impacts from Alternative B are within potential wetlands. The impacts of Alternative B to vegetation and wetlands are characterized as low intensity because less than 5 percent of any vegetation type in the project area would be impacted; long-term duration; important in context since wetlands are protected by legislation; and limited in geographic extent since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative B is rated minor for impacts to vegetation and wetlands.

A major component of Alternative B is the GMT1–GMT2 Access Road. This is linear feature would be slightly longer than that for Alternative A could result in slightly greater impacts to vegetation due to inundation (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). These impacts would be mitigated by installation of culverts to allow maintenance of the existing hydrologic regime.

The GMT1–GMT2 Access Road allows year-round vehicle traffic (see Section 2.5.4.2 and Table 2.5-3), which would cause indirect impacts resulting from gravel spray and dust deposition onto the vegetation as discussed above. Ice roads would be required during Years 1 and 2 to support construction activities. Because ice roads take longer to melt than the surrounding snow, they have a potential to cause temporary flooding during spring break-up (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). Tundra flooding could also occur where ice roads cross streams, but this would be mitigated by slotting or breaching ice roads in the stream channel. The impacts on vegetation of seasonal ice roads from construction would be limited and they would occur only during Years 1 and 2.

Alternative C

Alternative C would have direct impacts to vegetation totaling 92.0 acres (excluding impacts from vertical support members), with the largest area involving tussock tundra vegetation. The impact of vertical support members is estimated to involve only 0.1 acre of total impact. The GMT2 pad, airstrip and Airstrip Access Road would occupy mostly Tussock Tundra with small amounts of Moist Sedge-Shrub Tundra. Air access facilities and the occupied structure pad would occupy mostly Tussock Tundra, with smaller amounts of Moist Sedge-Shrub Tundra, Fresh Sedge Marsh, and Wet Sedge Meadow Tundra. The direct impacts would affect minor amounts of each vegetation type within the project area, with the greatest relative impact being 0.2 percent of Tussock Tundra and 0.3 percent of Fresh Sedge Marsh.

The indirect impacts of Alternative C, occurring from gravel spray and dust deposition from all gravel infrastructure extending up to 300 feet from the edge of the gravel footprint, would total an estimated 230.8 acres. The majority of the acreage affected would include these vegetation types: Tussock Tundra, Moist Sedge-Shrub Tundra, Fresh Sedge Marsh, Wet Sedge Meadow Tundra, and Old Basin Wetland Complex. The area of potential effect from indirect impacts for Alternative C would be 0.15 percent of the total project area. This area does not include more than 5 percent of any single vegetation type within the project area, and thus falls below the threshold for medium intensity under the vegetation impact criteria.

All areas of direct and indirect impacts of Alternative C are within potential wetlands. The impacts of Alternative C to vegetation and wetlands are characterized as low intensity because less than 5 percent of any vegetation type in the project area would be impacted; long-term duration; important in context since wetlands are protected by legislation; and limited in geographic extent since they are expected to occur within 300 feet of the project components. Overall, Alternative C is rated minor for impacts to vegetation and wetlands.

Alternative C includes additional pads (occupied structure pad and air access facilities) and a 0.9-mile-long Airstrip Access Road, totaling a 2.3-mile-long feature which could result in impacts to vegetation due to inundation (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). While these impacts are typically mitigated by installation of culverts to allow maintenance of the existing hydrologic regime, culverts would only be feasible along the Airstrip Access Road; the pads and airstrip are too wide to allow use of culverts.

Year-round access would be provided by aircraft, while summer vehicle traffic would be limited to the Airstrip Access Road (see Section 2.6.4 and Table 2.6-3). Aircraft landing at the airstrip and vehicle traffic would cause indirect impacts resulting from gravel spray/dust deposition onto the vegetation as discussed above. Dust distribution (and therefore impacts) associated with air strips may not be the same as with roads.

Ice roads would be required to support construction activities. Additionally, an annual 7.0-mile-long ice road would be required between the GMT1 pad and the occupied structure pad to allow vehicle access during winter throughout 30 post-construction drilling and operating years. The ice road may alter drainage during spring break-up and thus temporarily flood vegetation because the ice would melt more slowly than the surrounding snow (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). Blockage of streamflow could have the same effect, but this would be mitigated by slotting or breaching ice roads.

Gravel Mining

Gravel mining would be required to construct each of the action alternatives. Under Phase 3 of the Arctic Slope Regional Corporation Mine expansion, 465.3 acres would be directly disturbed, representing approximately 1.3 percent, less than 0.1 percent and 0.3 percent of the total acreage of Wet Sedge Meadow Tundra, Water (pond) and both Open and Closed Low Willow vegetation and wetlands, respectively, within the mapped project area.

Other Potential Impacts

There are no known occurrences of BLM sensitive plant species near the proposed facilities for any of the action alternatives. The nearest documented occurrence is approximately 7 miles away as described in Section 3.3.1, “Vegetation and Wetlands.” Overall, potential impacts to sensitive plant species are expected to be none to negligible under all the alternatives.

All action alternatives have the potential for spills to vegetation and wetlands resulting from pipelines, storage tanks, production facilities and infrastructure, drill rigs, or vehicles. Generally, because the location and length of oil transit pipelines under the action alternatives are similar, differences in the potential risk from a pipeline spill are minimal. Alternative C has a slightly greater potential risk of a pipeline spill due to the additional ancillary diesel pipeline.

However, greater differences in the risk to the surrounding environment are expected in regards to spill response capabilities as discussed in Section 2.9.2, “Spill Prevention and Response.” Over half of the GMT1–GMT2 Access Road (Alternatives A and B) is downgradient from the pipeline, and would act as a barrier to spill migration. The GMT1–GMT2 Access Road would also be used during pipeline inspections and spill response. Because Alternative C is roadless and relies upon air support and yearly ice road construction for incident response, risks to vegetation and wetlands associated with an oil spill are increased throughout the life of the project.

Potential impacts of oil spills are described in BLM (2012), and in Section 4.5 of this document. The extent of environmental impacts from a spill would depend on the type and amount of spilled material, the location of the spill, and the effectiveness of the cleanup. Based on North Slope spill history, it is anticipated that the majority of spills would be contained on a gravel road or pad with little or no impacts to wetlands or vegetation.

Alternative D

Alternative D, no action, would not permit the GMT2 Project and would have no new impacts on vegetation or wetlands from the GMT2 Project.

Comparison of Alternatives

A major difference in access between action alternatives is the inclusion of the GMT1–GMT2 Access Road (Alternatives A and B) or inclusion of the occupied structure pad, air access facilities, and Airstrip Access Road (Alternative C). Alternative C has the largest impact of all alternatives (92.0 acres), followed by Alternative B (87.2 acres), and Alternative A (77.9 acres). Alternative D (no action) would have no impact on vegetation/wetlands. Alternative C has a larger footprint than Alternatives A or B because of the need for the occupied structure pad, air access facilities, and the Airstrip Access Road.

The area of potential effect for indirect impacts as a result of gravel spray and dust deposition (within 300 feet of the gravel footprint) differs among alternatives. Alternative B has the largest footprint (711.9 acres), followed by Alternative A (621.8 acres) and Alternative C (230.8 acres). The areas for Alternatives B and A are significantly larger than that for Alternative C because they each include a linear feature (GMT1–GMT2 Access Road). Because Alternative C is more compact (all features are within 2.3 miles) the area of potential affect for indirect impacts is smaller.

Under all action alternatives, gravel placement would cover between 0.0 and 74.4 acres of each of five vegetation/wetland types (Alternative A: Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, Tussock Tundra, and Wet Sedge Meadow Tundra; Alternative B: Fresh Sedge Marsh, Moist Sedge-Shrub Tundra, Old Basin (Ice Rich) Wetland Complex, Tussock Tundra, and Wet Sedge Meadow Tundra; Alternative C: Fresh Sedge Marsh, Moist Sedge-Shrub Tundra, Tussock Tundra, and Wet Sedge Meadow Tundra; Table 4.3-2). Map 3.3-2 depicts the GMT2 Access Road route and vegetation types that would be crossed.

Alternatives A and B include construction of the GMT1–GMT2 Access Road and the GMT2 drill pad. Alternative C includes pads, air access facilities, and the 0.9-mile long connecting Airstrip Access Road. These features could result in impacts to vegetation from inundation (see Section 4.2.2.4, “Comparison of Alternatives, Water Resources”). Impacts would be mitigated by installation of culverts where feasible to allow maintenance of the existing hydrologic regime. For Alternatives A and B, culverts are considered at all water crossings. Alternatives A and B would potentially require an estimated 46 culverts and 50 culverts, respectively (Table 4.2-9). Alternative C would have a 0.9-mile Airstrip Access road, which could require an estimated five culverts. Discussion of water crossings is included in Section 4.2.2.3.

Alternatives A and B would require year-round vehicle traffic along the GMT1–GMT2 Access Road while Alternative C would provide year-round access via aircraft and vehicle access only during the ice-road season. Indirect impacts resulting from gravel spray/dust deposition onto the vegetation would result from vehicle traffic along the GMT1–GMT2 Access Road (Alternatives A and B) or from aircraft landing and vehicle traffic along the Airstrip Access Road (Alternative C). There would be less gravel spray/dust deposition associated with Alternative C from vehicle traffic due to the shorter Airstrip Access Road and typical vehicle traffic being slower than along the GMT1–GMT2 Access Road, but the amount of dust deposition from aircraft is not known.

Alternatives A and B would require 2 years of ice roads to support construction, while Alternative C would have 30 additional years of a 7.0-mile long annual ice road. These annual ice roads within the same corridor could result in the vegetation being scuffed or compressed year after year. These results may be additive, although at least one study has suggested otherwise (Yokel et al. 2007). Additionally, ice roads could alter drainage during spring break-up and temporarily inundate vegetation because the ice would melt more slowly than the surrounding snow. For all alternatives, blockage of streamflow could occur and thus temporarily inundate vegetation if ice roads are not adequately slotted or breached.

4.3.1.5 Mitigation

Design features and activities intended to minimize impacts from the project would be included in all the action alternatives. Lease stipulations, best management practices and permit requirements would provide additional protection measures.

Lease stipulations and best management practices, if properly implemented, should effectively reduce the impacts of development on vegetation (BLM 2012). Specifically, BMPs A-1 through A-7 on solid and liquid-waste disposal, fuel handling, and spill cleanup would reduce the potential for intentional or unintentional releases, spills, and solid waste onto the tundra. BMPs A-9 and A-10 would reduce air pollution. BMP C-2 regarding overland moves (and seismic work) would also effectively minimize impacts to vegetation. In addition to BLM best management practices, certain State of Alaska statutes and regulations also protect vegetation and wetlands. A list of State environmental protection regulations can be found in Appendix J.

Best management practices affecting development (BMP E-4, E-5, E-6, and E-12) such as facility design and construction of pipelines, roads, pads, airstrips, and other facilities, are expected to effectively minimize the amount of habitat that would be altered by gravel pads and other surface disturbances. Lease Stipulation G-1 would facilitate the regrowth of native vegetation following facility abandonment. The setbacks outlined in Lease Stipulations K-1 and K-2 associated with development near rivers and lakes would minimize impacts in high-value wetlands such as areas dominated by pendant grass, riparian or floodplain habitats. BMP L-1 would minimize impacts to vegetation of summer tundra travel, if such an action is proposed and permitted.

4.3.1.6 Conclusions

The likelihood of impacts to vegetation and wetlands identified in this document can be separated into reasonably foreseeable and potential as shown in Table 4.3-4. No evaluated effects were determined to be without impacts of one or the other category.

Plant communities and wetlands would be impacted by gravel mining and placement. They could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of natural drainage patterns.

Table 4.3-4. Likelihood of impacts; vegetation and wetlands

Reasonably Foreseeable Impacts	Potential
Smothering of vegetation and alteration of the natural soil horizon by compression from gravel placement.	Changes to vegetation or potential destruction caused by changes to natural drainage patterns or dewatering discharges from mining operations.
Alteration of snow accumulation patterns from gravel infrastructure and pipelines.	Physical damage and stress to plant communities from seasonal ice infrastructure and altered drainage patterns during spring break-up.
Shading of vegetation from pipelines.	Contamination from spills or leaks.
Loss of existing vegetation and wetlands from mine excavation and gravel placement.	Exposure of bare substrate and decreased vigor of associated vegetation around water sources if complete recharge does not occur.
Smothering of vegetation and changes in soil composition resulting from gravel spray/dust deposition caused by vehicle activity or aircraft traffic on gravel pads, road, and airstrip.	Damage to vegetation by impoundment of water from gravel infrastructure. Introduction of nonnative plant species by equipment use. Compression/alteration of wetlands from off-road tundra travel. Changes in chemical composition of tundra by discharges of treated domestic wastewater according to the terms of Alaska Pollutant Discharge Elimination System permitting.

Direct and Indirect Impacts

The direct impacts of construction and operation of the project alternatives include destruction of vegetation and wetlands during construction of gravel pads, roads, and airstrip; and from excavation of material sites and construction of vertical support members. These impacts are characterized as long term. The direct impacts would be slightly lower for Alternative A, intermediate for Alternative B, and greatest for Alternative C as described in Table 4.3-2. The area of potential effect for indirect impacts from Alternatives A and B are roughly 2.7 and 3.1 times, respectively, that from Alternative C (see Table 4.3-3).

Overall, all alternatives are predicted to have minor impacts to vegetation and wetlands. The primary difference is the relative immediacy of impact, with Alternative A and B having less direct impact and more indirect impact, and Alternative C having the most direct impact and least indirect impact. Alternative D would have no impacts to vegetation or wetlands. However, the direct impacts associated with a long-linear structure, such as a road, are not necessarily encompassed solely on wetland acreages filled, but rather on the different types of habitats and their juxtaposition to one another that the road crosses. A road may potentially bisect habitats, therefore impacting the “edge-effect” of adjacent habitats.

Risk of inundation would be similar for all action alternatives: Alternative B contains the longest access road and would have a slightly greater risk of inundation than Alternative A or C. However, impacts would be mitigated by installation of culverts for cross drainage (as for Alternative A). Alternative C contains the shortest access road, and would have culverts installed at similar intervals along the Airstrip Access Road, but culverts could not be installed across the airstrip since they are too wide to allow use of culverts. For all alternatives, culverts could not be installed across the GMT2 drill pad since it is too wide to allow use of culverts.

Potential Impacts Due to Climate Change

Studies of climate change in the Arctic have shown that warming temperatures affect the distributions and growth rates of plant species, resulting in changes to the composition of Arctic tundra toward increased shrub height and cover extent (Chapin et al. 1995; Sturm et al. 2001; Walker et al. 2006) and increased grass and sedge species in some areas. These increases would likely be at the expense of lichen and moss cover (Chapin et al. 1995; Cornelissen et al. 2001, Jorgenson and Buchholtz 2003c; Epstein et al. 2004; Walker et al. 2006). Warming may also increase the potential for thermokarst resulting from disturbance of organic mats or creation of impoundments. As the climate warms, spread of invasive plants northward would become more likely (Carlson et al. 2015), and project components would provide vectors and establishment sites for such plants (BLM 2012). There also exists a potential for interaction between project impacts and climate change effects. In particular, climate change could cause vegetation changes and wetland drying that may exacerbate the indirect impacts of gravel fill, including dust deposition and tundra drying. The latter may occur on the downgradient sides of gravel fills. Other effects of climate change are discussed in Section 3.2.4, “Climate Change.”

4.3.2 Fish

The potential impacts of oil and gas development on fish resources in the NPR-A, including the project study area, are discussed in BLM (2012, Section 4.3.7); potential impacts from the nearby GMT1 development that will be connected to GMT2 are found in BLM (2014, Section 4.3.2). The discussion here largely focuses on comparison of the alternatives.

Impact analysis criteria used in this assessment for fish and fish habitat are presented in Table 4.3-5. These criteria were developed based on a range of possible outcomes and provide a frame of reference for impacts.

Table 4.3-5. Impacts to fish and fish habitat [a]

Impact Category	Magnitude	Definition
Intensity	High	**Fish:** Would impact normal movements of fish populations, or survival or reproductive success, resulting in population-level impacts, or the distribution of fish populations. **Habitat:** Would impact greater than 25% of a water body (stream length or lake area) in the project area used as fish habitat (including spawning, overwintering, feeding, and seasonal migrating).
	Medium	**Fish:** Impact would be measureable, but would not affect normal fish/invertebrate movement, or would have the potential to impact individual fish survival or reproductive success, but population-level impacts not expected. **Habitat:** Would impact 5% to 25% of a waterbody used as fish habitat, or spawning or overwintering habitat outside of spawning or overwintering activity periods.
	Low	**Fish:** An impact that cannot be measured or detected. **Habitat:** Would impact less than 5% of a water body in the project area that provides fish habitat.
Duration	Long term	**Fish:** Impact would last longer than two life cycles of an affected species. **Habitat:** Impact would extend beyond the life of the project; restoration not possible.
	Interim	**Fish:** Impact would last longer than 2 years, but less than two life cycles of affected species. **Habitat:** Impact would last for life of project; restoration possible.
	Temporary	**Fish:** Impact would last 2 years (24 months) or less. **Habitat:** Impact would last through project construction, restoration possible or not needed.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Regional	Extends beyond project area.
	Local	Extends beyond project components but within project area.
	Limited	Within the footprint from project components.

[a] Fish habitat includes summer feeding areas, and spawning and overwintering habitat, as well as migration routes that connect summer feeding areas with overwintering habitat.

4.3.2.1 Construction

Ice Roads and Pads

The potential effects of ice roads and pads on fish include impacts to water-source lakes and fish in those lakes, water quality impairment during runoff, and fish barriers at stream crossings during spring breakup (BLM 2012, Section 4.3.7.2). These effects are mitigated by BMPs A-3, A-4, and A-5 (hazardous materials), B-1 and B-2 (water use), and C-3 and C-4 (stream crossings).

The amount of lake water use and water quality impairment risk associated with each alternative is proportional to the miles of ice road that would be required. From this perspective, during the construction phase the potential incidence of impacts on fish would be greatest under Alternative C (102.8 miles, 251.3 million gallons) and slightly less under Alternative A (96.5 miles, 227.9 million gallons) and Alternative B (95.2 miles, 230.8 million gallons).

Ice road stream crossings for the construction phase of each of the alternatives would occur at the Nigliq Channel and Tinmiaqsigvik (Ublutuoch) River during both years and additionally at the Colville River, Barely Creek, and Crea Creek during one of the years. In the past decade, industry has utilized the shallow upper Ublutuoch River crossing several times. The lower crossing would be in the vicinity of the permanent bridge where water depths are much greater (MJM Research 2005a) and overwintering habitat exists for several species of fish (Map 3.3-3) (Morris 2003). In-season monitoring would be necessary here to avoid impacts to fish habitat, similar to data collected annually at the Colville River ice bridge (e.g., Michael Baker Jr. Inc. 2013b). Portions of the ice road spanning the smaller streams would also require adequate breaching in the spring to ensure the passage of fish.

Gravel Mining

The potential effects on streams from gravel mining include changes in geomorphology as well as increased turbidity and sedimentation (BLM 2012, Section 4.3.7.2). Mitigation would occur under BMP E-8 (gravel mine site design and reclamation), which allows for site-specific considerations in developing a mining plan.

The Arctic Slope Regional Corporation Mine site is the proposed gravel source for the GMT2 Project, regardless of the action alternative. The Arctic Slope Regional Corporation Mine is adjacent to the Colville River, which is a valuable fishery resource for the region (Morris 2003; MJM Research 2007; Moulton et al. 2010). Alternative C would require the most gravel (930,000 cubic yards), followed by Alternative B (747,300 cubic yards), with the least amount of gravel required for Alternative A (671,300 cubic yards). However, since the Arctic Slope Regional Corporation Mine site does not directly disturb fish-bearing waters, none of the alternatives should have an impact on fish habitat due to gravel mining.

The placement of gravel on the tundra (gravel fill) for the construction of roads, pads, and airstrips would potentially cause an increase in turbidity and sedimentation in streams and lakes during the following spring breakup period. The longer-term potential impacts from gravel fill are discussed under Section 4.3.2.2, “Drilling and Operation.”

4.3.2.2 Drilling and Operation

Ice Roads and Pads

Only Alternative C would require ice roads (7.0 miles annually) during the drilling and operation phase of the project, necessitating a greater amount of winter water needs (drilling: 2.5 million gallons per year; operations: 7.5 million gallons per year) compared to Alternatives A and B (0.0 miles per year; drilling 2.5 million gallons per year; operations: 0.5 million gallons per year). The annual ice road program under Alternative C would be necessary over the life of the project, making fish resources the most susceptible to winter impacts under that alternative.

Roads, Pads, and Airstrips

Possible effects of roads, pads, and airstrips (i.e., gravel fill) on fish resources are related to runoff patterns, runoff content, and stream crossings (BLM 2012, Section 4.3.7.2). These potential effects are mitigated by Lease Stipulations/BMPs A-2 (wastewater), A-3, A-4, and A-5 (hazardous materials), A-7 (produced water), Lease Stipulation E-2 (infrastructure setback from fish-bearing waters), E-5 (minimize footprint), E-6 and E-14 (stream and marsh crossings), and K-1 (Fish Creek and Ublutuoch River setbacks). The specific location of gravel infrastructure under each alternative most strongly influences the potential effects on surrounding waters.

Alternatives A and B require a gravel road between GMT1 and GMT2, while Alternative C only requires an airstrip access road. Generally, the greater the road length, the more likely surface water flow may be altered and potentially impact natural water levels in streams and lakes. Similarly, the greater the road surface area, the more likely fish resources may be impacted from runoff content (e.g., water quality) or further effects on runoff patterns caused by the addition of this impervious surface. Alternative B requires the longest road (9.3 miles) and largest surface area (72 acres). Alternative A requires slightly less length (8.2 miles) and area (62.8 acres), while Alternative C requires much less than either of the other alternatives (0.9 mile, 7.2 acres). However, while the road under Alternative B would be slightly longer than under Alternative A, Alternative B more closely follows a watershed boundary, potentially reducing possible impacts to surface water drainage. Additionally, the road under Alternative B does not cross any fishbearing streams. The road under Alternative A crosses a small stream (outlet from Lake M9925) where ninespine stickleback have been observed. A culvert designed to allow passage of ninespine stickleback seasonally into Lake M9925 could mitigate impacts to the system.

The placement of the GMT2 drill pad is the same for all alternatives; the pad is situated in an area of localized high terrain with minimal contributing upstream catchment area or surface water cross drainage. However, pad size is greater under Alternative C (19.1 acres) than under Alternatives A and B (14.0 acres). Additionally, Alternative C would require an occupied structure pad (18.4 acres) and an airstrip (47.3 acres) while the other alternatives would not, further contributing to a greater likelihood of impacts to fish resources from gravel pads under Alternative C.

A final consideration for potential impacts of roads, pads, and airstrips on fish resources is the proximity of these structures to lakes and streams. For example, the E-2 Lease Stipulation requires that permanent oil and gas facilities be set back greater than 500 feet from fishbearing waterbodies. The only gravel infrastructure that would be located within 500 feet of a fishbearing waterbody is the road for Alternative B, which would be located within that distance from Lake M9925.

Pipelines

The potential for pipelines to effect fish resources is related to inspection and maintenance, stream crossings, length (fluid spill potential), proximity to fishbearing waterbodies, and number of different pipes (BLM 2012, Section 4.3.7.2). These elements would be mitigated by BMP A-3 (spill prevention and response plan), Lease Stipulation E-2 (infrastructure setback from fish-bearing waters), BMP E-4 (pipeline design, construction, and operation), and BMP L-1 (summer tundra travel), and State of Alaska statutes and regulations (see Appendix J).

Only slight differences exist among the alternatives regarding the risk of a pipeline impacting fish. The maintenance plan would be the same, there are no stream crossings, and the lengths are very similar, with Alternative B having a marginally longer pipeline (9.4 miles) compared to Alternatives A and C (8.6 miles). However, the Alternative B pipeline does remain set back greater than 500 feet from all fishbearing waterbodies, while Alternatives A and C are closer than that to Lake M9925. Finally, Alternative C would have an additional pipe for diesel and mineral oil, which would not be required under Alternatives A and B.

Table 4.3-6. Comparison of impacts by alternative and project phase

Project Component	Alternative A	Alternative B	Alternative C
Years of ice roads	2-3	2-3	32
Miles of ice roads (construction)	96.5	95.2	102.8
Estimated winter water needs for ice roads and pads (construction) [a]	227.9 MG	230.8 MG	251.3 MG
Ice road stream crossings (construction)	Nigliq Channel & Ublutuoch River (2 years each); Colville River, Barely Creek, & Crea Creek (1 year each)	Nigliq Channel & Ublutuoch River (2 years each); Colville River, Barely Creek, & Crea Creek (1 year each)	Nigliq Channel & Ublutuoch River (2 years each); Colville River, Barely Creek, & Crea Creek (1 year each)
Miles of ice roads (drilling & operation)	0	0	7.0
Estimated winter water needs for ice roads and pads (drilling & operation) [a]	Drilling: 2.5 MG/year Operations: 0.5 MG/year	Drilling: 2.5 MG/year Operations: 0.5 MG/year	Drilling: 9.5 MG/year Operations: 7.5 MG/year
Ice road stream crossings (drilling & operation)	0	0	0
Gravel mine needs	671,300 cubic yards	747,300 cubic yards	930,000 cubic yards
Gravel road length	8.2 miles	9.3 miles	0.9 miles
Gravel road surface area	62.8 acres	72 acres	7.2 acres
GMT2 drill pad	14.0 acres	14.0 acres	19.1 acres
Occupied structure pad	0	0	18.4 acres
Airstrip & apron	0	0	47.3 acres
Gravel road stream crossings	1 (M9925 outlet)	0	0
Fishbearing waterbodies within 500 feet of gravel infrastructure	1 (M9925)	1 (M9925)	0
Pipeline length	8.6 miles	9.4 miles	8.6 miles
Fishbearing waterbodies within 500 feet of pipeline	1 (M9925)	0	1 (M9925)
Additional pipeline components?	none	none	Diesel & mineral oil supply

[a] MG = million gallons.

4.3.2.3 Comparison of Alternatives

In general, the potential impacts of each action alternative on fish and fish habitat are related to individual project components most relevant to fish resources, as listed in Table 4.3-6.

All alternatives pose similar risk to fish and fish habitat during the first 2-3 years of the construction phase. After that, much less risk would occur during winter under Alternatives A and B, as compared to Alternative C, which would require an annual ice road. In considering year-round potential impacts, Alternatives A and B would have similar types of possible effects from permanent roads, although Alternative A would place fish resources at the greatest risk due to a stream crossing. Alternative C would have the least year-round potential impacts to fish; however, the substantial increase in impervious surface area required for the airstrip and occupied structure pad could lead to increased impacts under Alternative C in the vicinity of the GMT2 pad. The impact risk associated with Alternative C would be localized at the GMT2 pad, while the impact risk from Alternatives A and B would span the landscape. The risk to fish resources from oil pipelines would be very similar under all the alternatives, although the additional diesel (and mineral oil) pipe required for Alternative C makes that alternative more likely to result in an impact from pipelines.

4.3.2.4 Mitigation

The risk of impacts to fish and fish habitat related to project activities would be reduced by adherence to best management practices and lease stipulations. These best management practices and lease stipulations include requirements and guidelines for handling hazardous materials, water use, ice road stream crossings, culvert placement and design, and size and location of pads, roads, and pipelines. A list of best management practices and lease stipulations that will reduce the risk of impacts to fish and fish habitats is outlined in the below list. In addition to BLM best management practices, certain State of Alaska statutes and regulations also protect fish resources. A list of State environmental protection regulations can be found in Appendix J.

- BMP A-2: Pumpable waste be injected and that mud and cuttings be stored only temporarily until they are used to facilitate injection or backhauled.
- BMPs A-3 and A-4: Require impermeable containment, spill prevention, and response planning.
- BMP A-5: Prohibits equipment refueling within 500 feet of the active floodplain of any water body and fuel storage exceeding 210 gallons must also be outside of this setback.
- BMP A-6: Prohibits surface discharge of reserve-pit fluids.
- BMP B-1: Prohibits winter water withdrawals from rivers and streams.
- BMP B-2: Limits withdrawal based on maximum depth and fish species present; requires intake screens on water withdrawals and screen design must be approved by Alaska Department of Fish and Game, Division of Habitat; sets restrictions on withdrawals during ice-free periods; limits compaction or removal of snow from an area of grounded ice.
- BMP C-3: Streambank protection; removal, breaching or slotting of snow and ice bridges before spring breakup.
- BMP C-4: Location of winter transportation bridges.
- Lease Stipulation E-2: Prohibits permanent oil and gas facilities being constructed within 500 feet from fish-bearing water bodies. *Note:* BLM authorized a deviation from this stipulation (BLM 2004a).
- BMP E-4: Requires that pipelines be built and operated with the best available technology for detecting and preventing corrosion or mechanical defects.

- BMP E-5: Minimization of impervious surfaces by encouraging a reduced development footprint.
- BMP E-6: Mandates fish passage and emphasizes that bridges, rather than culverts, are the preferred method for channel crossings; addresses stream and marsh crossings, is to reduce the potential for altering natural drainage patterns. (Examples of fish-passage culvert design are provided as an attachment to Appendix A.)
- BMP E-8: Requires approval of the gravel mine site design and reclamation in consultation with other appropriate federal, state, and North Slope Borough agencies and would be subject to additional protections under AS 16.05.871.
- BMP E-14: Requires hydrology and fish studies to determine the appropriate structures at stream channel crossings to reduce impacts on fish.
- Lease Stipulation D1: Restricts drilling in rivers, streams, and fish-bearing lakes.
- Lease Stipulation E-2: Requires that permanent oil and gas facilities and infrastructure be more than 500 feet from lakes, with essential pipeline and road crossings evaluated on a case-by-case basis; limits pipelines within 500 feet of fish-bearing waters and crossing of lakes; restricts discharge of pollutants from vehicle and equipment use, personnel camps, and produced fluids.
- Lease Stipulation K-1: Establishes setbacks from major rivers, including Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River; exceptions for essential road and pipeline crossings. *Note:* BLM authorized a deviation from this stipulation (BLM 2004a).
- Lease Stipulation K-2: Establishes a 0.25-mile development setback from deep-water lakes, defined as those greater than 13 feet except essential road and pipeline crossings considered on a case-by-case basis.

4.3.2.5 Conclusion

As described above, the potential impacts to fish 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 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.

Based on the impact criteria established in Table 4.3-5, the various project components most relevant to fish (Table 4.3-6), and the potential impacts associated with those, Alternative C would have the greatest potential impact on fish resources during the winter (due to ice road stream crossings and lake water withdrawals) and the greatest impacts from pipelines due to reduced capacity to detect and respond to spills. Impacts from gravel infrastructure would likely be more extensive under Alternatives A and B. While there are slight differences between some project components within Alternative A and B, the magnitude of risk would be very similar.

The context of all alternatives would be “important”, with anadromous fish species and anadromous waters in the project area protected by legislation, along with the existence of seasonal habitats critical to the life history of many fish species. Similarly, the geographic extent of all alternatives would be “regional”, due to the fact that many fish species make extensive seasonal movements and utilize a variety of habitats that can extend beyond the project area. Given the fairly low level of fish resources present in the immediate area between GMT1 and GMT2, the intensity of effects would likely be “low” and the duration would likely be “temporary”.

4.3.3 Birds

The potential direct and indirect impacts to birds from the activities and infrastructure associated with the proposed GMT2 Project and other action alternatives are addressed in this section.

The GMT2 Project has the potential to impact birds; bird behavior; and their 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 (BLM 2012, U.S. Army Corps of Engineers 2012).

The impact evaluation criteria for birds are presented in Table 4.3-7 and are based on the general impact criteria described in Section 4.1.2, “Impact Criteria.”

As indicated by the impact criteria, this evaluation primarily utilizes habitat to make determinations as to impact ratings. The size and percentage of the project area covered by potential high-value habitats for each focal bird species, shown in the first column of Table 4.3-8 and Table 4.3-9, are used in evaluation of direct and indirect impacts. Potential high-value habitats were selected using statistical analysis which identified species preference for select habitat types within the Alpine Satellite Development Plan project area and Colville River Delta whenever available (Johnson et al. 2013). For some species groups (e.g., gulls, geese, shorebirds, and passerines), potential high-value habitats were selected by habitat use documented in Johnson et al. (2013) and BLM (2004). The evaluation of birds is divided into two project phases: (1) construction, and (2) drilling and operation.

Table 4.3-7. Impact criteria; birds

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting 25% or more of a single high-value bird habitat present within the project study area.
	Medium	Potentially affecting more than 5%, but less than 25% of a single high-value bird habitat present within the project study area.
	Low	Potentially affecting 5% or less of a single high-value bird habitat present within the project study area.
Duration	Long Term	Lasting longer than 10 years.
	Interim	Lasting longer than 2 years, but less than 10 years.
	Temporary	Lasting less than 2 years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region, and is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality or region and is not protected by legislation.
Geographic Extent	Regional	Extends beyond the GMT2 Project area.
	Local	Extends beyond 300 feet from project components, but within the GMT2 Project area.
	Limited	Within the footprint and extending 300 feet from project components.

4.3.3.1 Construction

Birds and bird habitats could be impacted during construction by habitat loss and alteration, disturbance and displacement, and mortality.

Habitat Loss and Alteration

Long-term bird habitat loss and alteration would be initiated during gravel extraction and placement of fill. These activities would be completed during the winter, when most birds are absent from the project area. No birds or nests would be lost as a direct result of gravel mining or placement of fill. During construction of roads and pads, gravel mine sites and tundra covered by gravel would be lost to use by birds. This loss of habitat would continue through the duration of the construction and operation of the project (BLM 2012). Habitat restoration are likely to create habitats that are different from the ones initially lost to gravel extraction and placement and may not be able to support species that may have been displaced.

In addition to permanent habitat loss, temporary loss of habitat associated with gravel placement could occur on tundra adjacent to gravel structures, where accumulated snow from snow-plowing activities or snowdrifts would become compacted and lead to delayed snowmelt. Delayed snowmelt persisting into the nesting season could preclude tundra-nesting birds from nesting in those areas (BLM 2012).

Gravel infrastructure such as roads and pads can result in gravel spray and dust deposition (e.g., from vehicle traffic or wind), which can affect bird habitat by causing early snowmelt, and thus, early green-up on tundra adjacent to roads, pads, and airstrips which could attract waterfowl and shorebirds early in the season when other areas are not yet snow-free. Dust deposition could also increase thermokarst and soil pH, and reduce the photosynthetic capabilities of plants in areas adjacent to roads (Auerbach et al. 1997). Ground and air traffic (including helicopters), and wind can influence the amount of dust that may be deposited adjacent to roads and pads (BLM 2012). For this analysis, a distance of 300 feet from the edge of gravel roads and pads was used to estimate the zone of impact for dust deposition, as discussed in Section 4.3.1, "Vegetation and Wetlands."

Tundra ice roads would cause temporary bird habitat loss and alteration. Ice roads remain in place until after most birds have initiated nesting, causing temporary nesting habitat loss (Yokel et al. 2007) (Section 4.3.1 "Vegetation and Wetlands"). Ice roads also compress the vegetation, especially standing dead vegetation used for concealment by some nesting birds. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (U.S. Army Corps of Engineers 2012). Generally, changes in the thermal regime or compaction of soil have not been found to result from ice road construction. A study by Yokel et al. (2007) suggests that seasonal ice roads and pads constructed within the same footprint each year do not have additive effects over years.

Relatively slow melting ice roads could act as temporary dams, causing impoundments of water. Impoundments created by ice roads or gravel structures could be ephemeral (drying up early during the summer) and could cause temporary or permanent flooding on adjacent tundra, or they could become permanent water bodies that would persist from year to year. Hydrological impacts along roads and pads, such as impoundments are discussed in Section 4.2.2, "Water Resources." Tundra covered by impounded water could result in a loss of nesting and foraging habitat for some birds. Impoundments could also create new foraging and brood-rearing habitat that would be beneficial to some bird species, although the proximity to roads also may increase the potential for traffic-induced mortality, especially of young (inexperienced) birds (BLM 2012).

Water withdrawal from lakes during ice road construction has the potential to lower the level of lakes and affect waterfowl and shorebirds that use adjacent habitats, particularly small islands and shoreline areas that loons and waterfowl use for nesting. Changes in the surface levels of lakes due to water withdrawal would be dependent on the amount of water withdrawn, the volume of the lake, and the recharge rate. There is also potential for impacts to birds resulting from potential impacts to invertebrate and fish food resources from varying winter water levels if pumped lakes do not fully recharge (BLM 2012).

Disturbance and Displacement

Gravel mining and placement of gravel fill would occur during winter when most birds are not present. Road work such as grading, compacting, and reshaping of roads and pads would occur during summer when birds are present. The noise and vehicle traffic during these activities would likely disturb and displace birds away from gravel roads and pads. Disturbance causes birds to expend energy in responding, although it may not necessarily reduce their survival or productivity (U.S. Army Corps of Engineers 2012). Noise would likely cause the greatest disturbance to birds between June 1 and July 15 when birds on nests would be unable to move away from the disturbance (U.S. Army Corps of Engineers 2012). Construction-related disturbances to birds are also discussed in BLM (2004).

Some birds that may have nested at sites previously not covered by gravel could be displaced and move to adjacent areas to nest. Johnson et al. (2003a) reported that waterbirds nesting near the Alpine oil field that were displaced from nesting sites by gravel placement probably moved their nests to nearby adjacent habitats. In addition, there may be a functional loss of habitat in areas near roads and pads, if development-related disturbances preclude birds from utilizing these habitats. Impacts related to habitat loss may be more severe for species that have specific habitat requirements or exhibit site fidelity (BLM 2012).

Noise and visual cues from air traffic would disturb birds. Bird responses to aircraft include alert and concealment postures, interrupted foraging behavior, flight, and a reduction in nest attendance (U.S. Army Corps of Engineers 2012). The impacts of routine aircraft flights could range from bird avoidance of certain areas to abandonment of nesting attempts or lowered survival of young. The potential impact to birds from aircraft noise would probably be greatest during the nesting period when the movements of incubating birds are restricted and the molting period when, in addition to being a period of restricted movements, birds may be energetically stressed and sensitive to disturbance (BLM 2012).

Aircraft noise levels would be highest during take-offs and landings, and most aircraft-related disturbance would be concentrated around the airstrip for brief time periods. Disturbance may also increase as a function of flight frequency, and birds in areas that experience many flights may experience larger disturbance impacts than those in areas with few flights. The behavioral response of birds to aircraft disturbances near the existing and planned airstrips (see Chapter 2, “Proposed Project and Alternatives”) would not necessarily result in lowered nest success.

Although the potential exists for displacement of some nesting birds near routinely used airstrips, because of numerous over flights, landings, and takeoffs, some birds may habituate to routine air traffic. Within the project study area, the duration of flights would be short and occur in a specific area, and although likely to cause disturbance to birds, depending on the species and time of year that disturbance may be minimal. However, temporary displacement from high-value habitats could affect energy budgets of some birds, and incubating birds could be temporarily displaced from nests, making the nests more vulnerable to predation (BLM 2012). The mitigation measure of hazing birds at or near airstrips would likely result in temporary disturbance and possible displacement of birds.

Oil spill response training activities using watercraft may be conducted on rivers and lakes during the open-water season. Spill response training activities would have the potential to disturb foraging, nesting, or brood-rearing waterfowl and other birds.

Disturbance to birds could result in temporary or permanent displacement from high-value habitats, potentially resulting in decreased nesting and nest attendance, nest abandonment, nest predation, and increased energy expenditures that could affect an individual bird’s survival or reproduction. Disturbances could displace birds from feeding habitats and negatively affect energy budgets. Disturbances would impact birds during the entire time the birds are using the project area, although the impacts may vary depending on the species involved, including the pre-nesting period when birds gather to feed in open areas near roads, during nesting if the disturbance causes the bird on the nest to leave the nest exposing the nest to an increased rate of predation, and during brood-rearing and fall staging when some geese exhibit higher rates of alertness in areas near roads than do birds in undisturbed areas. Some evidence suggests that pedestrian traffic may have a greater impact on some species of birds than vehicular traffic (BLM 2012).

Mortality

Birds may collide with structures necessary for operation such as communication towers, flare towers, buildings, antenna guy-wires, and elevated pipelines. Descriptions of such structures associated with GMT2 can be found in (Section 2.4.3, “Drill Pad and Support Facilities”). Satellite dishes, elevated radio antennae, and radio repeater sites would also act as potential collision hazards. Although bird collisions with oil field structures are expected to be infrequent, some collisions and resultant mortality are probable.

Bird collision events with infrastructure during poor weather conditions are rare and episodic, but would have the potential to occur for the life of the project (long term). Facilities would always be lighted, a situation which can attract birds (U.S. Army Corps of Engineers 2012). Poor visibility due to fog and low light conditions, which are common in the project study area (see Section 3.2.3.1, “Climate and Meteorology”) would contribute to the risk of collisions with infrastructure. The potential for impact is lessened by the mitigating measure of downward shielded lighting. Most infrastructure collisions would likely involve individual birds or several birds from small flocks, but under certain conditions could involve large numbers of individuals.

Vehicle traffic on infield gravel roads poses the greatest threat to birds during the summer, when the largest numbers of birds are present in the project study area, possibly resulting in bird collision mortality. Among other species that are at risk, geese attracted to roadsides by early vegetation sprouting, brood-rearing waterfowl, and ptarmigan utilizing roadside grit are susceptible to collisions with vehicles. Although geese may gain access to nutritious forage near roads, their exposure to vehicle disturbances also increases. Overall, vehicle collision mortality is generally thought to be low within North Slope oil fields, although this is poorly documented (U.S. Army Corps of Engineers 2012).

Predation

Ravens, gulls, Arctic fox and red fox, bears and other predators may be attracted to areas of human activity where anthropogenic sources of food and shelter are present. Survival of these predators could increase due to the availability of anthropogenic food sources and infrastructure that may provide nesting or denning sites, particularly during the winter. Other food sources for predators can arise from roadkill on new roads creating opportunities for scavenging predators. BLM has included recommendations for a roadkill monitoring and reporting system in Section 4.7, “Mitigation Measures and Monitoring.” Increased levels of bird and egg predation due to elevated numbers of predators could adversely affect bird populations (BLM 2012).

Oil field operators have installed predator-proof dumpsters at camps and implemented new refuse handling techniques in recent years to minimize the attraction of predators. In addition, oil field workers undergo training to make them aware of the problems associated with feeding wildlife. Backensto (2010) found ravens in the North Slope oil fields to be very productive and that they used processing facilities, bridges, towers and inactive drill rigs being most often for nesting. At the Alpine oil field, Johnson et al. (2003a) reported that ravens were rarely observed in the area prior to development of infrastructure, but were commonly observed after development with nests confirmed in multiple years since. Although ravens were commonly observed after the construction of the Alpine development, Johnson et al. (2003a) reported no post-development increase in predation rates of loon and waterfowl nests.

4.3.3.2 Drilling and Operation

Habitat Loss and Alteration

After initial placement of gravel to construct roads and pads in the project study area, some habitat alterations from the indirect impacts of snowdrifts, dust fallout, thermokarst, and ponding would continue during project operation as described above (Section 4.3.3.1., "Construction"). An oil spill could impact birds using terrestrial or aquatic habitats, and could have a particularly large effect on congregations of shorebirds and waterfowl. Potential impacts to birds would depend on the location and size of the spill and on the time of year.

Disturbance and Displacement

The types of disturbance and displacement impacts that occur during the construction phase of this project (Section 4.3.3.1, "Construction") would continue through the drilling and operations phase of the project, including noise and visual cues from vehicles, aircraft, pedestrians, bird hazing (as a mitigation measure), and other disturbances. The potential displacement of birds caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase. The impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives.

Mortality

The potential for mortality from sources such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and large numbers of birds are present in the project area. Birds attracted to the roadside by altered habitat, described above, would be at risk of mortality by vehicle strikes (BLM 2012). Mortality impacts that occur during the construction phase of this project, such as collisions with infrastructure (see Section 4.3.3.1, "Construction") would continue through the drilling and operations phase of the project.

An oil discharge in molting, staging, or brood-rearing habitats could impact large numbers of birds that congregate in these areas. Increased predation on nests from predators attracted to development is a concern for birds nesting in the GMT2 Project Study Area. Predators such as fox, bear, and predatory birds are attracted to the increased scavenging opportunities associated with development and humans.

Abandonment and Reclamation

The abandonment and reclamation of project facilities may involve removing gravel pads and roads or alternatively leaving these in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Winter activities would cause little disturbance or displacement, because most birds would be absent from the area. Depending on the types of abandonment and reclamation that actually occurs, summer road and air traffic could cause disturbance, displacement, and mortality to birds that would be similar in type, but at potentially lower intensity levels and for shorter durations than caused by traffic during the construction and operations phases.

Gravel pads, roads, and airstrips that are not revegetated would have diminished value to most birds. Revegetation without gravel removal would not return the site to its current utility for and use by birds (BLM 2012).

4.3.3.3 Comparison of Alternatives

In general, the potential impacts of each action alternative on birds and bird habitat are related to individual project components most relevant to bird resources, as listed in Table 4.1-1.

All alternatives pose a similar extent of risk to birds and bird habitat during the first 2 years of the construction phase. After that, much less risk would occur during winter under Alternatives A and B, as compared to Alternative C, which would require an annual ice road. In considering year-round potential impacts, Alternatives A and B would have similar types of possible affects from permanent roads, which would be much less under Alternative C. However, the substantial increase in impervious surface area required for the airstrip and occupied structure pad could lead to increased impacts under Alternative C in the vicinity of the GMT2 pad. The risk to bird resources from oil pipelines would be very similar under all the alternatives, although the additional diesel (and mineral oil) pipe required for Alternative C makes that alternative potentially more likely to result in an impact from pipelines.

A major difference in components within Alternatives A and B, as compared to Alternative C, is with regard to the proposed access (i.e., with or without a gravel road from GMT1). Alternatives A and B require a gravel road which is a narrow linear feature crossing a variety of habitats; Alternative C has a similar sized gravel footprint, but in a concentrated location crossing fewer habitats. Direct impacts resulting from the footprint of Alternative C would be focused in the immediate vicinity of GMT2. The impacts associated with the presence or absence of a gravel road are noted throughout this section along with comparison of the alternatives as a whole.

Habitat loss and alteration would vary somewhat among the alternatives. The direct impacts (acres) of habitat loss due to gravel placement on potential high-value habitats for a suite of bird species/groups are shown in Table 4.3-8. Table 4.3-9 presents the predicted area of indirect impacts (acres) to potential high-value bird habitats (for the same suite of bird species/groups as in the direct impact analysis) within a 300-foot buffer around gravel infrastructure. Although the spatial extent of indirect impacts on bird habitats are greater than those for direct impacts, most direct impacts on birds (loss of habitat) are expected to be more significant than indirect impacts (potential change in vegetation).

Considered individually, each of the action alternatives would result in a direct impact (total gravel footprint) representing less than 1 percent of all the potential high-value habitats for selected bird species available within the project study area. In addition, none of the alternatives would directly impact more than the 1 percent of any single habitat identified as a potential high-value bird habitat (Table 4.3-8). Alternative C has the largest gravel footprint and the largest number of acres (92.0 acres) of potential high-value habitats directly impacted by the placement of gravel compared to 77.7 and 87.2 acres impacted by Alternatives A and B respectively (Table 4.3-8). Impacts from direct gravel placement is expected to be of low intensity, long term in duration, local in extent, and important in context (due to federal legislation of migratory birds (Table 4.3-10).

Indirect impacts (based on a 300-foot zone extending out from gravel fill) to potential high-value bird habitat under Alternatives A, B, and C would each amount to less than the 1 percent (Table 4.3-9) of potential high-value habitats for birds for all of the habitats analyzed. In addition, none of the alternatives would indirectly impact more than the 2 percent of any single habitat identified as a potential high-value bird habitat (Table 4.3-9).

Table 4.3-8. Direct impacts to potential high-value bird habitat types from GMT2 infrastructure within the GMT2 Project area

Habitat Type [a, b, c]	Project Area (Acres) [d, e]	Habitat Type as Percent of Total Project Area [f]	Alternative A		Alternative B		Alternative C	
			Acres	(%)	Acres	(%)	Acres	(%)
Deep Open Water without Islands (GU, KE, TS)	10,276	7.1%	--	--	--	--	--	--
Moist Low Shrub (PA)	7,015	4.8%	--	--	--	--	--	--
Moist Sedge-Shrub Meadow (TS, SB)	23,682	16.4%	19.8	0.1%	19.7	0.1%	10.3	0.0%*
Moist Tussock Tundra (TS, PA, SB)	29,899	20.6%	51.0	0.2%	59.1	0.2%	74.4	0.2%
Non-Patterned Wet Meadow (YL, SB)	8,442	5.8%	--	--	--	--	1.7	0.0%*
Old Basin Wetland Complex (KE, SB)	10,031	6.9%	5.1	0.1%	5.9	0.0%*	--	--
Patterned Wet Meadow (YL, TS, SB)	26,111	18.0%	1.8	0.0%*	2.0	0.0%*	--	--
Sedge Marsh (KE, YL, TS, SB)	1,781	1.2%	-	-	0.5	0.0%*	5.7	0.3%
Shallow Open Water without Islands (KE, TS)	1,218	0.8%	--	--	--	--	--	--
Total High Value Habitat	**118,455**	**75.3%**	**77.7**	**0.06**%	**87.2**	**0.07**%	**92**	**0.08**%
Unmapped Area	10,465	6.6%	--	--	--	--	--	--

Notes: Values greater than 0 but less than 0.1 are noted with an asterisk (0.0 percent*). (--) cells indicate the habitat is not present within area considered for impact analysis.

[a] Information is only presented for those habitats that have been determined to be potential high value bird habitats, totaling 118,455 acres (75 percent of the total acreage of the GMT2 Project Study Area) mapped for habitat.

[b] Source information for habitat preferences of pre-nesting KE, nesting/brood-rearing TS, nesting YL based on Monte Carlo analysis in Tables 5, 7, 11, 17, 23, and 25 of Johnson et al. (2015). Source information for habitat of nesting/brood-rearing SB and nesting/foraging PA, BLM (2004a, Section 4F.3.3, pages 1134–1153).

[c] Bird species/groups analyzed for habitat preferences/use: King Eider (KE), Passerines (PA), Shorebirds (SB), Tundra Swan (TS), Yellow-billed Loon (YL).

[d] Note that 10,465.3 acres (6.6 percent) of the GMT2 Project area extends outside of the habitat map coverage. All project facilities under all action alternatives are within areas of mapped vegetation.

[e] Total acreage of the GMT2 Project Study Area, including both the mapped habitat area and the unmapped area is 157,408.4 acres.

[f] Total impacted acreage may differ slightly from other impact totals listed within the document due to rounding of individual calculated habitat impacts and presentation of only preferred avian habitats.

Table 4.3-9. Indirect impacts to potential high-value bird habitats within the project study area (300-foot zone of influence)

Habitat Type [a, b, c]	Project Area (Acres) [d, e]	Habitat Type as Percent of Total Project Area	Alternative A		Alternative B		Alternative C	
			Acres	(%)	Acres	(%)	Acres	(%)
Deep Open Water without Islands (GU, KE, TS)	10,276	7.1%	--	--	0.6	0.0%*	--	--
Grass Marsh (YL, TS)	525	0.4%	--	--	--	--	--	--
Moist Dwarf Shrub[f]	241	0.2%	0.3	0.0%*	--	--	--	--
Moist Low Shrub (PA)	7,015	4.8%	1.4	0.0%*	--	--	--	--
Moist Sedge-Shrub Meadow (TS, SB)	23,682	16.4%	172.3	0.7%	172.3	0.7%	37.9	0.2%
Moist Tussock Tundra (TS, PA, SB)	29,899	20.6%	349.4	1.2%	442.0	1.5%	178.2	0.6%
Non-Patterned Wet Meadow (YL, SB)	8,442	5.8%	-	-	0.0%*	0.0%*	4.2	0.0%*
Old Basin Wetland Complex (KE, SB)	10,031	6.9%	67.3	0.7%	67.8	0. 7%	2.4	0.0%*
Patterned Wet Meadow (YL, TS, SB)	26,111	18.0%	20.6	0.0%*	16.7	0.0%*	1.0	0.0%*
Sedge Marsh (KE, YL, TS, SB)	1,781	1.2%	7.5	0.4%	12.5	0.7%	7.1	0.4%
Shallow Open Water without Islands (KE, TS)	1,218	0.8%	2.9	0.2%	--	--	--	--
Total High Value Habitat [g]	**119,221**	**75.7%**	**621.7**	**0.5%**	**711.9**	**0.6%**	**230.8**	**0.2%**
Unmapped Area	10,465	6.6%	--	--	--	--	--	--

Notes: Values that are greater than 0 but less than 0.1 are noted with a dash (0.0 percent*). (--) cells indicate the habitat is not present within area considered for impact analysis.

[a] Information is only presented for those habitats that have been determined to be potential high value bird habitats, totaling 119,221 acres (76 percent of the total acreage of the GMT2 Project Study Area) mapped for habitat.

[b] Source information for habitat preferences of pre-nesting KE and nesting/brood-rearing TS based on Monte Carlo analysis in Tables 5, 8, 21, 23 of Johnson et al. (2013). Source information for habitat of brood-rearing/molting GE found in Table 26 of Johnson et al. (2013); not based on Monte Carlo analysis. Source information for habitat of nesting GU found in Table 30 and page 73 of Johnson et al. (2013); not based on Monte Carlo analysis. Source information for habitat of nesting/brood-rearing SB and nesting/foraging PA, BLM (2004, Section 4F.3.3, pages 1134–1153).

[c] Bird species/groups analyzed for habitat preferences/use: Geese, inclusive of brant and snow geese (GE), Gulls, inclusive of glaucous and Sabine's gulls (GU), King Eider (KE), Passerines (PA), Shorebirds (SB), Raptors and Owls (RO), Tundra Swan (TS).

d Note that 10,465.3 acres (6.6 percent) of the GMT2 Project area extends outside of the habitat map coverage. All project facilities under all action alternatives are within areas of mapped vegetation.

e Total acreage of the GMT2 Project Study Area, including both the mapped habitat area and the unmapped area is 157,408.4 acres.

f Moist Dwarf Shrub is not considered a high value habitat for any bird species included in the project area.

The Arctic Slope Regional Corporation Mine site is the proposed gravel source for all alternatives. The Arctic Slope Regional Corporation Mine site is an existing commercial gravel source on the East Channel of the Colville River, approximately 6 miles southeast of CD4, 21.0 miles east of GMT2, and 4.5 miles east-northeast of Nuiqsut. The habitats that would be expected to be impacted as part of gravel extraction for the GMT2 Project from the Arctic Slope Regional Corporation Mine site include Deep Open Water without Islands, Non-Patterned Wet Meadow and Patterned Wet Meadow, Moist Low Shrub and Shallow Open Water Without Islands, all of which are potential high-value bird habitats,

Table 4.3-10. Area of potential high-value bird habitats impacted at the Arctic Slope Regional Corporation Mine site for all action alternatives

Habitat Type (acres within mapped project area) [a]	Project Area Mapped [b] (acres)	Direct Impact Acres (% Project Area)
Deep Open Water without Islands	10,276	26.0 (0.3%)
Moist Low Shrub	7,015	12.2 (0.2%)
Non-Patterned Wet Meadow	8,442	200.9 (2.4%)
Patterned Wet Meadow	26,111	225.0 (0.9%)
Shallow Open Water without Islands	1,218	1.4 (0. 1%)
Total	**53,062**	**465.5 (0.9%)**

[a] It is assumed that the gravel resources in Phase 3 of the Arctic Slope Regional Corporation Mine site are similar to those in Phase 2 of the Arctic Slope Regional Corporation Mine site. As it is as yet unknown the exact area from the Phase 3 gravel pit the gravel for GMT2 will be extracted, this table presents information from the entirety of the Phase 3 area although the estimated area impacted by gravel extraction as based on the Phase 2 permit would be 83 acres of surface disturbance for 2 million cubic yards of gravel (U.S. Army Corps of Engineers 2013).

[b] GMT2 Project area based on mapped area of 146,943.11 acres.

The gravel mine site will be rehabilitated as required under the approved Arctic Slope Regional Corporation Gravel Mine Reclamation Plan (U.S. Army Corps of Engineers 2016). The reclamation and mitigation goal is for waterfowl habitat with a matrix of undisturbed tundra, deep water, shallow and very shallow littoral, and waterfowl nesting islands. All reclamation work will occur as part of an overall gravel mining operation because both the overburden material and heavy equipment necessary for the activities would be available (BLM 2014).

Vehicle traffic on gravel roads may disturb or displace birds. Under all action alternatives, traffic would be most intense during construction, then taper off during drilling, and decrease again with post-drilling operation.

Alternatives A and B, share a common road (GMT1–GMT2) where impacts from disturbance and displacement of birds from ground transportation would be similar for both alternatives. Alternatives A and B disturb similar amounts of high-value bird habitat types with Alternative A directly disturbing 77.7 acres and Alternative B directly disturbing 87.2 acres, with the majority of those acres for both alternatives being Moist Tussock Tundra (Table 4.3-8). Indirect effects from Alternatives A and B would again primarily impact Moist Tussock Tundra (Table 4.3-9). Alternative C does not utilize a gravel road between GMT1 and GMT2; instead, it involves seasonal traffic across the tundra on ice roads. Alternative C includes a year round 0.9-mile gravel access road between GMT2 pad and the associated occupied structure pad and airstrip. Alternative C would directly impact 92 acres of high-value bird habitat with 81 percent of the habitat being Moist Tussock Tundra (Table 4.3-8). Indirect effects from Alternative C would again primarily impact moist tussock tundra (Table 4.3-9). Indirect effects from Alternative C are much smaller (37 percent of Alternative A and 32 percent of Alternative B) than from the other action alternatives due to the gravel area being concentrated in a much smaller area compared to the long linear feature (gravel road) created by Alternatives A and B. Alternatives A and B would have very similar, low intensity, impacts to birds and Alternative C would also have low intensity impacts that would be less than those for the other alternatives attributed to vehicle traffic.

The presence or absence of the GMT1–GMT2 Access Road would affect type and frequency of aircraft traffic in the project study area throughout the life of the project. Additional information and detail on aircraft traffic is provided within in Chapter 2, Sections 2.5.4, 2.6.4, 2.7.4 and Appendix B. Potential disturbance impacts to birds from aircraft traffic under Alternatives A and B would originate from new flights to/from the Alpine Processing Facility/CD1 airstrip and special studies utilizing rotary aircraft. Alternative C would involve all-season air traffic between the Alpine Processing Facility/CD1 airstrip (or Kuparuk, Deadhorse, or airports outside the North Slope) and the gravel airstrip at GMT2 and special studies utilizing rotary aircraft.

Under all alternatives numbers of flights are the greatest during the construction period, then once construction is complete flight numbers drop to a lower level for drilling and annual operations post-drilling. For Alternatives A and B after construction is completed aircraft traffic, primarily during the May –September time period when migratory birds are present in the area, consists exclusively of helicopter flights to support a variety of activities including fish and wildlife studies and visits to spill response equipment. Under Alternative C flights to the Alpine Central Processing Facility/CD1 site are the most intensive until the GMT2 airstrip is constructed and deemed operable. Afterwards, aircraft flights would go directly to the GMT2 airstrip. Flights would be required for routine access to the GMT2 drill pad during the non-ice road season (April–December). During ice road season, aircraft would still be utilized for support of equipment and personnel. Air traffic to/from the GMT2 airstrip would be greatest during drilling. Once drilling is complete, flights decrease in support of essential operations and special studies.

Potential impacts to birds from aircraft under Alternative C is greater than Alternatives A or B due to the requirement to use aircraft to access the GMT2 drill pad when ice roads are not feasible (roughly nine months of the year).

The impacts associated with aircraft traffic for all alternatives are expected to be of low intensity, long-term duration, and of local extent.

Alternatives A and B would have annual ice roads constructed in Years 1–3 to allow for construction of gravel infrastructure. Post-construction of gravel infrastructure there would be no ice roads needed for these two alternatives. Alternative C requires annual ice roads to be constructed for the life of the project. Few birds are present in the area during ice road season; however, re-use of ice annual road routes and ice pad locations could damage tundra, resulting in potential long-term impact to potential high value bird habitats.

Overall, Alternatives A, B, and C are predicted to have habitat loss and alteration rated as being of low intensity, long-term duration, and limited extent (Table 4.3-11)

Overall, Alternatives A, B, C are expected to result in minor impacts to birds and their habitats (Table 4.3-11).

Alternative D, No Action, would result in no impacts to birds.

Table 4.3-11. Impact criteria summary for birds; Alternatives A, B, and C

Impact Type and Affected Population	Intensity	Duration	Context	Geographic Extent
Habitat Loss and Alteration	Low	Long Term	Important	Local
Disturbance and Displacement	Low	Long Term	Important	Local
Mortality and Predation	Low	Long Term	Important	Local

4.3.3.4 Mitigation

Numerous stipulations and best management practices are in place to effectively protect birds and their habitats within the NPR-A. These include BMPs A-1 through A-7 and E-9, 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. The protection of bird habitats and food sources are addressed by BMPs B-1, C-3, C-4, and Stipulations E-2 and L-1, among others. It should be noted that BLM authorized a deviation from Stipulation E-2 (BLM 2004a). In addition to BLM best management practices, certain State of Alaska statutes and regulations also protect birds and their habitats. A list of State environmental protection regulations and BLM best management practices can be found in Appendix J.

A wildlife avoidance and interaction plan and a predator management plan, incorporating federal, state, and local stipulations on wildlife interactions would be developed as part of the operational permitting process.

The following design measures are recommended as part of the project design to avoid or minimize impacts on birds (U.S. Army Corps of Engineers 2012):

- Implementing controls to minimize nesting opportunities for predatory/nuisance birds, including the following:
    - Blocking off nooks and crannies with fabric/netting or other bird-nest deterrent.
    - Using scare devices to deter birds when they land in places likely to be nesting sites.
    - Removing nests as the birds try to construct them (before they have a chance to lay eggs).
- Designing facilities to minimize potential for bird strikes, including the following measures:
    - Careful consideration will be given to facility lighting (e.g., light hoods to reduce outward radiating light) that reduces the potential for disorienting migrating birds and reduces bird strikes.
    - Buildings and stack heights will be the minimum needed to perform their functions, with consideration for associated footprint. The flares will be free standing (no guy wires).
    - Communications towers will avoid the use of guy wires and will be attached to camps or other, larger structures when possible.
    - Powerlines and fiber-optic cables will either be buried or placed on the pipeline vertical support members.
    - Aircraft will generally maintain a 1,500-foot altitude to avoid impacts on ground nesting and foraging birds, except as required for takeoff and landing, safety, weather, and operational needs, or as directed by air traffic control.
- Limiting removal of water from freshwater lakes during the summer to minimize reductions in amount or quality of nesting and brood-rearing habitat through diminished water levels.

- Monitoring water withdrawal volumes and water body recharge, as needed or directed, by Alaska Department of Natural Resources and/or Alaska Department of Fish and Game in the future.
- Gravel placement on the tundra will primarily occur during the winter; however, if site preparation and/or construction activities are approved, under BMP L-1, to occur on the tundra during the summer, these activities would occur after July 31 (when most Arctic nesting birds have hatched). Areas in the vicinity of such field activities would be searched for nesting birds by a qualified biologist prior to the start of work. If an active nest was found, the appropriate USFWS office would be contacted for instructions on how to avoid or mitigate the potential loss of the active nest.
- Roadkill monitoring system for wildlife shall be developed and put into practice in order to monitor roadkill of birds and other wildlife on transportation routes.

4.3.3.5 Conclusion

Overall, Alternatives A, B, and C are predicted to result in minor impacts to birds and bird habitats. Alternative D, no action, would result in no impacts to birds or bird habitats.

Birds that could be affected by the action alternatives include loons, waterfowl, shorebirds, raptors, passerines, and ptarmigan. Most species in these groups migrate to wintering areas located outside of the NPR-A, and would not be directly affected by winter construction activities, although their habitats could be affected. A few species, such as ptarmigan, gyrfalcon, and snowy owl, may remain in the project study area during the winter, and could be temporarily displaced from high-value feeding or resting habitats by winter construction, drilling, or operations activities.

Activities related to the action alternatives, such as vehicle, aircraft, boat traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill cleanup activities, could cause disturbances that would affect birds. Summer fixed-wing or helicopter aircraft activity in support of the GMT2 Project, including related research, could result in disturbance to birds, causing temporary or permanent displacement from high-value feeding, nesting, staging, or brood-rearing habitats in localized areas near areas of activity.

Placement of gravel on the tundra for roads and pads, and removal of gravel at mine sites, could result in permanent habitat loss, especially if habitat restoration expected to take place after infrastructure features are retired is not successful. Temporary habitat loss or alteration could also occur in areas adjacent to gravel roads due to snow and/or dust deposition, thermokarst, and the formation of impoundments. Some types of habitat alteration, such as the formation of impoundments, could be beneficial to some species, while having a negative impact on others.

Withdrawal of water from source lakes during winter could impact birds if water levels or prey availability in source lakes were affected. Lake surveys conducted prior to water withdrawal, limits on the amount of water that may be withdrawn from lakes due to lease stipulations, and the ability of lakes to naturally recharge, would likely negate any potential negative impacts related to water withdrawal.

Bird mortality could result from collisions with ground or air vehicle or vessel traffic, or with towers, buildings, pipelines, bridges, or other facilities. It is expected that collisions would only be a minor source of bird mortality; however, over the course of the life of the GMT2 Project these mortalities may accumulate for some species. Predators attracted to areas of human activity could also impact tundra-nesting birds by causing depredation of eggs and young; however, lease stipulations designed to eliminate attraction of predators to camps or equipment maintenance sites would help mitigate potential increases in predators. Adherence to lease stipulations that require proper disposal of garbage to avoid human-caused changes in predator populations would likely minimize potential impacts to birds from increased predation pressure.

Although impacts to birds could occur as a result of the action alternatives, long-term studies of bird density and abundance in the Prudhoe Bay Oilfield, located on the Arctic Coastal Plain, indicate that oil production, as practiced in Prudhoe Bay, does not necessarily lead to substantial declines in bird density or productivity in or near the developed area (Bart et al. 2013).

Impacts to birds from climate warming may include a suite of impacts, both positive and negative. A longer open-water season may increase productivity of some species and increase productivity in aquatic and semi-aquatic systems, which provide food for many species of birds. Warmer soil temperatures are likely to increase thermokarst and may inundate low-lying tundra areas, increasing aquatic and wet tundra vegetation types. The increasing thickness of the active layer of soil above Arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative impacts to those species that relay on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development to bird habitat (BLM 2012).

4.3.4 Mammals

This section presents the potential impacts to terrestrial and marine mammals that would result from implementation of the proposed project and other action alternatives.

4.3.4.1 Terrestrial Mammals

The proposed GMT2 Project has the potential to impact terrestrial mammals as described in BLM (2004a) for the Alpine satellites area, for the entire NPR-A in BLM (2012), and for portions of the GMT2 Project area in BLM (2014). The following discussion summarizes the impacts and is supplemented with information related to terrestrial mammal impacts from the Point Thomson Final EIS related to terrestrial mammal impacts (U.S. Army Corps of Engineers 2012a). These documents are incorporated by reference.

Potential impacts to terrestrial mammals are based on habitat use, seasonal distributions, and seasonal movement patterns. Direct impacts to terrestrial mammals were evaluated and quantified using a 2.5-mile buffer around all project infrastructure and activity. The 2.5-mile buffer was established based on displacement distances evaluated in studies of caribou behavioral responses to disturbance and totals approximately 155,500 acres (FIG CITE). (Dau and Cameron 1986; Cameron et al. 1992, 1995; Wolfe 2000; Noel et al. 2004; Haskell et al. 2006; Haskell and Ballard 2008; Wilson, et al. 2012).

Caribou are common in the project area, are an important subsistence game species (see Section 4.4.5, "Subsistence"), and are well studied relative to other terrestrial mammals in the study area. Therefore, this impact analysis and subsequent discussion focuses on caribou. Potential impacts to other terrestrial mammals (grizzly bear, muskox, fox, wolf, wolverine, and small mammals) are described qualitatively.

Terrestrial mammal habitat loss is based on calculations presented in Section 4.3.1, "Vegetation and Wetlands." Impacts were evaluated by comparing the infrastructure footprints for the alternatives. Loss or alteration of habitats were evaluated based on estimated acreages obtained from GIS analysis of project facility dimensions. Direct impacts to habitat are those in which habitat would be covered or structurally altered by development (e.g., placement of gravel over tundra). Indirect impacts to habitat are those which occur as a result of the construction or presence of infrastructure (specifically, roads). These impacts include gravel spray or dust deposition, snow drifting, thermokarsting, and altered hydrology (see Section 4.2, *Physical Characteristics)* Indirect impacts to terrestrial mammal habitat were evaluated by using a 300-foot indirect impact zone extending out from the outer edge of proposed areas of gravel placement (Auerbach et al. 1997)

In addition to habitat impacts from road construction and other infrastructure development, terrestrial mammals may be disturbed by construction or operation activities, or may be killed or injured as a result of activities associated with the action alternatives. These impacts are also evaluated within the project area.

Terrestrial mammal impact analysis criteria are listed in **Error! Reference source not found.**. These impact criteria were adopted from the Point Thomson Final EIS (U.S. Army Corps of Engineers 2012a). Summaries of impact levels for all alternatives based on these criteria are described in Table 4.3-15.

Table 4.3-12. Impact criteria, terrestrial mammals

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting more than 25% of a high-valued terrestrial mammal habitat or population in the project area[a].
	Medium	Potentially affecting more than 5% and less than 25% of a high-valued terrestrial mammal habitat or population in the project area.
	Low	Potentially affecting 5% or less of a high-valued terrestrial mammal habitat or population in the project area.
Duration	Long Term	Lasting 5 or more years[b].
	Interim	Lasting between 2 and 5 years.
	Temporary	Lasting less than 2 years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region. Impacts will occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region. Impacts will not occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation. Impacts will not occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
Geographic Extent	Regional	Habitat loss and alteration or disturbance extending to the Arctic Coastal Plain or beyond[c].
	Local	Habitat loss and alteration: extending beyond the 300 feet indirect impact zone; disturbance: extending beyond the project area but within the Arctic Coastal Plain.
	Limited	Habitat loss and alteration: within the gravel footprint and 300 feet indirect impact zone; disturbance: within the project area (2.5-mile buffer around project footprint).

[a] Impacts to 25% or more of high-valued habitat are assumed to cause changes to the dynamics of a mammal population.

[b] Many terrestrial mammals breed annually, but some may reproduce more than once per year (e.g., voles, lemmings) while others reproduce every 2 or 3 years (e.g., grizzly bear).

[c] The maximum geographical extent of impacts will include only a small fraction of the State of Alaska.

Construction

Construction of ice roads, gravel roads, the airstrip, pipelines, and other infrastructure would primarily occur during the winter. However, some construction would occur in summer. Construction under project action alternatives would affect terrestrial mammals through direct and indirect habitat impacts, disturbance, and potential mortality due to vehicle collisions, burial during construction (small mammals), or in defense of life or property. Construction-related impacts to terrestrial mammals were evaluated for the project area in BLM (2004a) and for oil and gas activities for the NPR-A in BLM (2012).

Habitat Impacts (Loss, Alteration, or Fragmentation)

Under the project action alternatives, construction would result in direct and indirect habitat loss due to gravel extraction (see Section 4.2-1, "Terrestrial Environment") and the installation of permanent gravel roads, pads, and the airstrip (Tables 4.3-3, 4.3-14, and 4.3-15). Caribou and muskoxen would lose 77.9, 87.2, and 92 acres (Alternative A, B, C respectively) of foraging habitat due to direct placement of gravel for roads, pads, and in Alternative C an air strip, although forage habitat lost to road, well pad, or airstrip construction could provide novel insect relief habitat (Table 4.3-13, Pollard et al. 1990, 1996a, 1996b, Noel et al. 1998, Balllard et al. 2000, Murphy and Lawhead 2000). Up to an additional 621.8, 711.9, and 230.8 acres (Alternative A, B, C respectively) of foraging habitat may be lost from use due to indirect impacts. Arctic ground squirrels and other small mammals would lose minor amounts of foraging and burrow habitat due to gravel fill and mining. Grizzly bears would lose minor amounts of foraging habitat and could lose minor amounts of denning habitat. Road and facility construction may create denning habitat for bears and foxes, although it may disturb existing dens. Wolverines may be negatively affected by increased human development and activity once remote areas making the habitat less optimal or causing wolverines to avoid the disturbed area (May et al. 2006).

Ice road construction would crush standing dead vegetation, reducing summer concealment habitat , for small mammals and potentially increasing their risk of predation. Compaction of standing dead vegetation is expected to be interim in duration, requiring several growing seasons for standing dead vegetation density to recover. Damage to dwarf shrubs and tussock tundra from ice road construction could result in long-term impacts to vegetation cover (Yokel et al. 2007; Yokel and Ver Hoef 2014). Tundra ice roads and ice pads to support construction for Alternatives A and B would be required for 3 winter seasons and would cause temporary loss of approximately 159 (ice road) and 175 (ice pad) acres in years 1- 2, and 323 (ice road) and 135 (ice pad) acres in year 2 -3 of winter forage habitat for both small and large herbivores and would also cause the same amount of temporary loss of subnivean habitat for small mammals. Alternative C would require ice roads and pads to be constructed for the life of the project, construction would cause temporary loss of approximately 159 (ice road) and 205 (ice pad) acres in years 1- 2 and 323 (ice road) and 175 (ice pad) acres in years 2 - 3 of winter forage habitat for both small and large herbivores and would also cause the same amount of temporary loss of subnivean habitat for small mammals. Clearing and piling of snow from the pads, roads, and airstrip during the winter could result in the collapse of subnivean tunnel systems used by small mammals. Habitat loss due to snow piling (from plowing snow off of roads and pads) would be seasonal, but snow piling would likely occur annually in the same locations and would continue as long as the facilities were maintained, resulting in long-term habitat alteration. Ice roads and snow drifts would not melt before most birds begin nesting in late May to early June, altering the distribution and availability of avian prey to mammalian nest predators.

Indirect habitat impacts caused by gravel spray or dust deposition, snow piles or drifts, altered hydrology, or thermokarsting could reduce the forage available to terrestrial mammals on an additional 621.8, 711.9, 230.8 acres each year (Alternatives A, B and C respectively). During most years, the majority of the Teshekpuk Caribou Herd winter on the Arctic Coastal Plain, sometimes including the GMT2 Project area. High densities (> 2 caribou per 247 acres) have been recorded occasionally in the NPR-A survey area during late winter. During the non-winter months terrestrial mammals may be affected by the indirect impacts to varying degrees depending on the types of habitats that are impacted. Deep snow drifts would likely reduce availability of winter forage for large mammals, but may provide additional protection for small mammals using subnivean habitats. Dust deposition on snow along gravel roads would lead to early melt and green-up that may attract caribou, muskoxen, or small herbivores (Lawhead et al. 2004). Dust deposition would be greatest during construction when vehicle traffic would be highest. Terrestrial mammals attracted by emergent vegetation along gravel roads may be of increased risk to predation or collision-associated mortality.

Movements of small mammals such as lemmings and voles would be impeded by construction during both summer and winter. Although movement over roads occurs, risk avoidance behavior such as avoiding exposed environments may lead to increased avoidance of gravel roads. Additionally, small mammals crossing gravel roads during winter would be exposed to decreased air temperatures and higher winds compared to protected subnivean environments.

Disturbance

Disturbance of terrestrial mammals during construction would occur. Disturbance-related impacts to most terrestrial mammals would be minor. However, May et al. (2006) hypothesized that wolverine distribution may be partly influenced by direct disturbance or higher risk of human-caused mortality associated with infrastructure. During construction, caribou could be disturbed by low-level aircraft, light and heavy vehicle traffic, blasting at the ASRC mine site, construction and use of ice roads and ice pads, construction of the pipeline and on-site facilities, and the presence of newly-constructed roads, and increased hunting pressure along the proposed GMT1-GMT2 Access Road (Calef et al. 1976; Horejsi 1981; Shideler 1986; Tyler 1991; Murphy and Lawhead 2000). Caribou response to these disturbance sources would likely be highly variable: ranging from no reaction to escape behavior depending on distance from human activity, speed of the approaching disturbance source, frequency of disturbance, sex, age, and physical condition of the animals, caribou group size, and season, terrain, and weather (Webster 1997). These impacts are discussed below.

<u>Aircraft</u>

Aircraft would land at the CD1/Alpine Processing Facility during construction under all alternatives. The predicted number of construction-related fixed-wing and helicopter flights for Alternatives A and B are identical (See Table 2.9-3). Aircraft traffic of all types would be highest under Alternative C. Helicopter use during construction would be limited to emergency response, ice road clean-up, and flights associated with required monitoring studies.

Proposed aircraft operations during the construction phase of the project include transport of cargo into the Alpine airstrip by Twin Otter (DHC6) and CASA twin-engine (2E) turboprop aircraft (Alternatives A and B), transport of cargo by DC-6 (primarily) and C-130 four-engine (4E) aircraft into the GMT2 airstrip (Alternative C), transport of personnel into GMT2 by Twin Otter/CASA aircraft and helicopters (Alternative C), and helicopter flights into the project area in support of required special studies, monitoring, and ice-road clean-up (all alternatives). The degree to which noise may cause disturbances to wildlife is dependent on many factors and are described in Section 4.2.3.3 of this document.

The existing Alpine airstrip and the proposed GMT2 airstrip (Alternative C only) would be specific point sources of project-related noise generated by landing and take-off operations of cargo aircraft and helicopters. Depending on meteorological conditions and the ambient noise level at the time, noise generated by 4E aircraft operations at Alpine and GMT2 airstrips could temporarily dominate the acoustical environment for a distance of 5 to 7.5 miles from the airstrips, and noise generated by helicopters and 2E aircraft could temporarily dominate the acoustical environment for a distance of 1 to 2.5 miles.

Noise generated by 4E aircraft in transit could temporarily dominate the acoustical landscape for a distance of about 5 to 7.5 miles from the origin. Noise generated by helicopters and 2E aircraft could temporarily dominate the acoustical environment for a distance of about 1 to 2.5 miles from the origin and could be audible up to 5 miles.

Overall impacts of aircraft noise on the acoustical environment were found to be of high intensity and regional extent, but would be temporary and would attenuate to low intensity with increasing distance from the source. This would be the case for concentrated locations of aircraft activity (Alpine airstrip and proposed GMT2 airstrip), for dispersed landing sites, and for linear zones of audible aircraft noise centered along ground traces of aircraft flight paths.

Noise impacts attributable to aircraft operations during the construction phase (years 1 - 3) would be greater for Alternative C (2392 flights) than for Alternatives A and B (1302 flights for each alternative) due to much higher levels of aircraft use in the absence of gravel access roads in Alternative C (Table 2.9-3)

Numerous studies have explored the impacts of aircraft on caribou. The significance of these impacts is not conclusive, but general patterns have been documented. Caribou response to aircraft varies depending on the season, degree of habituation, aircraft, altitude, airspeed, flight patterns, weather conditions, frequency of overflights, and the sex and age composition of caribou groups (Wolfe et al. 2000). Low-level aircraft may elicit escape behavior (increased speed and direction changes) that can increase individuals' chance of injury (Harrington and Veitch 1991). This is particularly a concern during the calving season, when young calves are most vulnerable to trampling or other injuries (Wolfe et al. 2000). Low-level aircraft traffic in the vicinity of calving grounds and early post-calving aggregations can reduce calf survival (Wolfe et al. 2000). The calving grounds of the TCH and CAH are not within the boundary of the project area. Thus, aircraft associated with construction is not anticipated to adversely affect young calves or consequently, adult recruitment.

Prolonged exposure to low-level aircraft could increase daily energy expenditure and decrease individual fitness or reproductive capacity over time if not properly mitigated (Webster 1997). Alternatively, caribou can become habituated to aircraft; particularly when aircraft consistently maintain altitudes greater than 500 feet above ground level and do not engage in hazing or harassing behavior (Valkenburg and Davis 1983). Habituated animals do not associate aircraft with danger and, as a result, exert minimal additional energy when overflown (Webster 1997).

Hazing animals off airstrips would disturb caribou, which often gather on these areas for insect relief. Hazing would be conducted if necessary for safe aircraft operations. Impacts to individual animals are expected to be temporary and minor.

<u>Roads and Vehicle Traffic</u>

The most frequently discussed disturbance to caribou associated with roads is vehicle traffic. Vehicle traffic for all alternatives would be highest during the construction period (years 1 – 3; Table 2.9-2) and most of the construction associated with the GMT2 Project would occur during winter.

Impacts from roads and vehicle traffic attributable to construction activities vary among the action alternatives, with Alternative A (671,300 cubic yards of gravel) having the least impacts and Alternative C (930,000 cubic yards of gravel) having the greatest impacts due to differences in total gravel footprint to be constructed and associated amount of gravel mining necessary (Table 4.1-1). In addition, total vehicle trips and vehicle miles are projected to be higher for Alternative C (181,800 trips and 1,692,500 miles) for construction years 1 – 3) than for Alternatives A and B (166,100 trips and 1,339,700 miles and 170,800 trips and 1,433,300 miles respectively for construction years 1 – 3), which would result in a greater overall amount of vehicle-related noise in Alternative C.

The proposed GMT1-GMT2 Access Road is on the edge of TCH distribution, but is within a fall migration corridor (See Maps 4.3-2 and 4.3-3). From 2004 to 2017, 5% of the GPS collared caribou crossed the proposed road alignment during fall migration (Lawhead et al. 2015). Annual collared caribou crossings ranged from 0% to 31% (Lawhead et al. 2015, L. Parrett pers. comm.). This suggests that, under Alternatives A and B, a relatively small percentage of the TCH would encounter the newly constructed road and, although the frequency of encounters would vary annually, caribou encounters with the road would persist. Encounters would most likely be during fall, but caribou could be present in the vicinity of the road year-round.

The impacts of roads and vehicle traffic on caribou have been explored extensively in Alaska, but concrete conclusions regarding specific causes of behavioral changes (characteristics of a road that alter movement patterns), and whether behavioral change is context-dependent (i.e. exacerbated or mitigated by environmental variables, herd-dependent, or individual-dependent) have not been made. Thus, predicting a herd's response to a newly-constructed road is largely speculative. The following points, however, offer insight in to the potential impacts of the proposed GMT1-GMT2 Access Road on the TCH:

1) Studies in northern Alaska have shown that traffic volumes of 15 or more vehicles per hour may deflect caribou movements or delay successful road crossing (Cronin et al. 1994, Curatolo and Murphy 1986, Murphy and Curatolo 1987), and that caribou are most likely to approach infrastructure during reduced traffic periods (Haskell et al. 2006, Haskell and Ballard 2008, Pazacci et al. 2013). Thus, if traffic on the GMT1-GMT2 Access Road approaches this threshold, some local displacement of caribou may occur. Vehicle traffic during construction may exceed 15 vehicles an hour.

2) Similar to disturbance associated with aircraft traffic, multiple studies suggest that caribou habituate to infrastructure and roads. Wolfe et al. (2000) reported that, once caribou were initially exposed to infrastructure, crossing transportation corridors occurred more often than expected. Habituated cow-calf groups crossed roads as frequently as bulls, and roads did not have an observable effect on animal distribution or individual energetic cost. Boertje et al. (2012) and Nicholson et al. (2016) found that large ranges, historic movement patterns, and large-scale migratory behavior persist even when highways and roads bisected those ranges. This suggests that habituation to the GMT1-GMT2 Access Road is likely, but will take time. It also suggests that the historic range of the TCH will remain intact.

3) Individual caribou's responses to roads can be dramatic. Wilson et al. (2016) documented some collared animals moving nearly 60% faster after crossing the Red Dog Mine road and taking nearly 10 times as long to cross the road itself. However, while 40% of the animals demonstrated noticeable responses to the road, the rest of the collared individuals crossed the road without incident or perceptible change in their movement patterns. Annual variability of responses was high. It is worth noting that collared members of the TCH were unaffected by the road in this study. The authors postulate that the TCH's greater exposure to industrial development may explain the behavior discrepancy in the presence of the Red Dog Mine road between collared TCH and WAH caribou, but do not state this conclusively. They also caution the application of their results to other herds and situations, suggesting that caribou behavior is very context-dependent.

4) Cows with calves appear most sensitive to vehicle traffic (and industrial infrastructure in general), in early summer during, and immediately after, calving (Cameron et al. 2005). It is unlikely that cows and young calves would be affected by the road during this sensitive time period, as they would likely be northwest of the project area in the vicinity of Teshekpuk Lake.

5) Traditional ecological knowledge and, to some extent, recent literature suggest that initiation of migration and annual migratory paths are dictated by experienced adult cows (Padilla 2010, Guttal and Couzin 2011). The onset of fall migration would not coincide with peak construction activities

and highest traffic levels (during winter), although fall traffic or the presence of the road itself could still affect adult cows initiating and leading the fall migration.

Although research is still ongoing, these points suggest that some members of the TCH may alter their movement patterns in response to a newly constructed road, but the road would not disrupt the integrity of the herd’s historic range. Altered movement patterns would likely be most noticeable if the leaders of the fall migration are disrupted, but it is difficult to predict these changes on the periphery of the herd’s range.

Mortality or Injury

Construction of ice and gravel roads would likely result in some small mammal mortality. Small mammals active in winter (e.g. lemmings, voles, and shrews) may relocate to avoid being covered by construction materials, while those animals in hibernation (Arctic ground squirrels) would die if construction occurred over occupied burrows. While Arctic ground squirrels would be most vulnerable to this impact, road routes tend to avoid the raised land features that are amenable to digging burrows. Therefore, mortality would be relatively low.

Vehicle collisions with both small and large mammals may occur during construction, particularly during winter, when poor visibility is common and hard road surfaces are amenable to travel by animals (BLM 2004a). Speed limits on oil field roads are enforced, and ConocoPhillips has instituted wildlife avoidance policies and trainings which would be implemented on the GMT1-GMT2 Access Road as well, thereby likely reducing collision-related animal mortalities.

Caribou - Under Alternative C, caribou would likely use the proposed airstrip as insect relief habitat. Aircraft could potentially collide with caribou during takeoffs or landings. Caribou would be hazed from the airstrip for human safety, thereby reducing the potential for collisions and collision-related animal mortality.

Alternatives A and B would enable local hunters to use the developed road system, potentially increasing mortality of caribou, moose, muskoxen, or grizzly bears. While harvest could increase, overharvest of big game, specifically the TCH, as a result of this improved access is not anticipated. Harvest limits and hunting regulations are set by the Board of Game and the Federal Subsistence Board. Harvestable surplus is estimated by ADFG using annual population and harvest surveys (see: Parrett 2015). If population levels, demographic characteristics, or annual harvest suggest that the TCH or other large mammal populations cannot sustain harvest at current (or elevated) levels, the Board of Game and Federal Subsistence Board will adjust hunting regulations concerning the affected populations as appropriate.

Bears may attack humans for either predatory or defensive purposes. Foxes may become conditioned to humans and bite or threaten to bite personnel associated with the action alternatives. In these events, killing bears, foxes, or other mammals in defense of life or property (DLP) may be necessary. While this is uncommon in oil field developments, it remains a potential impact. ConocoPhillips has proposed implementation of design and operational measures that would minimize the potential for wildlife to become attracted to humans and infrastructure, thereby reducing potential DLP-related mortalities. These measures are summarized in ConocoPhillips’ Wildlife Avoidance and Interaction Plan.

Spills of refined products could occur during construction. The extent of impacts to terrestrial mammals would depend on the type, location, and amount spilled, the season, and the effectiveness of the response. Such incidents would be rare, and the majority of spills would be contained on the work surface, thereby not impacting terrestrial mammals or habitat. Although unlikely, terrestrial mammals could be coated with spilled liquids or ingest contaminated vegetation. This may result in mortality or decreased fitness.

Altered Survival or Productivity

Improperly managed food, garbage or petroleum products (e.g. fuel), and the availability of infrastructure for thermal protection, escape cover, or den sites can potentially increase the survival and productivity of Arctic foxes, bears, and weasels, (Burgess 2000, Shideler and Hechtel 2000, National Research Council 2003, USFWS 2003). Staged construction materials and equipment would create additional artificial escape and den habitat for predators. Studies of Arctic foxes and grizzly bears in the Prudhoe Bay oil fields have documented that these additional habitats contributed to increased densities and productivity of both species. Operational procedures and controls established to protect terrestrial mammals (see Mitigation section) would minimize factors that commonly attract them to oil field infrastructure.

While both the TCH and CAH have undergone recent changes in size, demography, and distribution, these changes are not thought to be related to oil field development (Parrett 2015, Lenart 2015). The GMT2 Project area does not overlap the calving grounds of the TCH or CAH, and construction activities would not affect parturient or lactating cows' access to high-quality forage, calf production, or adult recruitment.

Drilling and Operation

The drilling and operation phases of the action alternatives could affect terrestrial mammals through direct and indirect habitat impacts, disturbance, and potential mortality due to vehicle collisions or defense of life or property.

Habitat Impacts (Loss, Alteration, or Fragmentation)

Drilling and operations would not result in additional direct habitat loss beyond that described for construction. Indirect habitat impacts such as dust from driving or moving equipment on gravel roads would occur over the life of the project. Alteration of tundra foraging areas which may result from delayed melt of ice roads and pads, will be greatest under Alternative C, which would require ice roads and ice pads through the life of project as compared to ice pad only use in Alternatives A and B which would be terminated after 7 years (drilling).

Tundra ice pads to support drilling for Alternatives A and B would be required for 7 winter seasons and would cause temporary loss of approximately 10 acres per year from winter forage habitat for both small and large herbivores and would also cause the same amount of temporary loss of subnivean habitat for small mammals. There would be no ice roads built for drilling or operations for Alternatives A and B. Alternative C would require ice roads and pads to be constructed for the life of the project, drilling would cause temporary loss of approximately 29.7 (ice road) and 10 (ice pad) acres in years 3 – 10 (drilling) and 29.7 (ice road) and 2 (ice pad) acres in years 11 – 32 (operations) of winter forage habitat for both small and large herbivores and would also cause the same amount of temporary loss of subnivean habitat for small mammals.

Disturbance

Disturbance of terrestrial mammals during drilling and operations would occur. During drilling and operations, caribou could be disturbed by low-level aircraft, light and heavy vehicle traffic, construction and use of ice pads (during drilling for Alternative A and B) and ice roads (for the life of the project in Alternative C), noise from drill rig (during the entire drilling phase), the presence of gravel roads and pads, and increased hunting pressure along the proposed GMT1-GMT2 Access Road. May et al. (2006) hypothesized that wolverine distribution may be partly influenced by direct disturbance or higher risk of human-caused mortality associated with infrastructure.

Other than aircraft activities, drilling itself would be expected to generate the highest noise levels during the drilling and operations phases. Section 4.2.3.3 of this document found that the overall impacts of drilling noise on the acoustical environment would be of high intensity and regional extent for maximum noise levels, but median noise levels would be expected to be of high intensity to a limited extent. In both cases, impacts would be temporary and would attenuate to low intensity with increasing distance from the source. Drilling noise could contribute to local avoidance of infrastructure by wildlife, but would be unlikely to result in population-level impacts. Noise impacts attributable to drilling itself would not be expected to vary among the action alternatives under consideration.

Disturbance from vehicle traffic on gravel and ice roads and air traffic would continue during drilling and operation. Maximum traffic levels would likely occur when drilling activities occur simultaneously with final construction. Although the levels may differ, disturbance would be similar to that described for construction.

Aircraft

Alternatives A and B would require no fixed-wing aircraft flights for either the drilling or operations phases of the project. Alternative C would require 7525 fixed-wing aircraft flights (1210/year) for drilling and 6255 fixed-wing aircraft flights (270/year) for operations. Alternatives A and B would require 540 helicopter flights (90/year) for drilling and 2070 helicopter flights (90/year) for operations. Alternative C would require 858 helicopter flights (143/year) for drilling and 3,289 helicopter flights (143/year) for operations. Under Alternative C flight activities would include transport of cargo by 4E aircraft into and out of the GMT2 airstrip, and transport of personnel and cargo into and of GMT2 by 2E aircraft. Aircraft noise levels and associated impacts generally would be similar to those described above for the construction phase. Noise impacts would be of high intensity and regional extent, but would be of interim duration due to their occurrence through the entire operational phase of the project. Impacts of aircraft noise would be the same under Alternatives A and B, and would be greatest under Alternative C.

Low-level overflights for permit-required studies, routine operations, maintenance, and surveillance of pipelines may elicit responses in un-habituated caribou, although caribou will likely demonstrate some level of habituation after the 2-3 year construction period. There will be a greater number of flights under Alternative C over the life of the project, but these impacts are expected to be brief (Wolfe et al. 2000), and are not expected to impact caribou to a greater degree than Alternatives A or B.

Hazing animals off airstrips would continue under drilling and operations. Impacts will be the same as those described under construction.

Roads and Vehicle Traffic

Alternatives A and B would have similar lengths of gravel road (8.2 and 9.4 miles respectively) while Alternative C will have only a 0.9 mile gravel airstrip access road and an annual ice road of 7 miles.

For all Alternatives vehicle traffic will decrease substantially post construction with Alternative C having the highest traffic levels during the drilling and operation periods due to exclusively using ice roads for vehicle traffic. During drilling Alternatives A and B will require 9,000 trips annually while Alternative C will require 22,500 annually. During operations Alternatives A and B will require 700 trips annually while Alternative C will require 21,800 annually.

Impacts to caribou associated with roads and vehicle traffic would be similar to those described for construction. It is likely that some habituation of the TCH to the GMT1-GMT2 Access Road will have occurred during the 2-3 year construction period, although the extent to which caribou alter their movements in the presence of the road is not known.

Mortality

Animal mortalities associated with vehicle or aircraft collision could occur throughout the life of the project. The cause and effects of such collisions and mortality are the same as described for construction.

Vehicle collisions would likely decline during operations because of reduced personnel and transportation requirements on the GMT1-GMT2 Access Road for Alternatives A and B, and on ice roads in Alternative C. However, occasional vehicle collisions would still be possible. In addition to collision-related mortalities, other types of wildlife mortality such as entanglement, or DLP incidents could occur during operations, as has occurred in the Prudhoe Bay oil field (Streever et al. 2006, 2007; Sanzone et al. 2008, 2009).

Spills of refined products could occur during drilling and operations. Such incidents would be rare, but impacts to terrestrial mammals would be the same and those described for construction.

Altered Survival or Productivity

Factors altering survival or productivity during drilling and operations would be similar to those described for construction.

Comparison of Alternatives

Action alternatives differ primarily in how the GMT2 drill site is accessed, and these access considerations lead to differences in infrastructure development and operations. Under Alternative A or B, access to GMT2 relies on travel via a gravel road, except for seasonal ice roads used during construction. Under Alternative C, year-round access to GMT2 would be via aircraft, and seasonal access would be via winter ice roads. Alternative C requires construction of an airstrip at GMT2; Alternatives A and B require construction of the gravel GMT1–GMT2 Access Road. Vehicle traffic on gravel roads would be comparatively higher for Alternative A or B, than for C, and air traffic would occur only for Alternative C. Habitat and disturbance impacts to terrestrial mammals are compared for the three Alternatives.

The direct impacts of gravel placement on potential caribou use habitats are summarized in Table 4.3-13. Direct habitat impacts are greatest for Alternative C. Each alternative would have a total gravel fill footprint representing less than 1 percent of the total area of caribou habitat in the approximately 155,500-acre project area, and would impact less than 1 percent of specific habitats identified as potential caribou use habitats. Indirect impacts based on a 300-foot zone surrounding gravel infrastructure are highest for Alternatives A and B. Indirect impacts would impact less than 1 percent of the total project area in all Alternatives (Table 4.3-15).

Phase 3 expansion of the Arctic Slope Regional Corporation Mine site would result in loss of the existing vegetation and wetlands within the mine footprint. The vegetation types within the expected footprint of excavation are Wet Sedge Meadow Tundra (426 acres), Closed Low Willow (12 acres), and Open Low Willow (less than 1 acre), which are potential caribou use habitat. This impact, as a result of gravel extraction, would represent approximately 1.3 percent of the total 32,682 acres of Wet Sedge Meadow Tundra within the mapped project area, 0.5 percent of the 2,490 acres of Closed Low Willow, and less than 0.1 percent of the 3,868 acres of Open Low Willow. Mined gravel would be transported from the Arctic Slope Regional Corporation Mine site to the project area over ice roads during Year 1 (January–April 2019).

All action alternatives have the potential for spills resulting from pipelines, storage tanks, production facilities/infrastructure, drill rigs, or vehicles. Generally, because the location and length of oil transit pipelines under the action alternatives are similar, the risk of a pipeline spill occurring is similar among alternatives, although Alternative C has a slightly greater risk due to the additional ancillary diesel pipeline.

Difference does exist, however, in the risk to the surrounding environment. Over half of the GMT1–GMT2 Access Road under Alternative A is downgradient from the pipeline, and would act as a barrier to spill migration. The GMT1–GMT2 Access Road would also be used for pipeline inspections and spill response. Alternative B would move much of the road to the watershed divide, reducing this benefit of a road barrier. Because Alternative C is roadless and relies upon air support and yearly ice road construction for incident response, risks to terrestrial mammals and associated habitat associated with an oil spill are increased throughout the project life. Spills could potentially cause terrestrial mammal mortality, contamination of food sources, and damage of terrestrial mammal habitat.

Potential impacts of oil spills are described in Section 4.5 of this document. The extent of environmental impacts of a spill would depend on the type and amount of fluids spilled; the location of the spill; and the effectiveness of the cleanup. It is anticipated, based on North Slope spill history, that the majority of spills would be contained on a gravel road or pad with little or no impacts to terrestrial mammal habitat.

Alternatives A, B and C would have similar impacts to terrestrial mammals from habitat loss or alteration. As shown in Table 4.3-13, direct and indirect habitat impacts for Alternatives A and B are expected to be of low intensity (less than 5 percent of high-valued habitat will be altered by development), long-term duration (habitat will be altered by infrastructure for over 5 years), and limited in extent (habitat impacts occur within 300 feet of developed infrastructure). The affected resources, which in this case include important subsistence food resources for local communities, are rated important because caribou fill a distinctive ecosystem role within the locality and region (Section 4.4.5, “Subsistence”).

The project area is not within the concentrated caribou calving area of the TCH (Lawhead et al. 2015). Therefore, potential impacts to calving caribou are rated as low intensity to reflect the low likelihood that calving caribou would be impacted by habitat changes or disturbance (Table 4.3-13). Impacts to calving caribou would be long term and limited in extent, but unlikely. Potential impacts from habitat changes or disturbance to non-calving caribou are considered to be of medium intensity, long-term duration, and limited in extent (Table 4.3-14). The medium intensity rating is due to infrequent occasions when a large number of caribou are present in the project area (e.g., during some insect relief periods or fall migration), brief disturbance of non-calving caribou could potentially affect between 5 percent and 10 percent of the local caribou population (Prichard et al. 2017).

Both Alternative A and B would lead to increased vehicle traffic in the GMT2 Project area on roads connecting CD1/Alpine Processing Facility, GMT2 (proposed) and Nuiqsut. This new traffic would be primarily for industrial use, but would also include some traffic from Nuiqsut residents using the new GMT1–GMT2 Access Road. Annual ice roads would require construction activity and potentially disturb caribou throughout the project life for Alternative C. Impacts to terrestrial mammals from traffic on gravel and ice roads is expected to be of low to medium intensity, limited in extent, and important in context (Table 4.3-13) Re-use of annual ice road routes and ice pad locations could damage mammal habitat (tundra vegetation), a potential long-term impact.

The use of aircraft to access the site under Alternative C differentiates this alternative from Alternatives A and B. Aircraft noise during take-offs and landings associated with the high number of flights required for transport of personnel and for special studies for Alternative C is expected to result in only low intensity (Table 4.3-15) impacts to caribou in the project area due to the research finding that impacts to caribou from aircraft noise is expected to be of only short duration (Wolfe et al. 2000).

Considering multiple types of impacts to terrestrial mammals, all alternatives are expected to have impacts that are typically of low to medium intensity, long term duration, and limited in extent and for caribou, important in context (Table 4.3-15).

Alternative D, which would not approve GMT2 Project, would result in no new impacts to terrestrial mammals.

Table 4.3-13. Estimated direct impacts of action alternatives to potential caribou-use habitats

Potential Caribou-Use Vegetation[a]	Mapped Project Area[b] (acres)	Vegetation Type as % of Mapped Project Area	Alternative A		Alternative B		Alternative C	
			Acres	(%)	Acres	(%)	Acres	(%)
Barren	5,046	3.5	NP	NP	NP	NP	NP	NP
Closed Low Willow	2,490	1.7	NP	NP	NP	NP	NP	NP
Deep Polygon Complex	823	0.6	NP	NP	NP	NP	NP	NP
Moist Sedge–Shrub Tundra	23,682	16.4	19.8	--	19.7	--	10.3	--
Open Low Willow	3,868	2.7	NP	NP	NP	NP	NP	NP
Partially Vegetated	1,407	1.0	NP	NP	NP	NP	NP	NP
Riverine Complex	410	0.3	NP	NP	NP	NP	NP	NP
Tussock Tundra	29,899	20.6	51.1	0.2	59.1	0.2	74.4	0.2
Wet Sedge Meadow Tundra	32,682	22.6	1.8	--	2.0	--	1.7	--
Total Acres of Impact for Alternative[c]			77.9	N/A	87.2	N/A	92.0	N/A

Note: Values that are greater than zero but less than 0.1 are noted with a dash (--). (NP) cells indicate the vegetation type is not present within area considered for impact analysis.

[a] Includes potential forage and insect relief areas as discussed in "Methodology," Section 4.3.4.1.

[b] Percent of vegetation type acreage within the mapped vegetation portion of the project area. Note that 10,465.3 acres (6.6 percent) of the project area extends outside of the vegetation map coverage.

[c] Total of Impact for alternative does not include 0.1 acre from the installation of new pipeline vertical support members between GMT2 and GMT1.

Table 4.3-14. Estimated indirect (300-foot zone) impacts of action alternatives to potential caribou-use

Potential Caribou-Use Vegetation [a]	Mapped Project Area [b] (acres)	Vegetation Type as % of Total Project Area	Alternative A		Alternative B		Alternative C	
			Acres	(%)	Acres	(%)	Acres	(%)
Barren	5,046	3.5	NP	NP	NP	NP	NP	NP
Closed Low Willow	2,490	1.7	NP	NP	NP	NP	NP	NP
Deep Polygon Complex	823	0.6	NP	NP	NP	NP	NP	NP
Moist Sedge–Shrub Tundra	23,682	16.4	172.3	--	172.3	--	37.9	--
Open Low Willow	3,868	2.7	1.4	--	0.0	--	0.0	--
Partially Vegetated	1,407	1.0	NP	NP	NP	NP	NP	NP
Riverine Complex	410	0.3	NP	NP	NP	NP	NP	NP
Tussock Tundra	29,899	20.6	349.4	1.2%	441.9	1.4%	178.2	0.6%
Riverine Complex	490.4	0.3	NP	NP	NP	NP	NP	NP
Wet Sedge Meadow Tundra	32,682	22.6	20.6	--	16.7	--	5.2	--
Total Acres of Impact for Alternative			621.8	N/A	711.9	N/A	230.8	N/A

Note: Values that are greater than zero but less than 0.1 are noted with a dash (--). (NP) cells indicate the vegetation type is not present within area considered for impact analysis.

[a] Includes potential forage and insect relief areas as discussed in "Methodology," Section 4.3.4.1.

[b] Percent of vegetation type acreage within the mapped vegetation portion of the project area. Note that 10,465.3 acres (6.6 percent) of the project area extends outside of the vegetation map coverage.

Table 4.3-15. Impact criteria summary for terrestrial mammals, Alternatives A, B and C

Impact Type and Affected Population		Intensity	Duration	Context	Geographic Extent
Habitat Loss and Alteration	Small Mammals	Low	Long Term	Common	Limited
	Caribou Potential Use Habitats (within 300 feet)	Low	Long Term	Important	Limited
Disturbance	Arctic Fox Dens/Den Habitat	Low	Long Term	Common	Limited
	Grizzly Bear Dens/Den Habitat (within 2.5 miles)	Low	Long Term	Common	Limited
	Caribou (non-calving; within 2.5 miles)	Medium	Long Term	Important	Limited
	Calving Caribou [a] (within 2.5 miles)	Low	Long Term	Important	Limited
	Muskoxen and Grizzly Bear (within 2.5 miles)	Low	Long Term	Common	Limited

[a] The project area is not within the reported caribou calving use areas in NPR-A (BLM 2012, Map 3.3.6-5, Teshekpuk Caribou Herd Calving Areas).

Mitigation

Specific stipulations and best management practices that will decrease the risk of impact to mammals and their habitats within the NPR-A are summarized below:

Ensure that solid, liquid, and hazardous materials/wastes do not impact wildlife or their habitats, and to reduce the potential for garbage that attract predators:

- BMP A-2: requires comprehensive waste management planning, including methods to avoid attracting wildlife and affecting quality of local waters and wetlands;
- BMP A-3 and A-4: requires liners and impermeable containment, spill prevention and response planning;
- BMP A-5: prohibits fuel storage and refueling of equipment within 500 feet of the active floodplain of any water body;
- BMP A-6 and A-7: prohibit discharge of reserve-pit fluids and produced water;
- BMP A-8: requires bear-interaction plans to minimize conflicts.

Protect mammal habitat:

- BMP C-1: prohibits cross-country use of heavy equipment and seismic activity within 0.5 miles of grizzly bear dens;
- BMP E-5: requires design and location of infrastructure to minimize development footprint;
- BMP E-8: requires approved gravel mine site design and reclamation plan that minimizes impact on wildlife resources;
- BMP E-12: requires ecological land classification mapping of development area before facility construction is approved;
- BMP E-19: requires digital, spatial representation of all new infrastructure to be provided to BLM, for use in monitoring and assessing wildlife movements during and after construction;
- BMP G-1: requires reclamation of land used for infrastructure after oil and gas production ends;
- BMP L-1: requires BLM approval for use of low-ground-pressure vehicle traffic during summer to minimize impacts to habitat for caribou and other terrestrial mammals;
- Protect wildlife from disturbance by oil field infrastructure and related activities;
- BMP E-7: requires design standards for roads and pipelines to allow free movement of caribou (e.g., pipelines minimum 7-feet above tundra; minimum separation of roads and pipelines of 500 feet);
- BMP F-1: restricts the minimum altitude of air traffic to 1,500-feet above ground level whenever feasible to avoid disturbing caribou. Some required studies require lower altitudes and are exempted (e.g., avian, caribou, hydrology); requires submission of an aircraft use plan;
- BMP I-1: orient personnel on reducing resource conflicts, e.g., avoid disturbing biological resources and their habitat;
- BMP M-1: prohibits chasing wildlife with ground vehicles.

In addition to the mitigation measures noted above, there are BLM best management practices and stipulations that regulate the types of activities that can occur near water bodies, including rivers and streams, and types of equipment that can be used in the planning area. These would also serve to protect mammals and their habitats. A list of protective measures for mammals, including additional mitigation from the 2004 Record of Decision (BLM 2004b) is provided in Section 4.7, “Mitigation Measures and Monitoring.”

Conclusions

The likelihood of impacts to mammals identified in this document can be separated into reasonably foreseeable and potential as shown in Table 4.3-16. All of the evaluated effects were determined to have some impacts to the mammal populations in the study area.

Table 4.3-16. Likelihood of impacts, terrestrial mammals

Reasonably Foreseeable Impacts	Potential Impacts
Habitat loss and alteration from gravel extraction and gravel placement.	Increased insect relief habitat from gravel fill (raised gravel roads and pads).
Temporary loss of winter forage habitat from ice road construction.	Creation of denning habitat for bears and fox from gravel fill and facility construction.
Temporary subnivean habitat loss for small mammals from ice road construction.	Increased risk of predation for small mammals from ice road construction and reduced concealment cover.
Alteration of the distribution and availability to mammalian predators of nests and prey from ice roads and snow drifts.	Increased predation and vehicle collision mortality due to terrestrial mammals being attracted to early vegetation greening along roadways.
Habitat loss from snow piling and snow drifts around roads and pipelines.	Deflection or delay of caribou movements due to presence of gravel and ice roads and traffic on them.
Disturbance to caribou and muskoxen from infrastructure and human activity causing displacement from the immediate area.	Disturbance of Arctic fox dens, grizzly bear den habitat, and small mammal burrow habitat due to construction of ice roads and vehicle traffic.
Hazing caribou near airstrips that would likely result in temporary disturbance and temporary displacement.	Increased hunting pressure caused by increased access for Nuiqsut residents.
Blocking of movements of small mammals by gravel fill.	Increased risk of predation by loss of subnivean habitat from ice road construction.
Small mammal mortality from construction of ice and gravel roads.	Wildlife mortality due to exposure to flares, entanglement, and trapping and destruction of nuisance animals.
Increased mortality or injury from vehicle collisions along ice and gravel roads.	Oil discharge causing coating of furor the ingestion of contaminated vegetation.
Temporary disturbance to caribou caused by aircraft traffic.	Increased survival and productivity for Arctic foxes, bears, and weasels due to improperly managed human food or garbage, and the availability of infrastructure for thermal protection, escape cover, or den sites.
Habitat alterations in areas near gravel fill caused by deposition of gravel spray and (or) dust, altered hydrology, and thermokarsting could reduce the forage available to small and large terrestrial mammals.	

4.3.4.2 Marine Mammals

In general, marine mammals are not expected to occur either within the project area, or north of the project area along the coastline of Harrison Bay. The water along the coast is either beyond their geographical range or too shallow for most species to use during limited migrations through the area. Of the 10 marine mammals initially considered, it was determined that 6 are not expected to occur in the project area (as discussed in Section 3.3.4), and are not further evaluated. The four exceptions are polar bear, covered under Section 4.3.5, “Threatened and Endangered Species,” spotted seal, bearded seal, and the beluga whale. These marine mammals were described and evaluated in BLM (2014), which is incorporated by reference, and summarized below.

As noted in Section 3.3.4, BLM performed an evaluation of GMT1 development, and determined that the spotted seal, bearded seal, and beluga whale were unlikely to sustain impacts from that project (BLM 2015). As with GMT1, GMT2 Project facilities and project area are entirely inland, with no facilities, pipelines, or activities related to the project occurring on or immediately adjacent to the marine coastal zone. In the unlikely event of a large oil spill reaching open water during summer or fall, small numbers of beluga whales, bearded seals, and larger groups of spotted seals could be negatively impacted. No difference in impacts to marine mammals is expected under any of the action alternatives. In conclusion, assuming that no large oils spills reach the open water environment, impacts to marine mammals are expected to be negligible.

4.3.5 Threatened and Endangered Species

Impacts to threatened and endangered species are described in BLM (2004) and BLM (2012). The types of potential impacts to threatened and endangered species under the GMT2 Project are similar to that of other birds and mammals, and include habitat loss and alteration, disturbance and displacement, mortality, obstruction of movement, and predation. Section 4.3.3, “Birds,” and 4.3.4.2, “Marine Mammals,” provide discussion of potential impacts to birds and marine mammals in general.

The threatened and endangered species that have been reported to occur in or near the project study area are: Steller’s eider, spectacled eider, and polar bear. There are only three records of Steller’s eider breeding east of Utqiagvik (formerly Barrow) in the last 25 years (on the Colville River Delta in 1987 and in Prudhoe Bay in 1993; and inland from Dease Inlet/Admiralty Bay area in 1997 [Seiser and Johnson 2014]). Therefore, this species was not analyzed in depth for the GMT2 Project.

The impact evaluation criteria for threatened and endangered species are based on the general impact criteria described in Section 4.1.2, “Impact Criteria,” as presented in Table 4.3-. Impact evaluation for spectacled eider primarily utilizes habitat mapping and species-specific habitat preference based on 20 years of avian survey data, as described in Section 3.3.3, “Birds.”

Table 4.3-17. Impact criteria; threatened and endangered species, birds

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting 25% or more of a single high-value habitat present within the project study area.
	Medium	Potentially affecting more than 5%, but less than 25% of a single high-value habitat present within the project study area.
	Low	Potentially affecting 5% or less of a single high-value bird habitat present within the project study area.
Duration	Long Term	Lasting longer than 10 years.
	Interim	Lasting longer than 2 years, but less than 10 years.
	Temporary	Lasting less than 2 years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region, and is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality or region and is not protected by legislation.
Geographic Extent	Regional	Extends beyond the GMT2 Project area.
	Local	Extends beyond 300 feet from project components, but within the GMT2 Project area.
	Limited	Within the footprint and extending 300 feet from project components.

The types of potential impacts to threatened and endangered species are similar to that of other birds and mammals, and includes habitat loss and alteration, disturbance and displacement, mortality, obstruction of movement, and predation. Section 4.3.3, “Birds” provides discussion of potential impacts to birds in general.

Potential impacts to threatened and endangered species from project elements and activities vary among the different action alternatives during construction, drilling, and operations (i.e., production). Discussion of the potential impacts and comparison of alternatives is presented below.

Overall, the potential impacts to the threatened and endangered species that could potentially be affected by the action alternatives are expected to be of low intensity, local in extent, and long term in duration. Impacts for each particular threatened or endangered species range from no impacts to minor impacts.

4.3.5.1 Steller’s Eider

Nest searches in the Colville River Delta, Kuparuk River Unit, and northeast NPR-A over approximately 25 years have found no nests or indications of breeding by Steller’s eiders (Johnson et al. 2013). In a similar time period, only a few sightings of individuals have been recorded (Johnson et al. 2013; Seiser and Johnson 2014). Therefore, there is a low probability for their presence in the future at the project study area (Johnson et al. 2013). There is no designated critical habitat for this species on the North Slope. No impacts to Steller’s eiders are expected to occur as a result of any of the action alternatives and they are not further addressed in this section. There would be no impacts under the no-action alternative.

4.3.5.2 Spectacled Eider

Impacts to spectacled eiders from construction and drilling and operation within the project study area are discussed in BLM (2004) and in BLM (2012). Results from these previous analyses are summarized in this section and a comparison of alternatives with regard to project activities and infrastructure is provided, as well as conclusions regarding potential impacts to spectacled eider.

As indicated by the impact criteria (Table 4.3-17), this evaluation primarily utilizes habitat to make impact rating determinations. No direct impacts from gravel placement to potential high-value habitats within the GMT2 Project area have been identified, as there are no potential high value habitats found in the direct impact area. Only one potential high-value habitat was found in the indirect impact area within the project study area and that habitat, along with the area of potential indirect impact is listed for spectacled eider in Table 4.3-18 and were selected using statistical analysis which identified species preference for select habitat types within the NPR-A Study Area (Johnson et al. 2015). Two terrestrial habitats—Moist Sedge-Shrub Meadow and Moist Tussock Tundra—were significantly avoided and were notable because they occupy over 35 percent of the study area (Johnson et al. 2015).

There is no designated critical habitat for the spectacled eider on the North Slope. Data collected in multi-year surveys indicate the spectacled eider is present in the project study area; the species occurs in high concentrations on the Colville River Delta, and north of Nuiqsut. No direct impacts from gravel placement to potential high-value habitats within the GMT2 Project area have been identified. Potentially high value habitats utilized by the spectacled eider exist within the 300-foot zone of influence around the major components proposed in the GMT2 Project action alternatives (e.g., GMT1–GMT2 Access Road, GMT2 pad, pipeline, and airstrip). The spectacled eider could be directly or indirectly impacted by the proposed project under all action alternatives as a result of habitat loss and alteration, disturbance and displacement, obstruction of movement, various sources of mortality (e.g., vehicle collisions, nest predation), or spills.

Table 4.3-18. Indirect impacts to potential high-value habitats of spectacled eider within the project study area (300-foot zone of influence)

Habitat Type [a]	Project Area [b] (acres)	Habitat Type as Percent of Total Project Area	Alternative A		Alternative B		Alternative C	
			Indirect Impact (acres)	%	Indirect Impact (acres)	%	Indirect Impact (acres)	%
Shallow Open Water without Islands	1,218	0.8%	2.9	0.2%	--	--	--	--
Total [c]	1,218	0.8%	2.9	0.2%	--	--	--	--
Unmapped Area [d]	10,465	6.6%	--	--	--	--	--	--

Note: (--) cells indicate the habitat is not present within area considered for impact analysis.

[a] Source information for habitat preferences of pre-nesting spectacled eiders based on Monte Carlo analysis in Tables 5 and 8 of Johnson et al. (2013).

[b] Total acreage of the GMT2 Project Study Area, including both the mapped habitat area and the unmapped area is 157,408.4 acres.

[c] Total impacted acreage may differ slightly from other impact totals listed within the document due to rounding of individual calculated habitat impacts and presentation of only preferred avian habitats.

[d] Note that 10,465.3 acres (6.6 percent) of the GMT2 Project area extends outside of the habitat map coverage. All project facilities under all action alternatives are within areas of mapped vegetation

Construction

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality under any of the action alternatives would occur during the construction phase.

Habitat Loss and Alteration

Spectacled eiders and their potential high value habitat are not expected to experience any habitat loss or alternation from gravel extraction or fill placement for roads, pads, or airstrips. Eight potential high-value spectacled eider habitats occur within the GMT2 Project area, but none occur in the locations where gravel extraction or fill placement is proposed.

Temporary loss of spectacled eider habitat (indirect impact) associated with gravel fill could occur on the adjacent tundra, where accumulated snow from snow-plowing activities or snowdrifting is compacted, leading to delayed snowmelt. Delayed snowmelt persisting into the nesting season could preclude spectacled eiders from nesting in those areas (BLM 2012).

Tundra ice roads would cause temporary spectacled eider habitat loss and alteration because ice roads can remain in place until after eiders have arrived in the general area. Ice roads also compress the vegetation, especially standing dead vegetation that might be used by spectacled eiders for concealment. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (U.S. Army Corps of Engineers 2012). Relatively slow melting ice roads could act as temporary dams, causing impoundments of water.

Impoundments created by ice roads or gravel structures could be ephemeral (drying up early during the summer) and could cause temporary or permanent flooding on adjacent tundra, or they could become permanent water bodies that would persist from year to year. Hydrological impacts along roads and pads, such as impoundments, are discussed in Section 4.2.2, “Water Resources.” Tundra covered by impounded water could result in a loss of nesting and foraging habitat for spectacled eiders. However, impoundments could also create new feeding and brood-rearing habitat that could be beneficial (BLM 2012).

Water withdrawal from lakes during ice road construction has the potential to lower the level of lakes and affect spectacled eiders that use adjacent habitats, particularly small islands and shoreline areas that may be used for nesting. Changes in the surface levels of lakes due to water withdrawal would depend on the amount of water withdrawn, volume of the lake, and recharge rate. There is also potential for impacts to spectacled eiders resulting from potential impacts to invertebrate and fish food resources from varying winter water levels if pumped lakes do not fully recharge (BLM 2012). The impacts of lowered lake water levels are expected to be temporary.

Displacement and Disturbance

Gravel mining and placement of gravel fill would occur during winter when spectacled eiders are not present. Road work such as grading, compacting, and reshaping of roads and pads would occur during summer when these birds are present. The noise and vehicle traffic during these activities would likely disturb and displace spectacled eiders away from gravel roads, pads and airstrips. Disturbance would cause the spectacled eiders to expend energy in responding, although it may not necessarily reduce their survival or productivity (U.S. Army Corps of Engineers 2012). Noise would likely cause the greatest disturbance to spectacled eiders between June 1 and July 15 when they would be on nests and would be unwilling to move away from the disturbance (U.S. Army Corps of Engineers 2012).

Johnson et al. (2003a) reported that waterfowl nesting near the Alpine oil field that were displaced from nesting sites by gravel placement may move their nest sites to nearby habitats. In addition, there may be a functional loss of habitat in areas near roads, pads, and airstrips, if development-related disturbances preclude spectacled eiders from utilizing these habitats.

Noise and visual cues from air traffic could disturb spectacled eiders. Responses to aircraft could potentially include alert and concealment postures, interrupted foraging behavior, flight, and a reduction in nest attendance (U.S. Army Corps of Engineers 2012, Section 5.9.3.1). The impacts of routine aircraft flights could range from avoidance of certain areas to abandonment of nesting attempts or lowered survival of young. The potential impact to spectacled eiders from aircraft noise would probably be greatest during the nesting period when the movements of incubating birds are already restricted due to the need to incubate eggs and birds may be energetically stressed and sensitive to disturbance (BLM 2012, Section 4.3.8.2, page 176).

Aircraft noise levels would be highest during take-offs and landings, and most aircraft-related disturbance would be concentrated around an airstrip for brief time periods. Disturbance may also increase as a function of flight frequency, and spectacled eiders in areas that experience many flights may experience larger disturbance impacts than those in areas with few flights. Although the potential exists for displacement of some nesting spectacled eiders near routinely used airstrips, as a result of numerous over-flights, landings, and takeoffs, some eiders may habituate to routine aircraft traffic. Within the project study area, the duration of flights would be short and occur in a specific area. Although likely to cause disturbance to spectacled eiders, depending on the time of year disturbance from aircraft traffic may be minimal.

However, disturbance to spectacled eiders could also result in temporary or permanent displacement from high-value habitats, potentially resulting in decreased nesting and nest attendance, nest abandonment, nest predation, and increased energy expenditures that could affect an individual eider's survival or reproduction (BLM 2012). Disturbances could displace spectacled eiders from feeding habitats and negatively impact energy budgets. Disturbances would impact spectacled eiders during the entire time that they would be using the project area, although the impacts may vary depending on reduced forage opportunity during nesting if the disturbance causes the eider on the nest to leave the nest exposing the nest to an increased rate of predation, and during brood-rearing when some eiders exhibit higher rates of alertness in areas near roads than do birds in undisturbed areas. Some evidence suggests that pedestrian traffic may have a greater impact on some species of birds than vehicular traffic (BLM 2012). The mitigation measure of hazing birds at or near airstrips would likely result in temporary disturbance and possible displacement of spectacled eiders.

Mortality

Spectacled eider mortality could result from collisions with vehicles, aircraft, or structures, or predation, as described in Section 4.3.3, "Birds." Minor impacts could be sustained, but are unlikely, due to the low density of spectacled eiders in the project study area.

Spectacled eiders may collide with structures necessary for operation such as communication towers, flare towers, buildings, antenna guy-wires, and elevated pipelines. Descriptions of such structures associated with GMT2 are included in Section 2.4.3, "Drill Pad and Support Facilities." Satellite dishes, elevated radio antennae, and radio repeater sites would also add potential collision hazards. Although bird collisions with oil field structures are expected to be infrequent, some collisions and resultant mortality to some spectacled eiders are probable.

Bird collision events with infrastructure during poor weather conditions are rare and episodic, but would have the potential to occur for the life of the project (long term). Facilities would always be lighted, a situation which can attract birds (U.S. Army Corps of Engineers 2012). Poor visibility due to fog and low light conditions, which are common in the project study area (see Section 3.2.3.1, "Climate and Meteorology") would contribute to the risk of collisions with infrastructure. The potential for impact may be lessened by downward shielded lighting.

Vehicle traffic on infield gravel roads poses the greatest threat to birds during the summer, when the largest numbers of spectacled eiders are present in the project study area, possibly resulting in bird collision mortality. Overall, collision mortality is generally thought to be low within North Slope oil fields, although this is poorly documented (U.S. Army Corps of Engineers 2012).

Predation

Ravens, gulls, Arctic fox and red fox, bears, and other predators may be attracted to areas of human activity where anthropogenic sources of food and shelter are present. Survival of these predators could increase due to the availability of anthropogenic food sources. Other food sources for predators can arise from roadkill on new roads creating opportunities for scavenging predators. BLM has included recommendations for a roadkill monitoring and reporting system in Section 4.7, "Mitigation Measures and Monitoring." Increased levels of bird and egg predation due to elevated numbers of predators could, in turn, impact spectacled eider populations over time (BLM 2012). In recent years, oil field operators have installed predator-proof dumpsters at camps and implemented new refuse handling techniques to minimize the attraction of predators. In addition, oil field workers undergo training to make them aware of the problems associated with feeding wildlife. At the Alpine oil field, Johnson et al. (2003a) reported that ravens (a predatory species) were rarely observed in the area prior to development of infrastructure, but were commonly observed after development with nests confirmed in 2000 and 2001. Although ravens were commonly observed after the construction of the Alpine development, Johnson et al. (2003a) reported no post-development increase in predation rates of waterfowl nests.

Drilling and Operation

The following section describes impacts to spectacled eiders during the drilling and operations phase.

Habitat Loss and Alteration

After initial placement of gravel to construct roads, pads and airstrips in the project study area, some habitat alterations from the indirect impacts of snowdrifts, dust fallout, thermokarst, and ponding could continue during project operation as described in Section 4.3.3.1, "Construction."

An oil spill could impact spectacled eiders using terrestrial or aquatic habitats. Potential impacts to spectacled eiders would depend on the location and size of the spill, and on the time of year. An oil discharge in nesting or brood-rearing habitat could impact spectacled eiders that might congregate in these areas. Impact from spills is addressed in Section 4.5, "Impacts of Oil, Saltwater, and Hazardous Material Spills."

Disturbance and Displacement

Road work such as grading, compacting, and maintenance of roads and pads would occur during summer when these birds are present. The noise and vehicle traffic during these activities would likely disturb and displace spectacled eiders away from gravel roads, pads and airstrips. The potential displacement of birds caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase; the impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives. However, in general, vehicle and aircraft traffic would significantly reduce after construction is complete.

The potential displacement of spectacled eiders caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase; the impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives.

Oil spill response training activities using watercraft could be conducted on rivers and lakes during the open-water season. Spill response training activities would have the potential to disturb foraging, nesting, or brood-rearing spectacled eiders.

Mortality

Overall, the potential mortality impact to spectacled eiders is considered minor for all the action alternatives. There would be no mortality impacts under Alternative D.

The potential for mortality such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and spectacled eiders are present in the project area. Mortality impacts that occur during construction of this project, such as collisions with infrastructure would continue through the drilling and operations phase of the project.

Predation

Increased predation on nests from predators attracted to development is a concern for spectacled eiders nesting in the GMT2 Project study area. Predators such as fox, bear, and predatory birds are attracted to the increased scavenging opportunities associated with development and humans.

Abandonment and Reclamation

Abandonment and reclamation of project facilities may involve removing gravel pads, roads, and airstrip or alternatively leaving these (or some facilities) in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Winter activities would cause little disturbance or displacement, because most spectacled eiders would be absent from the area. Depending on the types of abandonment and reclamation that actually occurs, summer road and air traffic could cause disturbance, displacement, and mortality to spectacled eiders that would be similar in type, but at potentially lower intensity levels and for shorter durations than caused by traffic during the construction and operations phases.

Gravel pads, roads, and airstrips that are not revegetated would have diminished value to most birds in general. Revegetation without gravel removal would not return the site to its current utility for most birds. If gravel was removed, habitat similar to that currently existing in the area could be created and used by birds, although the precise mix of habitat types would likely not be the same as what prevailed at the time of disturbance (BLM 2012).

Comparison of Alternatives

The following sections compare the proposed action and project alternatives.

Habitat Loss and Alteration

Spectacled eiders utilize wet, aquatic, and halophytic habitats (saline) during breeding, employing islands, peninsulas, shorelines, hummocks in wet meadows, and polygon rims as nesting habitat. Each action alternative would impact small amounts of wet, aquatic, and halophytic habitat types. Eight such high-value spectacled eider habitat types occur in the project study area and were analyzed for potential direct gravel footprint impacts, and indirect impacts of gravel/dust within 300 feet of footprints (Table 4.3-18).

There is anticipated to be no potential loss and alteration of spectacled eider habitat resulting from direct gravel placement under all action alternatives as no spectacled eiders have been found in the areas which would be directly impacted by gravel. There would be no habitat impacts from direct gravel placement under Alternative D.

Indirect impacts from gravel (based on a 300-foot zone extending out from gravel fill) to spectacled eider high-value habitat are less than 0.2 percent of the high-value habitat found in the study area (Table 4.3-18). There would be no indirect habitat impacts sustained under Alternative D.

Disturbance and Displacement

Spectacled eider density in the GMT2 Project study area is between 0 and 0.101 birds per square kilometer (Table 3.3-16). Given that a low density of spectacled eiders are present in the project study area, few spectacled eiders would potentially be affected by any of the action alternatives. Project-related activities during the summer when spectacled eiders are present would have the highest potential to disturb or displace birds near gravel roads, pads, and airstrips. Summer activity in Alternatives A and B would include vehicle traffic on the GMT1–GMT2 Access Road (year-round use for the life of the project). Summer activity for Alternative C would be characterized by increased aircraft traffic during the non ice-road season to access the GMT2 pad (vehicle access is seasonal by ice road).

All action alternatives are expected to have overall low intensity of disturbance and displacement impacts to spectacled eiders. Alternatives A and B would result in industrial and local vehicle traffic in the area. Alternatives A and B would include vehicle traffic on the GMT1–GMT2 Access Road (year-round use for the life of the project). Summer activity for Alternative C would be characterized by increased aircraft traffic during the non ice-road season to access the GMT2 pad (vehicle access is seasonal by ice road). Spectacled eiders would only be expected in the area from June through October.

Mortality

Overall, the potential mortality impact to spectacled eiders is considered minor for all the action alternatives. There would be no mortality impacts under Alternative D.

Predation

The GMT2 Project could increase the numbers of predators in the area, which could result in increased predation of spectacled eiders and their nests, similar to that described in Section 4.3.3.1, “Construction.” Spectacled eider densities are low in the project study area and predation impacts from the GMT2 Project are unlikely to occur. Overall, the potential predation impact to spectacled eiders is considered minor for all the action alternatives. There would be no additional predation impacts under Alternative D.

Conclusion

Given that a low density of spectacled eiders are present in the project study area, few spectacled eiders would potentially be affected by any of the action alternatives. Spectacled eiders, however, are considered a unique resource given their threatened status under the Endangered Species Act.

Overall, Alternatives A and B are predicted to have habitat loss and alteration rated as being of low intensity, long-term duration, and local extent (Table 4.3-19). However, Alternative C impacts from air traffic could extend into adjacent areas beyond the project study area, depending on the flight paths for airstrip approach and altitudes, resulting in a limited, regional level extent of impact (Table 4.3-20).

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality to spectacled eiders under any of the action alternatives would occur during the construction phase. Levels of disturbance, displacement would continue into development and drilling phases, but generally would significantly reduce after construction is complete. There would be no additional impacts under Alternative D.

Potential loss and alteration of potential high-value spectacled eider habitat from placement of gravel on tundra for roads and pads is not expected under any of the action alternatives as no spectacled eiders have been found in the areas that would be directly impacted by gravel.

Potential indirect impacts to spectacled eider high-value habitat under all action alternatives would be long term and would amount to less than the 5 percent low intensity threshold (less than 1 percent of each high-value habitat analyzed).

Summer fixed-wing or helicopter aircraft activity in support of the GMT2 Project, including related research, could result in disturbance to birds, causing temporary or permanent displacement from high-value feeding, nesting, or brood-rearing habitats in localized areas near areas of activity. All action alternatives are expected to have overall low intensity of disturbance and displacement impacts to spectacled eiders based on impacts to suitable habitat within the proposed development. Disturbance and displacement would only occur during summer months when eiders are present in the region.

Overall, the potential mortality, including predation, impact to spectacled eiders is considered minor for all the action alternatives.

Although impacts to spectacled eiders could occur as a result of the action alternatives, long-term studies of bird density and abundance in the Prudhoe Bay oilfield, located on the Arctic Coastal Plain, indicate that oil production, as practiced in Prudhoe Bay, does not necessarily lead to substantial declines in bird density or productivity in or near the developed area (Bart et al. 2013).

Table 4.3-19. Impact criteria summary for spectacled eider, Alternatives A and B

Impact Type and Affected Population	Intensity	Duration	Context	Geographic Extent
Habitat Loss and Alteration	Low	Long Term	Important	Local
Disturbance and Displacement	Low	Long Term	Important	Local
Mortality and Predation	Low	Long Term	Important	Local

Table 4.3-20. Impact criteria summary for spectacled eider, Alternative C

Impact Type and Affected Population	Intensity	Duration	Context	Geographic Extent
Habitat Loss and Alteration	Low	Long Term	Important	Local
Disturbance and Displacement	Low	Long Term	Important	Regional
Mortality and Predation	Low	Long Term	Important	Local

4.3.5.3 Polar Bear

Potential impacts to polar bears are described in BLM (2004a, 2012, 2014) and are summarized and incorporated in this section.

The Beaufort Sea coastline, creek and river banks, and bluffs along lakes throughout the coastal area of NPR-A provide important areas for polar bear resting, feeding, denning, and seasonal movements. There have been no polar bear dens documented within 1 mile of the proposed infrastructure (for any of the action alternatives) (Map 3.3-6). However, den locations are not static, and polar bears have been known to den as far inland as the GMT2 Project area. Female polar bears have fidelity to general areas of suitable denning habitat, but not specific denning sites (USFWS 2011b). The GMT2 Project area is outside the region where den concentration is expected to be highest (Amstrup and Gardner 1994; Durner et al. 2013). Mapping of potential polar bear denning habitat (described in Section 3.3.5.3) suggests that the GMT2 proposed pad location, the GMT1–GMT2 Access Road route, and most of the pipelines would be outside the area designated as critical denning habitat. All proposed GMT2 facilities would be outside the area designated as critical for feeding (Durner et al. 2013; USFWS 2014a).

Incidental take regulations promulgated in August 2016 under the Marine Mammal Protection Act authorized nonlethal, incidental, unintentional take of small numbers or polar bears for oil and gas-related activities in the Beaufort Sea and adjacent northern coast of Alaska (81 FR 52276). Under the Incidental take regulations, letters of authorization can be requested from industry to authorize the take of small numbers of polar bears and Pacific walrus incidental to the development and production operations associated with this project. Project stipulations require that no activities occur within 1 mile of known or suspected polar bear dens.

Construction

While no dens are known to have occurred within a mile of GMT2 proposed infrastructure, man-made features may create suitable denning habitat in addition to the topographic features that naturally occur. Denning habitat within/adjacent to infrastructure can be created through drifting of snow.

Polar bears are also attracted to infrastructure through the smell of food or food waste. While the GMT2 Project area is between 12 and 18 miles inland, bears may move further inland in search of food as sea ice becomes scarce during summer and fall.

Stipulations require that no construction activities occur within 1 mile of known or suspected polar bear dens. The primary causes of impact to denning or non-denning polar bears would be related to noise caused by vehicle and aircraft traffic or construction activity. Non-denning polar bears could be attracted to or avoid the construction activity, depending on the individual bear.

Drilling and Operation

Impacts to denning or non-denning polar bears during drilling and operations would mainly be attributed to noise from vehicles, facilities, and aircraft (as described above for construction). Polar bears in the Beaufort Sea rarely venture far inland in the summer (Amstrup 2000). Therefore, they are less likely to be affected by drilling and operations during the summer. Drilling and operations would occur year-round in all action alternatives.

Comparison of Alternatives

All action alternatives could cause similar impacts to denning or non-denning polar bears during construction. Impacts (if any) during drilling and operations would be primarily during the winter when some female polar bear come ashore for maternity denning.

Habitat Loss and Alteration

Polar bears generally den in areas of topographic relief greater than 1.3 meters (e.g., along river and lake banks, coastal areas, and abandoned man-made gravel pads) where drifting snow accumulates early in the winter and provides adequate snow cover throughout the denning season (Durner et al. 2013). Bears will generally select the leeward side of features relative to the prevailing winds, and generally avoid human activity (Durner et al. 2013). Map 3.3-6 shows potential denning habitat within the GMT2 Project area (i.e., topographic features which may result in adequate snow depth for a polar bear to create a den).

The proposed GMT2 pad location, the GMT1–GMT2 Access Road (Alternatives A and B), and airstrip and occupied structure pad (Alternative C) would be located more than 5 miles from the Beaufort Sea coast and thus out of designated critical habitat where polar bears are more commonly reported (USFWS 2014a).

Under all the action alternatives, habitat loss and alteration impacts to polar bears are expected to be minor. There would be no impacts under Alternative D.

Disturbance and Displacement

Denning female polar bears could potentially be disturbed by project-related activities as described for terrestrial mammals (see Section 4.3.4.1, “Terrestrial Mammals”). Denning polar bear females are sensitive to disturbance, and if disturbance occurs after establishing a den, abandonment of the den could occur resulting in mortality of cubs.

Annual ice road construction could impact polar bears already in dens. However, polar bear den detection methods (e.g., forward-looking infrared or dog surveys) prior to road construction would identify den sites along the proposed route, and dens would be avoided.

The presence of camps or human activity may attract polar bears to the project vicinity and could result in incidental or intentional harassment for the protection of both bears and humans. BMP A-8 and USFWS LOA requirements on personnel training and harassment protocols should minimize this impact.

Potential disturbance and displacement impacts to polar bears would be minor for all the action alternatives. There would be no impacts under Alternative D.

Mortality

Polar bears could experience mortality from project-related activities as described for terrestrial mammals (see Section 4.3.4.1, “Terrestrial Mammals”), or in the event a large oil spill reached marine waters. Potential impacts of oil spills are described in Section 4.5 of this document. The extent of environmental impacts of a spill would depend on the type and amount of material spilled, the location of the spill, and the effectiveness of the cleanup. It is anticipated, based on North Slope spill history, that the majority of spills would be contained on a gravel road or pad with little or no impacts to polar bears. Polar bear deaths resulting from vehicle collisions, ingestion of hazardous chemicals, and defense of life kills or other impacts are unlikely to occur. Waste management protocols at the work site, personnel training, and permit/lease stipulations are designed to minimize such occurrences.

Subsistence hunters regularly use the project area. However, it is not expected this would result in an increased level of mortality to polar bears as the GMT2 Project does not increase access to areas where there are higher concentrations of polar bears (along the coastline). Subsistence take quotas are established under the Iñuvialuit-Iñupiat Polar Bear Management Agreement (76 FR 47021), and harvests are generally lower than the quota.

The potential mortality impacts to polar bears resulting from all the action alternatives are expected to be minor. There would be no impacts under Alternative D.

Mitigation

Specific measures to protect polar bears are provided in BLM (2013a):

- BMP A-8: Preparation and implementation of bear-interaction plans to minimize conflicts between bears and humans.
- BMP C-1: Prohibition of heavy equipment within one mile of known or observed polar bear dens.

Conclusion

The likelihood of impacts to polar bears identified in this document can be separated into categories of “reasonably foreseeable,” “potential,” and “no impact anticipated” as shown in Table 4.3-21.

The potential impacts to polar bears resulting from all the action alternatives are expected to be minor, with negligible impacts on the population. There would be no impacts to polar bears under Alternative D.

Table 4.3-21. Likelihood of impacts; threatened and endangered species, polar bear

Reasonably Foreseeable Impacts	Potential/Speculative Impacts	No Impact Anticipated
Disturbance to or displacement of denning and non-denning polar bears due to noise from construction, drilling, and operations.	• Creation of denning habitat through construction of infrastructure and drifting snow. • Attraction to infrastructure through the smell of food/food waste. • Harassment of polar bears for protection of bears and humans if bears are attracted to work camps and project vicinity. • Increased mortality or injury from vehicle collisions along ice and gravel roads. • Oil discharge coating fur, or ingestion of contaminated prey or vegetation. • Disturbance to den sites from ice road construction (forward-looking infrared surveys would identify den sites prior to construction and the den sites would be avoided)	Mortality from increased hunting access (project does not increase access to areas where there are higher concentrations of polar bears)

4.3.5.4 Threatened and Endangered Species Evaluated but Unlikely to Sustain Impacts

Ringed Seals

Ringed seals prefer stable, land-fast ice or drifting pack ice and are not expected to occur in locations where the GMT2 Project area overlaps with the Tiŋmiaqsiġvik (Ublutuoch) River or the Fish Creek Delta. No facilities or pipelines are proposed on or immediately adjacent to the marine coastal zone or on waterway crossings with connectivity to marine habitat.

Overall, the potential impacts to ringed seals as a result of the GMT2 Project are expected to be negligible. There would be no impacts to ringed seals under Alternative D.

Bowhead Whale

Bowhead whales migrate through the Beaufort Sea, but generally do not occur in the nearshore waters north of the GMT2 Project area. However, potential impacts are considered here because of the ecological and cultural importance of the bowhead. No impacts to population, habitat, migration, foraging, breeding, survival, or mortality are expected (BLM 2004).

There would be no marine transportation-related impacts (e.g., barging) to bowhead whales associated with the GMT2 Project, as there is no marine activity involved. In summary, there are no potential impacts to bowhead whales expected to occur resulting from the GMT2 Project.

Other Species

As described in BLM (2012) the fin whale and humpback whale (both listed as endangered) do not occur in the GMT2 Project area. The Pacific walrus (candidate) is also extralimital in the Southern Beaufort Sea (76 *Federal Register* 47040, August 3, 2011), and there is a very low probability of adverse impacts from the GMT2 Project. Potential impacts to these three species were described in BLM (2012), but due to the proposed inland location of GMT2 within the NPR-A, impacts are not further considered in this document. The fin whale, humpback whale, and Pacific walrus are, however, subject to the same protective measures as other Endangered Species Act or Marine Mammals Protection Act-listed species.

4.4 Social Systems

This section analyzes the potential impacts ("environmental consequences") of the GMT2 Project on social systems. The organization of this section follows that of Chapter 3's description ("Affected Environment") of social systems, and thus, includes cultural resources (including archaeological and traditionally used sites), socio-cultural systems, economic impacts, several aspects of current land use, subsistence, public health, and environmental justice.

4.4.1 Cultural Resources

The following is a discussion of potential impacts to cultural resources from the GMT2 Project alternatives. Actions related to the construction, drilling, operations and closure of the proposed GMT2 Project were analyzed for their potential for direct and indirect impacts to cultural resources. This section details potential effects to cultural resources based on the proposed alternatives as analyzed under NEPA and National Historic Preservation Act regulations. For a discussion of cultural resources in the GMT2 Project study area see Chapter 3, Section 3.4.1.

4.4.1.1 Methodology

This cultural resources impacts analysis focused on determining potential project effects to verifiable remains, material evidence, and specific locations associated with past human activity or of traditional religious or cultural importance. Data sources used to inventory project area cultural resources include the Alaska Department of Natural Resources, Office of History and Archaeology, Alaska Heritage Resources Survey database (Alaska Department of Natural Resources Office of History and Archaeology 2017), and the North Slope Borough Traditional Land Use Inventory (North Slope Borough 2017b). Recent cultural resources surveys of the study area (Reanier 2009a, 2009b, 2014a, 2014b; Reanier and Kunz 2010) also provide useful contextual information about sites in the project area.

Section 106 regulations define the area of potential effect for cultural resources as: "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effect is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16[d]).

For cultural resources, direct affects typically occur due to ground disturbance during construction. Accordingly, the area of potential effect for direct effects to cultural resources is limited to the proposed GMT2 Project footprint. This includes new permanent infrastructure (e.g., roads, airstrip, pads, and pipelines), existing infrastructure that will be used as part of the project, mining at the gravel source, and ice roads. Other activities and events that can directly impact cultural resources might be in the vicinity of, rather than directly within, the project footprint. These can include damage caused by equipment during the construction, drilling, and operation phases of the project, and unanticipated incidents such as blowouts, spills, or fires and subsequent cleanup activities. Drilling, operations, maintenance, and closure of facilities would result in minimal new ground disturbance, with less of a chance for subsequent direct impacts.

Typically, indirect effects to cultural resources occur through increased use or visual or noise effects. These can include illegal collection due to increased access to an area, subsidence and erosion, or changes to the landscape due to development that alters the viewshed and soundscape. The area of potential effect for indirect effects relating to access consists of a 2.5-mile buffer surrounding new GMT2 new infrastructure components, including roads, the airstrip, pads and pipelines. The area of potential effect for indirect effects relating to visual or noise effects consists of a 5-mile buffer surrounding the project's new infrastructure components. This analysis area is based on descriptions of noise and visibility discussed in BLM (2004a, Section 3.2.3, 4A.2.3.3, 3.4.8, 4.4.8) and BLM (2012, Section 3.4.9).

Under the National Historic Preservation Act, historic properties are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Historic Preservation Act maintained by the Secretary of the Interior (36 CFR Part 800.16(l)(1)). To evaluate impacts, historic properties are subject to the criteria of adverse effect. A significant or adverse effect to historic properties, as defined both by 36 CFR Section 800.5 would include:

- An undertaking that directly or indirectly alters any of the characteristics of a historic property that qualify the property for inclusion in the National Historic Preservation Act. This includes diminishing the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.
- Adverse effects on historic properties include, but are not limited to: (i) physical destruction of or damage to all or part of the property; (ii) alteration of a property, including restoration, rehabilitation, repair, maintenance, and stabilization; (iii) removal of the property from its historic location; (iv) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and (v) introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.
- Effects may be considered not adverse when the property is of value only for its potential contribution to archaeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of research.

For the GMT2 Project, direct impacts could occur in the project footprint during the construction and/or operation phase of the action. Examples of direct impacts to cultural resources could include ground-disturbing activities that result in physical destruction of or damage to all or part of a cultural resource, removal of the resource from its original location, change in the character of the resource's use or change of the physical features within the resource's setting that contribute to the importance of the resource, change in access to traditional use sites by traditional users, or loss of cultural identity with a resource.

Indirect impacts to cultural resources for the GMT2 Project could occur away from the project infrastructure footprints within the 2.5-mile area of potential effect. Indirect impacts to cultural resources could occur throughout the construction and operation phases of the project and during project closure. Examples of indirect impacts to cultural resources in the analysis area could include removal, trampling, or dislocation of cultural resources and culturally sensitive areas by personnel and visitors; complete or partial destruction of a site from erosion, melting permafrost, subsidence, vibrations, or other landscape changes caused by new GMT2 infrastructure components; the loss of traditional meaning or importance of a resource or loss of cultural association with a resource; neglect of a resource that causes deterioration; and vandalism or the illegal collection or looting of artifacts.

The noise and visual indirect impact analysis area for cultural resources extends 5 miles from proposed GMT2 new infrastructure components. Examples of noise and visual impacts to sites may include interrupted views that would adversely affect character, nature, or feeling of cultural resources, such as direct views of project components from cultural resource sites; and loss or degradation of viewshed features. Altering the soundscape and viewshed of a property can alter the integrity setting and feeling, which can be critical for demonstrating that a site conveys its significance for the National Historic Preservation Act (Hardesty and Little 2009, pages 62–64).

The analysis of impacts on cultural resources includes direct and indirect impacts to Alaska Heritage Resources Survey and Traditional Land Use Inventory sites by alternative. Impacts to other important features of the Nuiqsut cultural landscape, such as altering the way subsistence hunters access hunting areas, decreased use of subsistence areas due to decreased availability of subsistence resources, accompanying 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, are assessed in "Sociocultural" and "Subsistence" Sections (4.4.2 and 4.4.5) and are not repeated in this analysis.

4.4.1.2 Impacts by Alternative A

ConocoPhillips' proposed GMT2 Project (Alternative A) includes the drill pad, gravel access road, and pipeline, along with the ice roads and gravel source used to construct GMT2 (Map 2.5-1). This section presents cultural resource impacts by Alternative A and the analysis focuses on potential site impacts due to GMT2 within the whole study area regardless of land status. Alternative A development overlaps with existing infrastructure relating to the village of Nuiqsut, the Alpine units (BLM 2004), and GMT1 (BLM 2014). This section first addresses sites in the APE, identifying which sites require no further discussion due to reasons such as removal and which sites require further consideration. The resulting sites that may be potentially impacted due to expansion will then be assessed according to phase (construction, drilling, and operations), activity, proximity to those activities under Alternative A.

Potentially-Impacted Sites

As shown in Table 4.4-1, no TLUI or AHRS sites are located within the Alternative A direct effects APE. No sites are located in the footprint of the GMT2 Alternative A gravel road or pad, nor are any sites located in the direct footprint of the proposed ice road routes. Three sites, however, are plotted in or in close proximity to the footprint of the ASRC gravel mine located outside the NPR-A and warrant some discussion. Two sites listed in the TLUI (Qayaqtuaġiaq—TLUIHAR078 and Sigirauk—TLUIHAR103) are plotted within the footprint of the ASRC gravel mine—Phase 3. Qayaqtuaġiaq is mis-plotted in the modern TLUI 3 miles north of where it has been verified to be (Rick Reanier, personal communication 2017). As discussed above, to date the existence of either a site named Sigirauk or a fishing or hunting camp at the plotted location in the TLUI remains unheard of by Nuiqsut elders and unconfirmed, and without traces of cultural remains, no cultural site can be verified at this location (Rick Reanier, personal communication 2017). The most current information available suggest that GMT2 Alternative A will not result in any direct effects to cultural resources.

Table 4.4-2. Traditional land use inventory sites impacted by GMT2 Project

Alternative	Direct Impact Analysis Area	Indirect Impact Analysis Area	Visual and Noise Impact Analysis Area	Total Number of Cultural Sites in Analysis Areas
Alternative A	0	10	14	24
Alternative B	0	10	14	24
Alternative C	0	10	14	24

The AHRS and TLUI indicate 15 sites within the 2.5-mile indirect effects APE. Two of these sites, HAR-00055 and Nappaun (HAR-00089/TLUIHAR081), have been totally destroyed due to erosion, while the commercial lifeboat at HAR-00054 is no longer present. Therefore, Alternative A will not contribute to any access, viewshed, or soundscape impacts to these three sites and they will be discussed no further. Four TLUI sites, (Nuiqsut—TLUIHAR061, Napasalgun—TLUIHAR077, Tuiġauraq—TLUIHAR075, and Qayaqtuaġiaq—TLUIHAR078) are located within or just south of Nuiqsut. GMT2 development does not provide any easier access to these locations than is already provided, so Alternative A will not alter the accessibility, viewshed, or soundscape to these sites and they will be discussed no further. The Putu site—TLUIHAR079/HAR-00158, is located between 600 and 1800 meters of the ice road used for hauling gravel between the ASRC mine and the GMT2 development area; Putu will be addressed further in the construction section below. Sites such as Tiŋmiaqsiuġvik (TLUIHAR087), Apqugaaluk (TLUIHAR083), Nanuq (TLUIHAR082/HAR-00156), Uyaġagvik (TLUIHAR080/HAR-00155), and Niglivik 2 (HAR-

00157) are located between 100 and 1800 meters of both the existing road system and the temporary ice roads that closely parallel the permanent Alpine Development roads out of Nuiqsut; these will be addressed further in the construction and operations sections below. The plotted location for Nanuq north of CD4 is notable as it falls approximately 150 and 100 meters from the permanent road and proposed ice roads route, respectively, which will warrant some further discussion below in the construction and operations sections.

The AHRS and TLUI indicate 15 sites within the 5-mile visual and noise effects APE. Sites Iḷaaniġruaq—TLUIHAR063 and Itqiḷippaa—HAR-000163/TLUIHAR074 are located south of Nuiqsut. As is the case with the three sites within and just south of Nuiqsut, GMT2 development does not provide any easier access to these locations than is already provided, so Alternative A will not alter the accessibility, viewshed, or soundscape to these sites and they will be discussed no further. Nine other sites in the visual and noise effects APE including HAR-00044, HAR-00059, HAR-00068, HAR-00070, HAR-00074, HAR-00077, HAR-00078, Niġliq (TLUIHAR084/HAR-00169), and HAR-00171, are located north and east of CD1, CD2, CD4, and CD5 and the connecting road system; these will be addressed further in the construction and operations sections below. Three sites including HAR-00053, HAR-00069, and Sikulium Paaŋa (TLUIHAR041) are located to the northwest of the GMT2 development pad and road, which will be addressed further in the construction and operations sections below.

Construction

The potential for the discovery of unanticipated archaeological deposits during construction activities exists within proposed disturbance areas and could result in direct effects. Unanticipated discoveries could result in displacement or loss—either complete or partial—of archaeological material. Such disturbance affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric activity, settlement and subsistence patterns. However, given the number of previous surveys conducted in the study area, the relatively small number of cultural resources documented, and the low probability of the construction footprint areas for containing cultural resources, impacts from unanticipated discoveries are considered unlikely.

No sites fall within 5 miles (the visual and noise boundary) of the gravel road, pad, or pipeline that will be constructed for GMT2. Therefore, construction phase for these elements is not expected to impact any sites.

Putu (historic sod house site) is located within the 2.5-mile vicinity of the gravel source ice road, and any impacts to this site would be limited to the construction phase. In terms of impacts, the intensity of building an ice road 500 or more meters from Putu is expected to be low and without a perceptible change to either resource. Any impacts that alter accessibility, viewshed, or soundscape will occur only through the winter over one to two years, thus any potential impacts will be temporary in duration. Any potential impacts would be local in extent, and would not affect a resource of regional or statewide significance, particularly as Putu's context is a common resource type on the North Slope. Overall, the likelihood of an impact affecting this site as a result of Alternative A is highly unlikely.

Tiŋmiaqsiuġvik (fishing area), Apqugaaluk (fishing area), Uyaġagvik (a location for fishing, hunting, trapping, and collecting net weight stones), and Niglivik 2 (historic sod house site) are located within the 2.5-mile vicinity of the existing road system and the temporary ice roads that closely parallel the permanent Alpine Development roads out of Nuiqsut. Any impacts to these sites due to the ice roads would be limited to the construction phase. In terms of impacts, the intensity of building an ice road 500 or more meters from one of these sites is expected to be low without a perceptible change to any of the resources. Any impacts from the ice roads that alter accessibility, viewshed, or soundscape will occur only through the winter over one to two years, thus any potential impacts will be temporary in duration. Any potential impacts would be local in extent, and would not affect a resource of regional or statewide significance, particularly as the fishing, hunting, and trapping locations and historic sod house ruins are common context types for cultural resources on the North Slope. Overall, the likelihood of the winter ice roads having an impact occurring at any of these locations as a result of Alternative A is highly unlikely.

Nanuq (historic sod house site used by reindeer herder families) is plotted approximately 100 meters from the existing gravel and a temporary ice roads between CD1 and CD5, which warrants further discussion due to the site's context and its proximity to GMT2 development. Due to the sizes of domestic sites on the North Slope that often span one or more hundred meters wide, there is a substantial possibility that an ice road may cross through the site. The expected intensity of building an ice road 100 meters or less from this site would be moderate with a potentially perceptible change to the resource but unlikely to result in the permanent loss of context. Any impacts from the ice road that alter accessibility, viewshed, or soundscape will occur only through the winter over one to two years, thus any potential impacts will be temporary in duration. Any impacts would be regional or extended in extent as Nanuq is associated with Reindeer herding that occurred out of the Barrow herds (Hedman and Meinhardt 2006; Mager 2012; Simon 1998; Sonnenfeld 1959; Stern 1980; Stern, et al. 1980) and is expected to be of regional, if not statewide, significance. The context can be considered important; despite not having been assessed for eligibility on the national register, the abundance of cultural remains described in the AHRS and its ties to a significant event in the history of North Slope Iñupiat (the historic reindeer herding that occurred between the late 19th and first half of the 20th centuries) suggest that this site is significant to regional Iñupiat history. Overall, it is highly unlikely that the Alternative A winter ice roads will impact the Nanuq site, primarily due to the short duration over the course of two winters and the frozen and snowy conditions. It can be expected that these snow-covered and frozen conditions will hinder surface visibility and soil erodability and penetrability, thus limiting the likelihood of illegal collection, subsidence, and erosion due to increased access to an area.

HAR-00044 (grave marker), HAR-00059 (prehistoric caribou rib with cut marks), HAR-00068 (historic sod house site), HAR-00070 (grave), HAR-00074 (grave), HAR-00077 (historic sod house site), HAR-00078 (historic sod house site), Niġliq (Location of prehistoric and historic trade fairs; registered on NRHP), HAR-00171 (historic sod house site), HAR-00066 (Fragmentary mammal fossils), HAR-00053 (memorial site), HAR-00069 (historic sod house site), and Sikulium Paaŋa (fishing and hunting area) are located north, west and east of the existing gravel and a temporary ice roads connecting CD1, CD2, CD4, CD5, GMT1, and GMT2.

Any impacts to these sites due to the ice roads would be limited to the construction phase, and would be limited to visual and audible changes. In terms of impacts, the intensity of building an ice road more than 2.5 miles from one of these sites is expected to be extremely low without a perceptible change to any of the resources. The ice roads do not provide substantially-improved access to the sites, making it extremely unlikely that the ice roads will contribute to physical disturbance to these sites. Any impacts from the ice roads that alter accessibility, viewshed, or soundscape will occur only through the winter over one to two years, and any potential impacts to site integrity due to the ice roads will be temporary in duration. HAR-00059, HAR-00068, HAR-00077, HAR-00078, HAR-00171, HAR-00066, HAR-00069 and Sikulium Paaŋa can be considered to have contexts that are common throughout the North Slope, and if any aspects of integrity were impacted by the Alternative A ice roads, they would not affect resources beyond the local level. On the other hand, HAR-00044, HAR-00070, HAR-00074, and HAR-00053 contain human remains or grave markers and are considered unique contexts as they fulfill a distinctive role across the Iñupiat communities of the North Slope. If any aspects of their integrity were impacted by the Alternative A ice roads, the impacts would extend across the region, if not the state and nation. Finally, Niġliq is on the NRHP and considered to have a unique context with a significant role in the history of Iñupiat communities of the North Slope; impacts to this site would affect cultural resources and communities across the region. Overall, however, it is highly unlikely that the Alternative A winter ice roads will impact the physical integrity, viewshed, or soundscape of any of these sites given the >2.5-mile distance between the sites and the roads and the limited duration over two winters that the ice roads will be in use.

Drilling

Drilling is expected to proceed year-round for approximately 7 years. Direct effects to undocumented and/or buried cultural resources during the physical drilling process would be limited to the GMT2 pad footprint. No surficial cultural remains have been identified within 5 miles of the pad, and no buried remains were identified through subsurface testing at the GMT2 pad site. Therefore, it is unlikely that any unknown cultural remains will be disturbed by drilling at GMT2. With no known cultural resources located within a 5-mile radius of the GMT2 drill pad, no indirect affects relating to access, visibility, or sound are expected to affect these resources in the APE due to drilling.

Other components of the drilling phase for Alternative A (e.g. mobilization, moving, and demobilization of drilling equipment along the road systems) are not expected to affect cultural resources as they are temporary in duration and would occur within the road systems addressed in the construction section above and the operations section below. Indirect effects to undocumented and/or buried cultural resources would be identical to those identified for the construction phase addressed above.

Operations

Drilling is expected to proceed year-round for approximately 7 years, with operations continuing for an estimated 32 years. No major ground-disturbing activities are associated with the operations phase of Alternative A. The potential for spills would still exist, and spills of hydrocarbons or toxic materials could disturb or contaminate the surface of shallow-buried, unidentified cultural resources. Visual and/or noise effects could also occur from GMT2 equipment operation, drill tower installation, and pipeline operation. However, as addressed above for the construction and drilling phases, surface and subsurface surveys in the drill pad and surrounding area for cultural remains did not reveal any sites within 5 miles of the GMT2 drill pad, access road, or pipeline. Without any known cultural resources located within a 5-mile radius of the GMT2 drill pad, road, or pipeline, these operations are not expected to directly or indirectly affect cultural resources.

GMT2 operations will rely on vehicle traffic over the existing Alpine road system throughout the year, including snow-free seasons when some cultural materials could be visible from the surface. However, this road system is already constructed and in use by CPAI employees and Nuiqsut residents and would not contribute any direct impacts to cultural resources. GMT2 operations could contribute to indirect access-, visual-, or noise-related effects through increased vehicle traffic on the Alpine road system. The GMT2 production pad will require an estimated 75 operations and maintenance workers that would need to travel between GMT2 and the CD1 facilities daily. The increase in personnel transport is expected to have a negligible effect on access-related indirect impacts due to BLM’s (2013) Best Management Practices I-1 that addresses training employees to not disturb cultural remains. GMT2 operations are expected to last up to 32 years, after which the drilling operation will be abandoned and vehicle traffic in support of GMT2 will cease. Therefore, the increase in personnel transport to and from GMT2 is expected to have a temporary effect on visual- and noise-related indirect impacts.

Impacts to the Nuiqsut Cultural Landscape

Alternative A can have both direct and indirect impacts on the Nuiqsut Cultural Landscape. Direct impacts to the Nuiqsut Cultural Landscape could include physical destruction or damage to the landscape through ground-disturbing activity; restricted access to multi-generational camps, hunting areas, and travel routes used by Nuiqsut residents due to physical barriers and user avoidance of industrial areas; and the destruction or degradation of any, including unknown or unrecorded, cultural sites or areas through construction activities or incidents associated with project activities. Indirect impacts of Alternative A to the Nuiqsut Cultural Landscape may include altering the way subsistence hunters access hunting and fishing areas away from the community (e.g., a shift from overland travel by snowmachine or four-wheeler to the use of roads); altering routes used to access hunting areas and to travel between villages, cabins, and camps; decreased use of the landscape in the vicinity of project components due to decreased availability of subsistence resources, and accompanying 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 include disruptions to ambient noise levels 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.

Project components associated with Alternative A overlap the Nuiqsut Cultural Landscape. As demonstrated by the GMT1 Supplemental EIS (BLM 2014, Section 4.4.1, Map 3.3-9, Map 3.4-3), cultural activity has historically occurred and continues to occur within the overarching GMT2 Project study area, with a heavy occurrence of overland travel routes north and west of Nuiqsut to Fish Creek and along the Nigliq Channel. Subsistence use areas also encompass the entire GMT2 Project study area. However, new construction, transportation, and operations for GMT2 will extend away from the Nuiqsut travel routes illustrated by Stephen R. Braund and Associates (BLM 2014, Map 3.3-9). By this measure, it can be expected that increased traffic over transportation routes established by GMT1 and the Alpine Units in support of Alternative A will likely contribute to traditional travel routes disruption resulting from GMT1 and Alpine development. However, development relating to Alternative A will likely avoid further encroachment into such travel routes. The anticipated impacts on traditional uses of the cultural landscape is addressed in more detail in the Sections 4.4.2, 4.4.3, 4.4.4, and 4.4.5.

4.4.1.3 Impacts by Alternative B

Alternative B includes a drill pad, a gravel access road (GMT1—GMT2 Access Road), and pipelines, but realigns the GMT1—GMT2 Access Road to follow the watershed boundary between Fish Creek and the Tinmiaqsiugvik River drainage basins (Map 2.6-1). The potential for direct or indirect impacts to cultural resources in the APE is not affected by this rerouting and site impact potential remains identical between Alternatives A and B.

Potentially-Impacted Sites

Direct, indirect, and visual and noise impacts to cultural resources under Alternative B are similar to those identified for Alternative A.

Construction

Direct, indirect, and visual and noise impacts to cultural resources due to the Alternative B construction phase are similar to those identified for Alternative A.

Drilling

Direct, indirect, and visual and noise impacts to cultural resources due to the Alternative B drilling phase are similar to those identified for Alternative A.

Operations

Direct, indirect, and visual and noise impacts to cultural resources due to the Alternative B operations phase are similar to those identified for Alternative A.

Impacts to the Nuiqsut Cultural Landscape

Direct, indirect, and visual and noise impacts to cultural resources, including the Nuiqsut Cultural Landscape are similar to those identified for Alternative A.

4.4.1.4 Impacts by Alternative C

Alternative C is similar to Alternative A, except with (1) increased development in the vicinity of the GMT2 production pad for a larger drill pad, airstrip, apron, occupied structure pad, and airstrip access road and (2) without a gravel access road between GMT1 and GMT2 under Alternative C. Access would instead be year-round by aircraft and seasonally by an ice road in lieu of the Alternative A access road. The ice road would follow a route identical to that of the Alternative A gravel access road (Map 2.7-1 and Map 2.7-2). Given the near-identical development plans between Alternatives A and C, this section will address only the differences during construction and operations under Alternative C.

Potentially-Impacted Sites

Direct, indirect, and visual and noise impacts to cultural resources under Alternative C are similar to those identified for Alternative A.

Construction

There is potential for discovering unanticipated archaeological deposits during construction of the larger drill pad, airstrip, apron, occupied structure pad, and airstrip access road under Alternative C. Unanticipated discoveries could result in displacement or loss—either complete or partial—of archaeological material. However, surface and subsurface surveys in the drill pad and surrounding area for cultural remains have not revealed any such remains within 5 miles of the GMT2 drill pad. Given the number of previous surveys conducted over this area, the relatively small number of cultural resources documented, and the low probability of the construction footprint areas for containing cultural resources, impacts from unanticipated discoveries are considered unlikely.

All other direct, indirect, and visual and noise impacts to cultural resources due to the Alternative C construction phase are similar to those identified for Alternative A.

Drilling

Despite a larger production pad, there is no difference in the planned number of wells between Alternatives A and C. Direct, indirect, and visual and noise impacts to cultural resources due to the Alternative C drilling phase are similar to those identified for Alternative A.

Operations

The Alternative C access road for the operations phase would be an ice road that follows a route identical to that of the Alternative A gravel access road. There are no difference in sites impacted due to the GMT2-GMT1 access roads between Alternatives A and C. Increased air traffic during operations without use of an ice road would not result in an increase to site accessibility, and would temporarily affect the viewshed and soundscape for sites in the APE for the estimated 32 year duration of GMT2 operations.

All other direct, indirect, and visual and noise impacts to cultural resources due to the Alternative C operations phase are similar to those identified for Alternative A.

Impacts to the Nuiqsut Cultural Landscape

Most direct, indirect, and visual and noise impacts to cultural resources, including the Nuiqsut Cultural Landscape, will be similar to those identified for Alternative A, with the exception of disturbance due to increased aircraft in the area during the spring, summer, and fall. The anticipated effects of aircraft on traditional uses of the cultural landscape is addressed in more detail in the Sections 4.4.2, 4.4.3, 4.4.4, and 4.4.5.

4.4.1.5 Impacts by Alternative D: No Action

Under Alternative D, the no-action alternative, the GMT2 Project and associated infrastructure would not be permitted, leaving the current uses of the land in the project area unchanged. No ground-disturbing activities associated with the proposed project would occur and there would be no concomitant adverse effects to Alaska Heritage Resources Survey sites, Traditional Land Use Inventory sites, historic properties, or locations of cultural significance located in the study area. Therefore, no adverse effects or impacts to cultural resources or the Nuiqsut cultural landscape are anticipated under Alternative D.

4.4.1.6 Mitigation

Use of practical and reasonable mitigation measures would reduce impacts to cultural resources from implementation of the proposed action and alternatives. Specific measures to protect cultural resources can be implemented by best management practices. The implementation of best management practices and potential mitigation measures that were described in the GMT1 EIS and the NPRA-Record of Decision for the protection of cultural resources could also reduce the cumulative effects to cultural resource from oil and gas, and non-oil and gas activities, in the GMT2 Project area. Potential impacts to cultural resources from the GMT2 Project can also be mitigated by design, construction procedures and operational features.

Avoidance

BMP E-13 states that “Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity including ice roads. Upon finding any potential cultural resource, the lessee or their designated representative shall notify the authorized officer and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer” (BLM 2013).

North Slope Borough regulations mandate that development activities implement avoidance measures to ensure protection of these cultural resource sites during project activity by establishing a 500-foot avoidance buffer (North Slope Borough 2017a).

Cultural resource surveys should also include research and consultation or interviews with Nuiqsut residents regarding locations of previously unidentified cultural resources to help ensure that no unidentified cultural resources are adversely impacted by construction and operation activities and potentially assist in identifying the significance of sites and mitigating impacts. Knowledgeable residents from Nuiqsut should also be included during cultural resource field surveys as resource advisors.

Minimization

BMP E-1 states that “All roads must be designed, constructed and maintained to create minimal environmental impacts and to protect subsistence use areas and access…”—which will ensure continued use of travel routes identified as elements of the Nuiqsut Cultural Landscape. Alternative A incorporates subsistence access and pullouts into the proposed project design to mitigate impacts to travel routes. ConocoPhillips will continue to consult with the local community on the locations of proposed subsistence access areas as part of the proposed GMT2 Project.

Potential visual impacts to two cultural resources near the far margin of the 5-mile impact buffer would be minimized by using the recommended mitigation in BLM (2004a) that would blend structures and permanent facilities into their surroundings and reduce impacts from lighting on facilities over 20-feet high. Potential mitigation measure for visual resource impacts, as described in BLM (2004a), include:

> All structures would be painted to blend with the natural environment. All colors would be pre-approved including emergency spill containers along river channels. BLM will use computer-generated colors to determine the color for structures that blend in best with the background colors

of the natural landscape and may do a color test onsite. Self-weathering steel, or best management practice, will be used on all metal structures not otherwise painted, including but not limited to pipelines, communications towers and drill rigs, thus providing a more natural color of brown.

Reduction of potential noise impacts is provided through design and operations, mitigation described in Section 4.7, Protective Measure F-1 of the BLM (2013a), and BMPs A-9, A-10, E-1, and E-8 from the 2013 NPRA-Record of Decision.

4.4.1.7 Conclusion

Direct impacts to cultural resources are identical across the three action alternatives, with the only differences being minor changes in the access routes and methods between GMT1 and GMT2. There are no anticipated direct or indirect impacts to cultural resources as a result of the GMT2 development plan alternatives.

Of the 28 cultural sites listed in the AHRS and TLUI as being in the APE, four either no longer exist or cannot be identified, 10 are in the 2.5-mile indirect impact area, and 14 are in the 5-mile visual/noise impact area. Seven sites in the APE are located within or south of Nuiqsut and are not expected to be impacted by GMT2 (GMT2's development and construction routes will not extend any closer to these sites than is already provided by the village and its existing infrastructure).

The construction phase is not expected to result in any direct or indirect impacts to cultural resources. Under each alternative, no cultural sites are known to exist in the direct footprint, and given the number of previous surveys conducted in the study area, the relatively small number of cultural resources documented, and the low probability of the construction footprint areas for containing cultural resources, direct impacts from unanticipated discoveries are considered unlikely. Further, all permanent infrastructure constructed for GMT2 (pad, access roads, pipeline, and other support features for Alternative C) are beyond the 5-mile visual/noise boundary from any documented cultural sites and are, therefore, not expected to result in any indirect impacts.

Gravel extraction from the ASRC mine's Phases 2 and 3 is not expected to result in any direct or indirect impacts to any cultural resources, nor are any such impacts expected within the 2.5- and 5-mile vicinities of ice roads that will be constructed for the purpose of hauling gravel from the mine to the GMT2 development area. The gravel operation would be temporary, lasting for up to two winters, and it can be expected that snow-covered, and frozen conditions will hinder surface visibility and soil erodability and penetrability, thus limiting the likelihood of illegal collection, subsidence, and erosion due to increased access to sites in the 2.5- and 5-mile vicinities of gravel extraction and transport areas.

Similarly, it is unlikely that use of ice roads that parallel the Alpine Development road system for transporting heavy equipment to GMT2 will impact sites within the 2.5- and 5-mile vicinities of the road system. One site, Nanuq—an historic sod house site used by reindeer herder families, is an important site located within the 2.5-mile indirect effects area, close (approximately 100 meters) to the temporary ice and permanent gravel road systems. However, it is unlikely that this site would be impacted due to ice road construction and use due to the frozen, snow-covered conditions that would hinder surface visibility and soil erodability and penetrability over the short, two year construction phase. Five sites (four grave sites and Niġliq—a traditional prehistoric/historic trade fair site that is registered on the NRHP) are located within the 5-mile indirect effects area north of the Alpine ice roads. While these site contexts have significant roles in the history of North Slope Iñupiat communities, it is highly unlikely that the winter ice roads will impact the physical integrity, viewshed, or soundscape of any of these sites given the >2.5-mile distance between the sites and the roads, and the limited duration over two winters that the ice roads will be in use.

The drilling phase is not expected to result in any direct or indirect impacts to cultural resources. Without any surficial remains identified within 5 miles of the GMT2 pad area, and no buried remains identified through subsurface testing at the GMT2 pad site, direct and indirect effects to cultural resources during the drilling phase are considered unlikely. Other components of the drilling phase for Alternative A (e.g. mobilization, moving, and demobilization of drilling equipment along the road systems) are also not expected to affect cultural resources as they are temporary in duration and would occur within the road systems (addressed in the construction and operations sections).

The operations phase is not expected to result in any direct or indirect impacts to cultural resources. Without any known resources located within a 5-mile radius of the GMT2 drill pad, road, or pipeline, it is unlikely that any cultural resources will be directly impacted by hydrocarbon or toxic material spills, or indirectly impacted by unauthorized collecting and disturbance or changes to sites' viewshed and soundscape.

GMT2 operations and maintenance will require increased traffic along the road system between CD1 and GMT2 throughout the year, including snow-free seasons when some cultural materials could be visible from the surface. However, by following BMP I-1 (BLM 2013), informing GMT2 personnel on the importance of cultural remains and how to avoid disturbance, indirect impacts such as unauthorized collection and disturbance of cultural resources near the road system can be avoided. As GMT2 operations are expected to last up to 32 years, visual- and noise-related impacts resulting from increased transport to and from GMT2 would be temporary.

4.4.2 Sociocultural Systems

Sociocultural systems on the North Slope, as described in Section 3.4.2, are based in large part on the family structure and cultural values of the community, with a particular emphasis on the relationship of the Iñupiat with the land and its resources. Potential impacts on sociocultural systems from oil development are described by BLM (2004, Section 4F.4.1.1; 2012, Section 4.5.14.2–4.5.21.1; and 2014, Section 4.4.2).

Many North Slope Iñupiat experience some general effects of living as indigenous Americans in a period of rapid change. Determining which social impacts are attributable to nearby oil development is challenging; it requires isolating the impacts of nearby development from the overarching impacts of colonization and technological advances. Different Inupiaq entities and individuals are impacted differently. A 2015 sociocultural study on Nuiqsut concluded: "That development has brought changes is obvious to all, but whether such changes are perceived, experienced or defined as negative impacts or positive benefits is ultimately only something which each citizen of Nuiqsut can decide for him or herself," (Redmond and Thornsohn 2016, page 169).

Sociocultural impacts are inherently complex with widely varying positive and negative effects. Individual outlooks and experience and generational and gender differences can play roles, and there is a variety of opinions on the various effects people experience.

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

- Employment opportunities
- Increased or variable income and economic disparity
- Tensions related to the permitting process
- Changes to the Nuiqsut Cultural Landscape
- Disruptions to subsistence activities and uses
- Availability of NPR-A Impact Grant Funds

Alternatives A and B are analyzed together due to insignificant differences in anticipated impacts. Alternative C would likely have less support from residents of Nuiqsut (see Subsistence § 4.4.5) and some sociocultural factors would likely be more affected by it.

4.4.2.1 Impacts Common to All Alternatives

Construction and operation of the proposed project is not expected to result in an appreciable influx of new, non-resident workers to the community. Oil industry construction and operations personnel would be housed in temporary camps or at Alpine. Ice road construction personnel (e.g., employees of Nanuq and Arctic Frontier Construction) would be housed in the Kuukpik Hotel in town and adjacent camps. Because industry will provide housing, food, health care, and other services for oil industry workers, GMT2 would not be expected to result in an appreciable increase in demand on community resources.

An important result of nearby oil development is the annual ice road that connects Nuiqsut to the Dalton Highway. Nuiqsut residents appreciate and support the connection to the Dalton and urban centers annually during ice road season. There are clear social and economic benefits, such as providing residents the ability to travel to communities on the road system with their own vehicles. This gives them much greater freedom logistically and economically to travel, visit friends and family, and shop in places where groceries and other items are much less expensive and for items that are unavailable in Nuiqsut.

The connection the ice road provides facilitates the importation of alcohol and other drugs to Nuiqsut and other North Slope Borough communities. Alcohol and drugs are brought to North Slope villages by a variety of means throughout the year, but there is a noticable increase in the bootlegging economy in Nuiqsut and the availability of drugs during the ice road season (Paskewitz 2014; Native Village of Nuiqsut Tribal Council 2014a).

It is likely that the activities associated with gravel mining will have negative sociocultural impacts to a some residents because the noise and vibrations associated with blasting on a daily basis can be can be unnerving. Some residents experience stress associated with the physical impacts of the concussion waves, which can rattle objects and cause structures to shake. The risk of damage to heating or plumbing infrastructure is a concern, and there is confusion over who would be liable for any damages. Some residents are concerned about the dust and odors that result from the blasting, especially when they are perceptible in town or the dust settles on the ice covering the Colville River (US OSM, 2017).

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. Many express emotions of considerable grief and loss in describing those impacts. Many residents explain that they have "lost" these areas. Nuiqsut's 1979 Paisangich (translated as Nuiqsut Heritage or Cultural Plan) explains that the cultural landscape of Nuiqsut is occupied by a "heritage community that perpetuates Iñupiat culture" by harvesting resources, by "preserving places and ideals of value, and by transmitting this heritage to future generations." A 2017 update to the Paisangich states that "the presence of oil and gas infrastructure in traditional hunting areas represents a loss of land to community residents," (SRB&A 2017e p. 61). Although some residents take advantage of new infrastructure (i.e., road), "[t]o many hunters, these areas are no longer available to tehm for subsistence harvesting activities," (ibid). As shown on Map 3.3-9, cultural activity occurs throughout the project study area with a heavy occurrence of travel routes, trails, and cultural sites in the overland area north and west of the community to Fish Creek and along the Nigliq Channel. All alternatives would build permanent oil and gas infrastructure in subsistence use areas west of the community.

Economic Disparity

Some residents of Nuiqsut express tension and conflict with other NSB communities and the NSB government associated with nearby oil development. A main source of frustration is that the NSB and other communities are eligible for and receive NPR-A impact mitigation funds through the State of Alaska, while many Nuiqsut residents believe that Nuiqsut should be eligible for the majority of those funds because they are the most impacted by development. Other issues involve perceptions on the part of other NSB residents that all Nuiqsut residents are extremely wealthy, while some Nuiqsut residents feel they have the highest cost of living on the North Slope and are the only NSB residents dealing with the negative impacts of development (URS Corporation 2005). Tension over competition for NSB infrastructure funds and other programs are not specific to Nuiqsut or to GMT2 but are heightened in Nuiqsut due to the relatively high-stakes development issues.

As described under the “Economy” sections in Chapter 3 and Chapter 4, the GMT2 Project will provide economic benefits for the community of Nuiqsut, for the Kuukpik Corporation, for Arctic Slope Regional Corporation, the North Slope Borough, and the State of Alaska. Those sections also provide an overview of how all residents of Nuiqsut benefit economically from development. In addition to employment opportunities, Nuiqsut residents pay a flat rate of $25 per month for natural gas heating due to an agreement negotiated by Kuukpik Corporation that brought a natural gas pipeline to the community from Alpine. The Kuukpik Corporation and ConocoPhillips also regularly donate substantial amounts to various community groups and causes. The Kuukpik Corporation, as the primary driver of local economic growth in Nuiqsut, has pursued benefits for all residents and represented the interests of the entire community with great success (Redmond and Thornsohn 2016).

Rental and mineral royalties paid to the Kuukpik Corporation and Arctic Slope Regional Corporation (ASRC) could result in increased dividend payments to their shareholders and would occur under all alternatives. Mineral royalties would be the same under all alternatives, and rental royalty payments would be highest under Alternative A and lowest under Alternative C. An impact associated with income disparity is the competitive intra-community nature of securing impact mitigation funds and disagreements over the methods of dispersing other mitigation funds, described in Sections 3.4.4, 4.4.4, and 4.4.7.

Some residents of Nuiqsut are frustrated that the Kuukpik Corporation has not extended its shares to Kuukpikmiut residents born since the corporation was established in 1973[8]. Kuukpik Corporation leadership has long worked on a proposal to enroll younger residents that will be accepted by the majority of its existing shareholders, but it is a difficult process (see Redmond [2016] for a detailed description). Corporation leadership can only be elected, and bylaws can only be changed, by full shareholders. Of the original 212 full shareholders, approximately one-third are still alive. The original 21,200 shares are now

[8] The original Alaska Native Claims Settlement Act conferred benefits only to Natives who were alive at the time, but this restriction was later removed in an amendment. Alaska Native Claims Settlement Act’s original division of Natives born before and after the settlement created two classes within families and communities, an issue that was deeply disturbing to many Alaska Natives. This provision of Alaska Native Claims Settlement Act was seen as antithetical to Alaska Native traditions of sharing and threatened to exclude subsequent generations of Alaska Natives, commonly referred to as “afterborns,” from their heritage. Although shares could still be acquired through inheritance, the total number of shares would not change, disparities would be unavoidable, and increasingly smaller divisions of the shares would reduce dividends to insignificance. It was foreseen that arguments over the uses of Native corporation-owned land would arise, and that the corporation would make those decisions while the rising generation would be excluded from decision-making. Division, rivalries, and dismay over this situation were already becoming apparent in Alaska in the 1980s and Alaska Natives, foreseeing increasing dissension and distrust in their communities, lobbied successfully to have Alaska Native Claims Settlement Act amended (Berger, T. R. [1985]. Village Journey, The Report of the Alaska Native Review Commission. New York, Hill and Wang.

owned by approximately 368 shareholders, fewer than half of whom are full shareholders. Approximately one-third of the original full shareholders do not live in Nuiqsut (Redmond and Thornsohn 2016). Although it may not be economically rational for Kuukpik shareholders to dilute their shares and (and possibly threaten the future viability of the corporation), there is a degree of distrust of the village corporation due to this situation. The prospect of additional royalties accruing to Kuukpik Corporation from development of GMT2 could exacerbate this source of conflict.

Tensions Related to Permitting Processes for Development

The range of impacts that can be directly associated with the permitting process for development in Nuiqsut were described for the GMT1 project (BLM 2014, Section 4.4.2). These types of impacts have been researched on the North Slope and in Nuiqsut in recent decades, notably by Michael Galganaitis (Research Foundation of the State University of New York 1984), John Kruse (2006), and Adrian Redmond (2001, 2016).

These impacts include observations that development-related meetings have taken over a large part of social life in the community, confusion about the scheduling and steps in a permitting process, the powerlessness many residents experience with regard to oil development decision making, and distrust of the government and industry. Importantly, these are unique among social impacts because they are impacts that can be isolated from general effects of colonialism and modernization: they are impacts created specifically by nearby industrial development.

To better assess the intensity of social impacts and specifically illuminate tensions related to the permitting process (social impacts that are directly related to nearby oil development), a computer-assisted qualitative analysis of testimony given by Nuiqsut residents at public meetings on oil development was conducted. Appendix N of this document includes a description of the analysis, initial findings, and the complete codebook used in analysis.

In the testimony, the most frequent comments on social impacts associated with proposed oil development concerned Inupiaq culture, social conflict, bureaucracy[9] , economy, distrust, future generations, lack of power (disenfranchisement), and the lack of analysis of social impacts. Comments on these social impacts make up 8 (more than a third) of the top 20 subjects (all types) testified about. Table 4.4.-3 shows the number of codes, by meeting, for each of the 47 separate intuitive codes used for testimony. Other social issues that were coded include community capacity to navigate the permitting process, the pace of permitting processes, the meetings themselves, and how testimony is documented and weighed ("comments").

[9] *Bureaucracy* is the code for comments describing difficulty or confusion with any aspects of the NEPA process or land management, including the documents themselves, any 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 and complaints about information overload and frustration with red tape were also coded for bureaucracy.

Table 4.4-3. Code counts for Nuiqsut residents' testimony on oil development

Topic	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
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, regs, Enforcement)	1	0	3	0	0	1	4	3	18	0	30

Topic	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:
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
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**

Depicting the code counts by code category indicates that despite extra attention to the permitting process at specific meetings, codes in that category tend to occur at a high frequency at most meetings. Figure 4.4-1 indicates that the range of issues characterized as related to the permitting process are the most frequently discussed, issues categorized as subsistence are the second most frequently discussed, and comments about the impact of development on Inupiaq culture and way of life are the third most common.

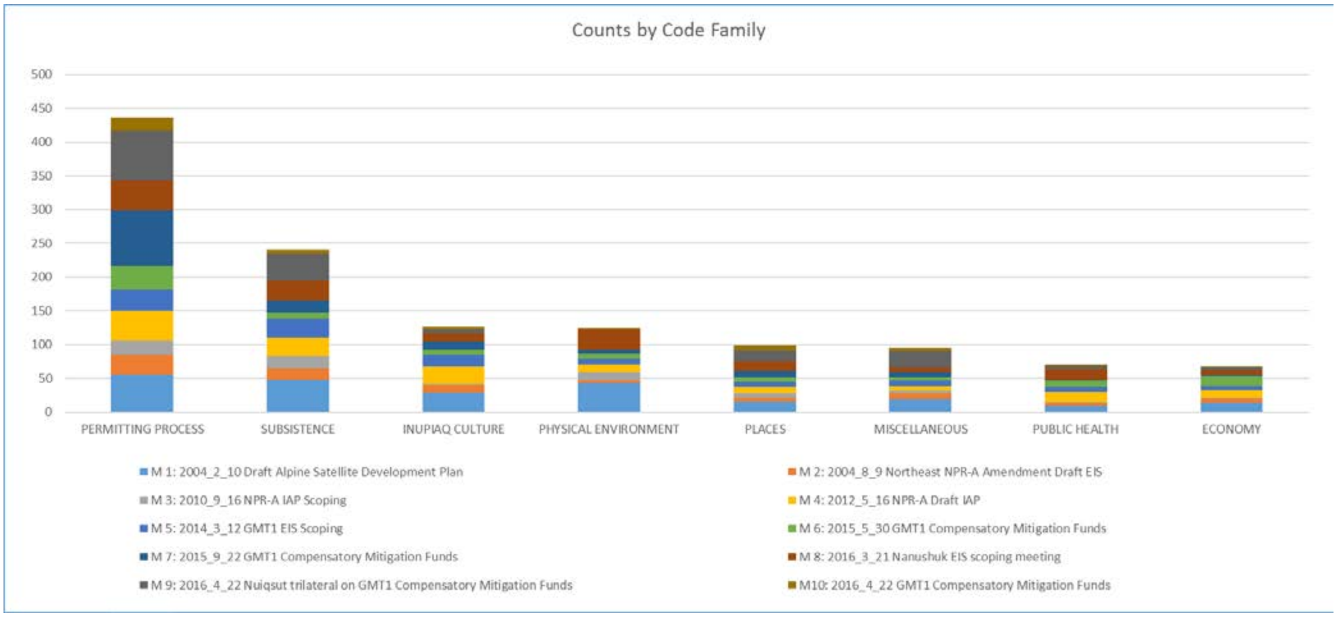

Figure 4.4-1. Counts by Code family

The coding software allows users to analyze co-occurrences of all codes (or 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-occur with Distrust nine times.

Pace

The pace of the permitting process for development projects around Nuiqsut is recognized as a social impact, particularly for individuals or entities that do not have the capacity to engage professionals and legal teams to assist with their effective participation. As noted in the 2005 Nuiqsut Village Profile, “Planning participation is fragmented. Timelines and meetings are spread out so it is hard to keep track of what is happening,” (URS Corporation 2005).

In May 2016, the Native Village of Nuiqsut Tribal council adopted a resolution and sent a letter to the Secretary of the Interior requesting that BLM not move forward with the permitting process for GMT2 until after the GMT1 project is fully constructed and impacts could be assessed.

> Moving forward with the public review process for GMT-2 would only add to the challenges and lasting harm to the community suffered through in the GMT1 permitting []. In order for Native Village of Nuiqsut to be a fully informed cooperating agency in the permitting process, Native Village of Nuiqsut will rely on our traditional knowledge and observations of the impacts from the completed GMT1 project, which has not even broken ground yet. We are also only beginning to understand the full range of impacts from the recently completed, and soon-to-be-expanded, CD-5 development, (Native Village of Nuiqsut 2016).

Community control over the pace of development was a main objective of Nuiqsut Paisangich-Nuiqsut Heritage: A Cultural Plan (Brown 1979):

The main objectives of this plan are to:

1. Control the pace and magnitude of change to promote stable and beneficial socioeconomic conditions in the village.
2. Protect the natural environment and wild resources from adverse effects of industrial and technological activities.
3. Establish the historical/cultural/subsistence resources and values of the village as major considerations in land-use planning, development, and operations.
4. Adapt imposed landownership and jurisdiction to the traditional law of free access and use by the homeland people.
5. Perpetuate traditional activities to assure transmission of cultural values to future generations (Brown 1979, page 43)

The three primary Nuiqsut entities (the Tribal government [Native Village of Nuiqsut], the village Alaska Native Claims Settlement Act corporation [Kuukpik Corporation], and the City of Nuiqsut) signed a tri-partite agreement in 1996 to cooperate, present a united front to oil industry and government agencies, and let Kuukpik Corporation represent the community on development issues. The tri-partite agreement stated that the 1979 Cultural Plan would be “adopted in whole and is representative of the common goal(s) of local control and self-determination," (Redmond and Thornsohn 2016, page 120). Although the Native Village of Nuiqsut council formally withdrew from the tri-partite agreement in 2014 (see BLM 2014 Section 4.4.2), all entities continue to support the Cultural Plan and support the production of an updated version. Although entities and individuals have divergent opinions on what pace is desirable, the request made by the democratically elected Tribal council to postpone permitting for GMT2 reflects the opinion of many residents of Nuiqsut. The Kuukpik Corporation’s lack of support for exploratory drilling at the Putu 1 well north of Nuiqsut during the 2016/2017 winter operational season (due to its proximity to town and the need for more time to engage and educate village residents) (Brehmer 2017) indicates that other Nuiqsut entities are concerned about the pace and proximity of development in recent years and are sensitive to this impact on the community.

Meetings

The frequency and nature of meetings related to the permitting process are recognized as a social impact on the North Slope. Residents have been participating in (or invited to participate in) an increasing number of governmental and industry meetings throughout recent decades. Overarching issues include meeting burnout, culturally inappropriate timing of meetings, frustration at the perceived ineffectiveness of testifying or disrespect for traditional knowledge, cultural communication differences, and constraints on subjects that can be discussed.

Participants in development meetings are often informed that only certain types of comments and input can be considered in the NEPA process (“substantive comments”). Many residents do not have adequate or appropriate evidence that government agencies are incorporating their comments and traditional knowledge in planning decisions. As corroborated by the testimony content analysis, a perennial concern is that they do not know what happens to their input, they suspect that the government is not doing anything with it, and this issue is aggravated when agencies return for each EIS process to request it. The inability for most people to effectively review and comment on an EIS contributes to feelings of disenfranchisement and lack of control over events that will affect their lives. A 2009 survey found that 70 percent of Nuiqsut respondents have reported concerns about EIS deficiencies (Stephen R. Braund and Associates 2009c). In a review of scoping testimony from three development projects in the Nuiqsut area (Alpine Satellite, Northstar, and Endicott), “lack of influence” was the most commonly identified concern (Stephen R. Braund and Associates 2013c).

An Inupiaq anthropology student recently focused on this subject for his master’s thesis and found that, from 2006 to 2015, the annual average number of development meetings in Utqiagvik more than doubled over previous year (Stotts 2016). Although many issues in terms of timing, respect for traditional knowledge, and communication styles have improved and residents’ acceptance of development projects has increased, meeting attendance is declining. After extensive interviews and observation of public meetings in Utqiagvik, Stotts (2016) discussed multiple issues, including what residents refer to as “the broken record”—local concerns receiving little to no response. Stotts’ research (2016) also found that interviewees felt they had little voice in the stakeholder engagement process and that, although they believe meetings are largely necessary, the number of meetings have negatively affected the local community.

These effects are concentrated in Nuiqsut, a much smaller, more traditional community with much more recent industrial development. Meetings there have replaced many regular community gatherings (e.g., “singspirations” and potlucks), and disagreements over development that are distressing in the meetings sometimes spread to other aspects of life.

For several reasons, federal government meetings tend to be the least popular. Stotts’ research (2016) found that federal government meetings on the North Slope are more constrained, rigid, official, and culturally obtuse. One reason is the lack of gifts and food at federal government meetings, which are understood as standard compensation for time and effort. In describing how mitigation has become an integral part of life in Nuiqsut, a recent sociocultural study notes that “[it] is a way of thinking that has not only been embraced by the oil industry, but also every other public or corporate entity that seeks to interact with the community. No public meeting is well attended unless the organizers provide a sumptuous buffet and door prizes” (Redmond and Thornsohn 2016, page 166). Federal government rules prohibit door prizes, raffles, and, with rare exceptions, the use of federal money to purchase meeting refreshments.

Another reason federal meetings are less popular is their purpose. Most BLM meetings in Nuiqsut, in keeping with the mandate of NEPA, are to provide the public an opportunity to share insights and concerns about impacts. Recent Alaska Native studies have found that meetings and outreach that focus on the negative (e.g., industrial impacts on subsistence and Inupiaq culture) are the opposite of what constitutes positive and life-affirming, inter-cultural interactions in villages (Peter et al. 2016). Thus, the government's responsibilities to understand and be transparent about impacts result in meetings that are rarely enjoyable and with the potential to remind residents of traumatic aspects of their history. On the North Slope, participants often believe that it is their duty and in their best interest to describe impacts in the most dramatic manner possible in order to make their comments be considered. Combined with the general belief that providing input has proven largely pointless, these meetings are often emotional and conflict-ridden.

Nuiqsut's 1979 Cultural Plan recognized these issues:

> *Commonly, state and federal agencies throw curve balls (that is, problems) at outlying villages, especially by means of public participation meetings. Seldom are the alternatives presented by officials at such meetings true alternatives. Rather, they tend to be variations on decisions already made. ("Would you like OCS development to proceed this way or that way?") Village participation in such meetings is often limited to bemused listening and watching. The meetings are too tightly scheduled, the official presentations are too long, and there is neither time nor provision for translation into the Inupiaq tongue. Assuming that some "input" or "feedback" does go on the record, it often remains there – as evidence of input or feedback but not as a public contribution to be acted upon. Thus, public participation becomes a pro forma exercise that fulfills procedural requirements of the laws that the agency is supposed to substantively administer. Thus, the problems remain with the village as agency officials fly off to the next meeting. This scenario reflects cross-cultural confusion and communication problems more than bad faith, but the results are the same for the village, (Brown 1979, page 50).*

As Stotts (2016) notes, many improvements have rendered meetings more meaningful for both agencies and residents. Nevertheless, and particularly in Nuiqsut, required development meetings present a negative social impact to residents who participate and give up potentially enjoyable free (personal, family, or hunting) time for a largely negative experience with no compensation for the hours spent or acceptable proof of effectiveness. Development meetings can also present negative social impacts for residents who do not participate in them. Some residents feel that they should attend the meetings because the future of their region and livelihoods are being weighed, but they have to decide between attendance versus hunting or family care or jobs. Others may feel they should attend, but they fear social or political repercussions from taking a position contrary to that of community leaders or they do not have the emotional resources to tolerate the negativity and conflict. Subsequently, they may experience guilt over not participating, complicated by exacerbated feelings of powerless in regards to the decision-making process, and they may feel that they have less standing to provide input in the future.

This dilemma—impacts stemming from participation and non-participation—was foreseen in Nuiqsut's 1979 Cultural Plan. In the attempt to save their heritage, village people who dedicate themselves to the bureaucratic process could become "immersed and indirectly co-opted. If, in frustration, they withdraw to pursue traditional activities, they may forfeit their heritage by inaction. Neither extreme is in the best interest of the village" (Brown 1979, page 44).

4.4.2.2 Alternatives A and B

Alternatives A and B would provide employment opportunities for the community of Nuiqsut and associated non-economic sociocultural benefits. The ability to commute to work daily in personal vehicles via the existing Kuukpik Spur Road and the GMT1–GMT2 Access Road and to return home after a shift to be with family, attend social events, and participate in subsistence activities would be beneficial for current employees, potential employees, and the families of those employees. Currently, permanent employees in skilled positions are required to stay at work for 2-week shifts and, unless it is ice road season, they are flown back to Nuiqsut for their days off. The community would like to have many more young people take advantage of the numerous seasonal or temporary jobs that do not require technical skills; however, many of these jobs are available in the non-ice road season and young people are particularly averse to giving up their social lives for jobs. The road connection to GMT2 that would be provided under Alternatives A and B would make employment at GMT2 significantly more socially acceptable for local residents. A strong community desire for this was cited in the 2005 Nuiqsut Village Profile: “People should be able to come home from Alpine during the workweek” (URS Corporation 2005). Employment opportunities will be highest during the construction phase (305 new jobs), and will decrease as the GMT2 Project moves into the drilling phase (75 new jobs) and the operations phase (11 new jobs).

One important difference between Alternatives A and B is economic, which could translate into sociocultural impacts. Under Alternative B, the gravel road would not be constructed on land owned by the Kuukpik Corporation and the corporation would therefore not receive rental payments for the use of its land. A detailed discussion of local, regional, and statewide economic impacts is included in this document in Section 4.4.4, “Economy.” Native Corporation shareholders[10] and other residents of Nuiqsut will likely experience economic benefits from development of GMT2. Economic security is one key component in the overall resilience of a sociocultural system.

Section 4.4.5 discusses potential impacts of Alternatives A and B on subsistence uses. Subsistence hunting and harvesting activities are central to the cultural identity and social cohesion of the community of Nuiqsut. Disruption of subsistence activities may affect social and kinship ties, many of which are based on the harvesting, processing, distribution, and consumption of subsistence resources. If subsistence harvesting opportunities are impacted, opportunities to engage in cooperative harvesting activities will also change. Reduced participation in subsistence activities could also negatively affect the community’s ability to pass on traditional knowledge about subsistence harvesting patterns and cultural values to younger generations. As discussed in Section 4.4.5, the GMT2 Project will introduce permanent oil and gas infrastructure into traditional hunting areas to the west of the community and contribute to the community’s sensitivity to being surrounded by development. Disruptions to subsistence harvesting patterns or perceptions of exclusion from traditional lands may result in social stresses on residents and on the community as a whole.

4.4.2.3 Alternative C

Sociocultural impacts associated with GMT2 under Alternative C would differ from those under Alternatives A and B, because there would likely be resentment that the development scenario generally opposed by residents was the one being constructed. It is likely that local supporters of development would oppose construction of Alternative C. Construction of Alternative C would likely result in high levels of dissatisfaction with the public process, and residents would feel their input was ignored. This would be a particularly sensitive impact for those who invested the most time and energy to participate in the GMT2 Supplemental EIS process. North Slope residents who have participated in that process and

[10] Almost all Inupiaq residents of Nuiqsut are shareholders in Arctic Slope Regional Corporation and many are shareholders, or related to shareholders, in Kuukpik Corporation.

similary processes have clearly stated that an alternative based on gravel road access is much preferred over any alternative where access is provided by air and ice roads.

Under Alternative C, Nuiqsut residents would not be able to commute to work or use a road to access the GMT2 area for subsistence hunting and fishing. Residents employed at GMT2 would be restricted to flying home periodically on industry aircraft or using ice roads in the winter. This would occur with a backdrop of repeated requests to increase local hire, especially for the temporary, less-skilled jobs that are available and that are more attractive to young people and/or people with families and/or people who need to undertake subsistence activities in their off hours. Because there would not be a gravel road, the Kuukpik Corporation would receive less rental royalty for the use of its selected lands, and this will likely result in lower dividend payments than would occur under Alternatives A or B.

4.4.2.4 Alternative D

No changes from baseline conditions would be expected under Alternative D because no action would take place under this alternative. The Native Village of Nuiqsut Tribal council has expressed frustration that the BLM cannot select Alternative D as a preferred alternative and has requested the Department of the Interior to delay permitting for GMT2, but the council has yet to articulate a preference between the GMT2 Supplemental EIS action alternatives. The range of sociocultural benefits associated with increased wage and dividend incomes and investment in the community that is likely to occur under Alternatives A and B would not be realized.

4.4.2.5 Summary and Comparison of Alternatives

Many sociocultural impacts are similar for Alternatives A and B, but the Kuukpik Corporation would not receive land rental fees under Alternative B. Alternative B would have greater negative sociocultural impacts due to reduced revenues to the village corporation. Alternative C would result in greater sociocultural impacts than Alternatives A and B due to no rental revenues to Kuukpik, the addition of seasonal ice road construction, and the lack of potentially countervailing benefits that could result from access to the site via a permanent gravel road.

However, based on testimony by residents of Nuiqsut, all GMT2 action alternatives would result in substantial sociocultural impacts. This conclusion is based on several sources (Lampe 2004; Leavitt 2014; Native Village of Nuiqsut 2016; Nukapigak and Kuukpik Corporation 2016) including oral and written testimony of residents from disparate entities and opinion groups contending that social impacts of oil development around Nuiqsut are substantial and have been underestimated by previous NEPA analyses. This testimony expands on examples and explanations of the impacts described here and many others. In addition to the impacts to subsistence described in Section 4.4.5, examples center on the feelings of loss associated with the devaluation of traditional sites, powerlessness and disenfranchisement experienced by many residents in regards to control over land use decisions, cultural issues that discourage employment in the oil fields, and multi-faceted conflict that the proposed GMT2 Project is causing in Nuiqsut.

The economic benefits experienced by many residents of Nuiqsut may outweigh or balance out adverse sociocultural impacts of GMT2 Alternatives A and B. Many residents acknowledge that the development helps the community, they have positive attitudes towards industry personnel, and they understand that social and environmental impacts are unfortunate but unintended consequences.

This analysis distinguishes that the sociocultural impacts of GMT2 (under either Alternative A or B) will be different for many individuals. Impacts would likely be less for individuals who do not use or value the GMT2 area as much as others; individuals who have not invested time, energy, and social capital into the permitting process; and some individuals whose economic gain from GMT2 Project outweighs any negative impacts they experience from the project.

4.4.2.6 Effectiveness of Lease Stipulations and Best Management Practices

Existing mitigation that addresses sociocultural and public health-related issues is provided by the following protective measures of BLM (2013, A-1, A-2, A-4, A-10, A-11, A-12, and I-1). These measures set numerous standards for industry in order to protect health and human safety from hazardous waste disposal (A-1), to precise fuel containment methods (A-4), and BMP A-10, which prevents degradation of air quality by requiring pre-development monitoring, inventory and monitoring of emissions, and emission reduction plans. BMP A-10 also establishes BLM's authority to establish new measures if air emissions are detected above the maximum acceptable levels. A-12 established that BLM will, in the case of an oil spill, minimize impacts by considering the immediate health impacts and responses for affected communities and individuals and establish long-term monitoring for contamination of subsistence foods and public health. BMP I-1 requires cultural and environmental training of personnel involved in oil field activities. Orientation and training must familiarize personnel with stipulations and best management practices and on the specific cultural concerns of the area. Personnel are trained to avoid disturbing sites, resources, and subsistence activities.

These mitigation measures have been in effect and have been added to and improved on for oil exploration activities in the NPR-A since the 1998 Northeast NPR-A Integrated Activity Plan. However, it should be noted that the BLM lacks the ability to eliminate negative sociocultural impacts for Nuiqsut residents through mitigation.

Following federal and Alaska guidance, the BLM will undertake regular government-to-government consultation with the Native Village of Nuiqsut throughout the GMT2 Supplemental EIS process and, in compliance with Executive Order 12898 on environmental justice, will work with Tribal members to confirm impacts and to collaboratively create mitigation measures.

A report on subsistence mitigation measures related to Nuiqsut (Stephen R. Braund and Associates 2013c) found that while industry and agencies have become more effective at addressing environmental concerns, several residents expressed the belief that Nuiqsut concerns regarding social impacts were not being adequately addressed (Stephen R. Braund and Associates 2013c, page 73). BLM, as a land management agency of the federal government, only has authority to make decisions regarding the use of BLM-managed lands.

4.4.2.7 Impacts and Concerns that Cannot Be Mitigated Under BLM's Authority

Numerous sociocultural concerns related to industry have been described to BLM throughout the Alpine Satellites Development planning process, including GMT1 and GMT2, and merit attention in order to ameliorate community/industry and community/government relations. The BLM has limited or no authority to establish traditional mitigation measures to address the following concerns and impacts identified through the consultation process.

- *Lack of a community rehabilitation program:* Failure to pass drug tests is one reason that the percentage of local residents employed in the oil field has declined. Many people would like to work temporary seasonal jobs in the field, but if they fail the drug test, they are ineligible until the following year. Oil development and oilfield services companies in Nuiqsut have policies requiring a permanent employee who fails a drug test to undergo evaluation and treatment before the individual can be reconsidered for employment. This can be a straightforward process for non-resident employees who have access to certified drug evaluation and treatment programs in urban centers and can return to employment within a short period of time. Local residents do not have easy access to either of these systems: there is several month waiting list for evaluations. Only once an evaluation has been obtained can the individual make an appointment for the required treatment, but there are only a few counselors who service the entire North Slope Borough and thus scheduling treatment is also difficult. The policies themselves are standard, but the system to address violations disenfranchises local residents from the employment opportunities presented by development.

- *Inadequate compensation systems:* Residents are frustrated because they experience the negative impacts of nearby development, but feel that they do not prosper economically in a manner that is proportionate and they feel that mitigation funds are inadequate to respond to impacts. Some residents also feel that the compensation systems that have been put in place have exacerbated intra-community conflicts and conflicts with the North Slope Borough (Stephen R. Braund and Associates 2013c). There is a substantial amount of frustration that the federal government does not have the authority to establish and monitor direct compensation programs.
- Throughout the years of oil development on the North Slope and with regards to GMT1, residents and leaders have asked the government to require industry to:
    - Give preference to local hire, and
    - Provide training programs for local residents.

4.4.2.8 Potential New Mitigation Measures

Many of the measures proposed to mitigate impacts to subsistence (Section 4.4.5.8) will also address some sociocultural impacts. Additional potential new mitigation measures to address sociocultural impacts will continue to be solicited through close consultation with residents of Nuiqsut and as proposed by the Native Village of Nuiqsut, a cooperating agency on this supplemental EIS. They will be presented in the final supplemental EIS for GMT2 and, if accepted and within the authority of the BLM to implement, will be established with the record of decision for GMT2. Through the consultation process, local entities and residents have already suggested numerous potential benefits to the community that they believe could begin to offset the negative impacts to their way of life. Although the BLM lacks the authority to require implementation of these measures, many of which could be considered social services, they are presented here.

Heritage Center in Nuiqsut: When asked what could offset the sociocultural impacts Nuiqsut would experience with development of GMT1, several residents articulated the need for a local heritage center and a place for youth sports and activities. This mitigation measure would address the fact that the community of Nuiqsut’s community center is no longer an ideal location for social events due to the regular development-related meetings that are held there, and would be a place where the community could meet, pass on traditional knowledge, and actively participate in cultural activities.

Support Cultural Projects: Support projects that document, teach, and protect culture, history, and language, such as: Updating the Nuiqsut Paisangich; establishing a library with a focus on Iñupiat culture that is open year-round; establishing a community-based photojournalism/media institute. Build recreation centers, teen centers, playgrounds, and/or picnic areas.

Provide Administrative and Technical Support: Assist communities in communicating with levels of government to get issues of concern addressed, such as hiring permanent grant writers to submit proposals for impacts mitigation and other grants and to produce grant requests, and assist local entities with obtaining technical and legal expertise to advise them on the permitting process.

Nuiqsut Drug Rehabilitation Program: The 2005 Nuiqsut Village Profile, based on data compiled during a comprehensive survey of every North Slope Borough household, noted this issue as a community priority: “Social services – A rehabilitation program, with certified counselors, is needed in the community” (URS Corporation 2005).

Provide Educational Support: Assist with the implementation/expansion of Science Technology Engineering Math programs within local schools, such as the Alaska Native Science and Engineering

Program in impacted communities. Support the development and implementation of job training programs in North Slope communities, including local oversight/monitoring of development activities (e.g., staff, training, funding to contract for technical and scientific expertise).

Provide Economic and Community Development Opportunities: Develop and implement programs that support local entrepreneurial and economic development in impacted communities. Fund the development of long-term community development plans for impacted communities. Build new housing to meet growing demand in impacted communities.

4.4.3 Economy

This section addresses the potential economic impacts associated with the construction and operation of the various GMT2 Project alternatives on the local economy of Nuiqsut, the regional economy of the North Slope Borough, and the statewide economy of Alaska.

The primary economic impacts of the action alternatives are expected to be moderate and would include the following:

- Increased economic activity in the community of Nuiqsut, the North Slope Borough, and the State of Alaska, resulting from direct industry spending on goods and services during the construction phase, operations phase, and until the decommissioning of facilities.
- Additional indirect and induced (i.e., multiplier) impacts resulting from supply chain purchase resulting from direct industry spending and spending of income earned by workers and government spending of revenues for capital and operating programs.
- Increased job opportunities for Alaskans, including residents of Nuiqsut and other communities in the North Slope Borough.
- Increased revenue to the City of Nuiqsut, the North Slope Borough, and the State of Alaska, resulting from shared royalties, state corporate income taxes, severance taxes, property taxes, bed taxes, NPR-A Impacts grant funds, and other fees.
- Increased revenues to Alaska Native corporations from shared royalties.
- Increased oil production on the North Slope that will result in additional secondary economic impacts, including increasing oil into the Trans-Alaska Pipeline System and State revenues.

Despite the decrease in the price of oil over the last several years, the economic impacts associated with the GMT2 Project action alternatives are within the range of impacts analyzed in BLM (2004, 2012, 2014). General impacts to the state, regional, and local economy resulting from potential oil and gas activity in the NPR-A are described in BLM (2004, Section 4F.4.2), BLM (2012, Section 4), and BLM (2015 Section 4.4.3).

BLM (2004, 2012) considered broader development scenarios than the GMT2 Project. BLM (2004) evaluated development of five satellites (including GMT2); two in the Colville Delta (CD3 and CD4) and three in the NPR-A (CD5, GMT1 [formerly CD6], and GMT2 [formerly CD7]). On the other hand, BLM (2012) addressed development scenarios encompassing the entire NPR-A. The development scenarios included oil production in the Mooses Tooth and Bear Tooth units and at Umiat. The analysis also considered production of yet-to-be-discovered oil and gas resources in other parts of the NPR-A.

The economic impacts presented in the following subsections are specific to the proposed GMT2 Project and the other alternatives as described in a previous section of this document.

4.4.3.1 Construction

The proposed GMT2 Project includes construction of a drill pad, an 8.2-mile gravel access road, three subsistence access road pull-outs, 8.6 miles of pipeline, and ice roads. Both proposed construction schedules for Alternatives A and B would see drilling begin in the second quarter of Year 3 and first anticipated oil in the fourth quarter of Year 3.

Project-related employment would include temporary jobs during the construction season. The winter construction workforce is estimated at 305 workers and summer season workforce is estimated to add up to 50 workers. The construction workforce would include specialized tradesmen (at particular short periods during construction). Construction seasons will either be 2 or 3 consecutive years.

As noted in BLM (2004), many of the construction workers hired would need skills and experience in drilling and pipeline construction. However, it is expected that there will be employment opportunities for residents of Nuiqsut and other North Slope Borough communities. For example, during the 2013–2014 winter construction activities at CD5, 32 Nuiqsut residents and Kuukpik shareholders were employed as construction workers including subsistence representatives and ice road monitors.

The City of Nuiqsut is also projected to receive increased bed taxes resulting from higher hotel occupancy during the construction phase of the project. The City of Nuiqsut has a 12 percent bed tax. During the off-construction season of August 2016–November 2016, City of Nuiqsut bed tax averaged $3,395 per month. During the GMT1 construction season of December 2016 through April 2017, it averaged $27,824 per month (Arnold 2017). Bed taxes from GMT2 are anticipated to be similar.

Indirect and induced economic impacts, also referred to as multiplier or spin-off effects, would result from in-state industry spending on goods and services, workers' spending of wages, and government spending of royalties and tax payments during construction.

Like other development projects in the North Slope, it is expected that many of the materials and equipment would be purchased outside of Alaska and would be shipped to the job site. A portion of the total projects costs, both capital and operating costs, will be paid to companies in Alaska for construction of the project. It can be expected that some of the contracts for construction of the facilities would be awarded to Alaska private corporations, including North Slope regional and village corporations. These payments to local businesses will in turn generate additional economic activity within the state, resulting in indirect economic effects in the form of additional business sales, employment, and labor income.

4.4.3.2 Operation

Operations at GMT2 are expected to begin in late Year 3 (possibly 2020), and oil production would be expected to ramp up and peak at approximately 28,000 barrels of oil per day by 2025, then decline at a nominal annual exponential rate of approximately 15 percent, to fewer than 1,000 barrels of oil per day by 2050.

Table 4.4-4 shows the Alaska Department of Revenue's projections of crude oil production at Alpine and the total for the Alaska North Slope through 2024. Note that the Alaska Department of Revenue production volumes at Alpine include production at Alpine, Fiord, Nanuq, Qannik, and Mustang[11] (after 2016).

Table 4.4-4 also shows that oil production on the North Slope is expected to continue to decline into the future. With development of GMT2, the annual production volumes at Alpine would increase by approximately 52 percent during GMT2's ramp-up period from approximately 2020–2024. In these same years, oil production at GMT2 would add about 4 percent to the total North Slope oil production. Note that this does not include projected production at GMT1. According to ConocoPhillips, the combined

[11] Development plans for Mustang indicate that oil will be processed onsite and will tie in to the Alpine and Kuparuk pipelines and Trans-Alaska Pipeline System.

projected production at GMT1 and GMT2 from 2020 to 2024 could add about 8 percent to the total projected North Slope oil production for those years.

Any additional oil production on the North Slope extends the life of the Trans-Alaska Pipeline System and benefits the State of Alaska through oil revenues. Oil revenues are dependent on the oil production levels and the price of oil at the wellhead. The State of Alaska would receive revenues from oil production in the NPR-A. However, revenues from the NPR-A are treated differently than those from state lands and the outer-continental shelf. As noted in Section 3.4.3, “Economy,” federal law designating the NPR-A established a requirement that 50 percent of lease sale revenues, royalties, and other revenues be paid to the State of Alaska, and the other half be paid to the General Fund of the U.S. Treasury.

As stated in BLM (2012), the State of Alaska General Fund receives shared revenues from federal leases two times per year and the State makes those available as grants to eligible municipalities in the following fiscal year. Communities in the North Slope Borough have historically received these grants. As noted in Section 3.4.3, “Economy,” at least two North Slope communities (Nuiqsut and Atqasuk) have had their fiscal year 2017 NPR-A Impact Grants held up by administrative technicalities. Barring a continuation of that trend, additional state-administered NPR-A Impact Grants for planning, construction, maintenance of public facilities, or for provision of essential public services can be expected by municipalities in the North Slope region from revenues associated with production at GMT2.

As described in Section 1.1, the GMT Unit has mixed land status with federally managed land, Native interim conveyed, and Native selected lands. The GMT Unit Agreement identifies notional participating area boundaries. The boundaries delineate the leases or areas of leases (tracts) which are expected to contribute a portion of the production from each reservoir to the agreement. In the GMT Unit, where only exploration drilling has occurred to date, these boundaries represent a theoretical interpretation of the reservoir locations. As geophysical data are evaluated, exploration and production wells are drilled, and the physical extents of each reservoir are discovered, enough information is collected to reasonably determine which leases should be included in a participating area. These boundaries are used by BLM to allocate production for royalty purposes to each committed tract within the participating area. Royalties are calculated using the allocation method defined in the unit agreement (BLM 2014).

Until these proposed participating areas are formally established in the GMT Unit, the exact acreage of each lease dedicated to each participating area is unknown. While the actual production area from these wells has yet to be formally delineated, Arctic Slope Regional Corporation will receive the royalties for the percentage of participating area contribution from Arctic Slope Regional Corporation-owned leases. Note that the proposed GMT2 drill pad is wholly on land selected by Kuukpik Corporation (Nuiqsut Village Corporation) under the Alaska Native Claims Settlement Act within the northeastern portion of the NPR-A, and as such will recover subsurface hydrocarbon resources owned by Arctic Slope Regional Corporation, on which Kuukpik has an overriding royalty interest. The associated revenue will be distributed to Arctic Slope Regional Corporation and Kuukpik shareholders. Other Alaska Native regional corporations will also receive royalties through application of Section 7(i) and 7(j) revenue sharing provisions of Alaska Native Claims Settlement Act.

Production from federal leases would also result in royalties paid to the Federal government, and the State of Alaska will receive 50 percent of these royalties. Tract allocations will be finalized at the time adequate geology, geophysics, and reservoir engineering information exists to appropriately describe each reservoir area. Participating area boundaries and tract allocations will be established pursuant to the requirements of 43 CFR 3137 and the GMT Unit Agreement between Arctic Slope Regional Corporation, ConocoPhillips, and BLM, and royalties will be paid according to that agreement.

It is estimated that total royalties from GTM2 production over the period 2020 to 2050 would amount to approximately $1.45 billion in 2015 dollars. This estimate is based on the federal royalty rate of 16.67

percent of wellhead value for high oil potential areas (BLM 2012), the expected annual production volumes at GMT2 (as shown in Table 4.4-4), and future oil prices as projected by the Energy Information Administration (Energy Information Administration's Annual Energy Outlook 2015). As described above, these royalty payments will be shared among the resource owners and the allocation of royalty payments among resource owners will be determined according to the GMT Unit Agreement.

In addition to royalties, the State of Alaska and the North Slope Borough would receive property tax payments associated with the taxable oil infrastructure that will be developed at GMT2. The property tax payments would be based on the assessed valuation of the facilities developed onsite. The annual levy is based on the full and true property value of property taxable under AS 43.56. For production property, the full and true value is based on the replacement cost of a new facility, less depreciation. The depreciation rate is based on the economic life of the proven reserves. Pipeline property is treated differently from production facilities in that it is valued on the economic value of the property over the life of the proven reserves. The state property tax rate is 20 mills. A local tax is levied on the State's assessed value for oil and gas property within a city or borough and is subject to local property tax limitations. The current North Slope Borough property tax rate is 18.5 mills, hence, the state portion of the property tax is 1.5 mills. Based on the above approach, it is estimated that the proposed GMT2 Project would generate total property tax revenue of about $226 million (in 2015 dollars) through 2050. Of this amount, approximately $209 million would accrue to the North Slope Borough and about $17 million to the State of Alaska.

Table 4.4-4. Projected crude oil production; Alpine, total Alaska North Slope, GMT2

Year	Alpine Barrels Per Day	Total Alaska North Slope Barrels Per Day	GMT2* Barrels Per Day
2015	66,700	509,500	-
2016	64,300	524,100	-
2017	60,300	534,100	-
2018	60,500	503,500	-
2019	55,500	473,200	-
2020	47,200	435,800	500
2021	40,100	400,400	10,000
2022	34,400	368,500	19,000
2023	29,800	342,900	24,000
2024	26,000	314,700	27,000
2025	Not available	Not available	28,000
2026	Not available	Not available	25,200
2027	Not available	Not available	21,420
2028	Not available	Not available	18,207
2029	Not available	Not available	15,476
2030	Not available	Not available	13,155
2031	Not available	Not available	11,181
2032	Not available	Not available	9,504
2033	Not available	Not available	8,079
2034	Not available	Not available	6,867
2035	Not available	Not available	5,837
2036	Not available	Not available	4,961
2037	Not available	Not available	4,217
2038	Not available	Not available	3,585
2039	Not available	Not available	3,047
2040	Not available	Not available	2,590
2041	Not available	Not available	2,201
2042	Not available	Not available	1,871
2043	Not available	Not available	1,590
2044	Not available	Not available	1,352
2045	Not available	Not available	1,149
2046	Not available	Not available	977
2047	Not available	Not available	830
2048	Not available	Not available	706
2049	Not available	Not available	600
2050	Not available	Not available	510

Note: Production numbers for Alpine and the North Slope stop at 2024 because Alaska Department of Revenue has only projected out to that year.

Source: 2014 Fall Revenue Forecast, Alaska Department of Revenue, Tax Division (Alpine and Total ANS crude production). GMT2 production volume estimates were developed based on new information on peak production volume and decline rates provided by ConocoPhillips. These estimates assume peak production of 28,000 bopd in 2025 down to less than 1,000 bopd by 2050.

State

The State of Alaska would also receive additional corporate income tax on petroleum activity and severance taxes from oil production. The corporate income tax is calculated as 9.4 percent of the Alaska share of worldwide income for each corporation. The Alaska income is calculated using a “modified apportionment formula,” which averages the Alaska share of the corporate worldwide property, sales, and extraction and applies that formula to calculate the Alaska share of worldwide income. The Alaska tax base for the special corporate income tax on petroleum depends on not only activity and profits within Alaska, but also on activity and profits in other locations. However, the model[12] used to estimate state corporate income taxes for the proposed GMT2 Project does not take into consideration the modified apportionment formula because data on the project proponent’s worldwide income is not readily available. The model simply evaluates all of the GMT2 Project costs and revenues and the resulting state income tax, as if the project proponent did not have any other projects in Alaska or elsewhere. Based on the model, it is estimated that proposed project would generate approximately $308 million (in 2015 dollars) in total state corporate income taxes through 2050. Finally, based on the State of Alaska’s current fiscal terms for petroleum activity (known as More Alaska Production Act), it is estimated that GMT2 would generate approximately $379 million (in 2015 dollars) in total severance taxes net of credits through 2050.

Employment

Project-related employment would include permanent operations and maintenance jobs. The drilling crew is estimated to total 75 workers.

Operations manpower requirements for the GMT2 production pad were presented in BLM (2004) (see Table 4.4-5). Each 12-hour position represents two people and is equivalent to 4,380 manhours per year. The manpower forecast is an estimate of the number of 12-hour positions (that is, two people per position) that would work onsite at the production pad location.

Table 4.4-5. Operations manpower requirements for GMT2 production pad

Field Personnel	Number of Positions
ConocoPhillips Operator	0.25
ConocoPhillips Maintenance	0.10
Contract Operator	0.25
Contract Maintenance	0.10
Heavy Equipment Operator	0.10
Heavy Equipment/Vehicle Repair	0.10
Incremental Number of 12-hour Positions at Production Pad	0.90

Periodic workovers of the wells and eventual removal of facilities would also generate additional employment for several years.

Year-round employment opportunities during the operation of the project would be available for local North Slope Borough residents and other Alaskans. With on-going and future training programs geared towards special skills required in oilfield services sponsored by both public and private entities, it is anticipated that local hire opportunities will be higher than historical rates. However, not all residents of Nuiqsut are able to or interested in work for the oil industry for various reasons, including employment

[12] The model used to estimate state corporate income taxes and severance taxes is the same model (that was developed by Alaska Department of Natural Resources and modified to fit the GMT1 project) used in estimating property taxes, as described in the comment above.

demands, perceived prejudices, cultural isolation when employed in the oil field, and their views of impacts from industry on their community (see Section 4.4.2, “Sociocultural Systems”).

Indirect and Induced Economic Impacts

Indirect and induced economic impacts, also referred to as multiplier or spin-off effects, would result from in-state industry spending on goods and services, workers’ spending of wages, and government spending of royalties and tax payments during the drilling and operation phases of the proposed project. The proposed development of GMT2 is estimated to cost about $1.83[13] billion (in 2015 dollars). This includes the costs of all the facilities: drill site, road, pipeline, other ancillary facilities, and the drilling costs. The total cost of the project during the operations phase (from 2020 to 2050) is estimated to amount to over $1.65 billion[14] (in 2015 dollars). Like other development projects in the North Slope, it is expected that many of the materials and equipment would be purchased outside of Alaska and would be shipped to the job site. A portion of the total projects costs, both capital and operating costs, will be paid to companies in Alaska for transportation, logistics, and other oilfield services. It can be expected that some of the contracts for operations and maintenance of the facilities would be awarded to Alaska private corporations, including North Slope regional and village corporations. These payments to local businesses will in turn generate additional economic activity within the state, resulting in indirect economic effects in the form of additional business sales, employment, and labor income.

Likewise, local spending by workers and government spending of revenues resulting from the proposed project would also generate multiplier effects statewide.

4.4.3.3 Summary and Comparison of Alternatives

The preceding section describes the projected economic effects associated with Alternative A, the proponent’s proposed design alternative for GMT2. This section discusses how the projected economic effects of Alternative A compare with the expected economic effects of the other alternatives being considered.

Table 4.4-6 summarizes the differences in estimated capital expenditures and projected royalties and taxes among the alternatives being considered. Estimated capital expenditures are based on information provided by ConocoPhillips, the project proponent, for the various alternatives.

The differences in capital expenditures are primarily due to the differences in infrastructure, including drilling expenditures, required under each alternative. The additional facilities and differences in logistics are explained in more detail in the discussion below for each of the alternatives.

[13] The estimated project cost is based on information provided by ConocoPhillips.
[14] Estimated total cost of the project during the operations phase is based on estimates of operating expenditures on a per barrel basis ($ per barrel of oil) of other existing oil fields in the North Slope. The model assumes that OPEX cost is about $17.50 (in 2015 dollars) per barrel of oil produced.

Table 4.4-6. Comparison of estimated capital expenditures, royalties, and taxes (billions, in 2015 dollars) by alternative

Action Alternative	Description	Total CAPEX	Royalties	Property Tax	State Corporate Income Tax	Sever-ance Tax	Royalties + Tax
Alternative A	ConocoPhillips Proposed Project	$1.60	$1.45	$0.23	$0.31	$0.38	$2.36
Alternative B	Alternate Road Alignment	Alt A +~$22 million	=Alt A	>Alt A	<Alt A	<Alt A	<Alt A
Alternative C	Roadless Access to GMT2	Alt A + ~$700 million	=Alt A	>Alt A	<Alt A	<Alt A	<Alt A

Note: These are estimates of total expenditures, taxes, and revenue that occur at different times. They are not discounted present values. CAPEX will occur during Years 1–3. Royalties and severance tax apply to 30 years of production.

As noted in the discussion of economic effects of Alternative A, property taxes are based on the assessed value of oil and gas property. Alternative C would require additional facilities and higher drilling costs relative to Alternatives A and B. Estimated property taxes are lowest under Alternatives A and B, because these alternatives have lower facilities and drilling costs compared to Alternative C. However, severance taxes and state corporate income taxes are expected to be higher under Alternatives A and B compared to C due to the current tax structure which is based on an operator’s net income.

Alternative B

Alternative B is very similar to Alternative A because it would involve the same drill site location and facility design and would be connected to GMT1 by a permanent road. The difference is the alternate road alignment in Alternative B, with the proposed road following the watershed boundary between the Fish Creek and the Tinmiaqsiugvik River drainage basins. This alternative would require a slightly longer road and pipeline, and may require additional surveying and engineering costs. The associated larger gravel requirements and road and pipeline routes would result in slightly larger capital expenditures for this alternative compared to Alternative A.

The impacts to the economy under Alternative B would be similar, but slightly higher than those under Alternative A. Royalties would be the same because production schedules and productions values are the same for both alternatives. However, there will be slight differences in employment, income, and taxes due to the differences in infrastructure requirements and value of facilities (capital costs) as noted above. While it is expected that property tax payments under Alternative B would be slightly higher, other state taxes (such as corporate income tax and production taxes) would be slightly lower due to the State of Alaska’s current tax structure that is based on net profits. Employment and income, particularly during the construction phase, are expected to be slightly higher given the additional infrastructure required under Alternative B.

Alternative C

Additional construction and drilling facilities would be required under this alternative (see Table 2.7-1 for the comparison of project components, facilities, and access for the various alternatives). The need for additional facilities at GMT2 under this alternative results in larger capital expenditures compared to Alternatives A and B. It is estimated that the total capital cost of Alternative C would be 43 percent higher compared to the cost of Alternative A and B.

While royalties under Alternative C would be the same as under Alternatives A and B because production schedule and production volume are the same, property tax revenues under Alternative C would be higher compared to Alternatives A and B due to the additional facilities and amenities that would be required during the construction and operations phases. However, state corporate income taxes and severance taxes under Alternative C would be lower compared to Alternatives A and B due to higher costs (current fiscal terms are based on net income).

Employment and income impacts under this alternative will be higher compared to Alternatives A and B. Year 2 of construction is expected to require 140 additional workers compared to Alternatives A and B. Drilling workforce under this alternative is also higher compared to Alternatives A and B, requiring 200 workers and an additional 20 people for camp operations. Alternative C may lead to increased economic activity in Nuiqsut due to additional income from use of the hotel.

Alternative D

There will be no direct economic impacts to the state and local economy under the no-action alternative. The range of economic effects associated with construction and operations as described under Alternative A would not be realized. Under Alternative D, the Kuukpik Corporation would not receive overriding royalty interest on Arctic Slope Regional Corporation’s subsurface hydrocarbon resources, and thus, Arctic Slope Regional Corporation and Kuukpik shareholders would not receive royalties. Likewise, other Alaska Native regional corporations would not receive royalties through application of Section 7(i) and 7(j) revenue sharing provisions of Alaska Native Claims Settlement Act.

Summary

Projected royalties paid to the royalty owners are the same for Alternatives A, B, and C, because they have the same production and price forecasts.

The estimated taxes include severance (production) tax, ad valorem (property tax), and state corporate income tax. Local governments, i.e. the North Slope Borough, participate only in the shared ad valorem taxes; the other taxes are paid to the State of Alaska. Note that under the State of Alaska’s oil and gas fiscal system (known as the More Alaskan Production Act), the severance tax is based on the net value of oil and gas produced, which is the value at the point of production less all qualified lease expenditures. Qualified lease expenditures include certain capital and operating expenditures. The State also has various tax credits that can partially offset the severance tax, including qualified capital expenditure credit, carried-forward annual loss credit, well lease expenditures credit, transferable tax certificate, transitional investment expenditure credit, new area development credit, small producer credit, and per-taxable-barrel credit.

As shown in Table 4.4-6, Alternative A would generate the highest tax revenue, but as CAPEX increase for the other alternatives, and the associated loss carry forward tax credit increases, the net (severance taxes less the various tax credits) state tax revenue diminishes. The other tax credits mentioned above can also reduce the net tax revenue to the state.

4.4.4 Land Use

All of the action alternatives would result in some level of impact to land use during construction, drilling, and operation. These types of impacts are described by BLM (2004, 2012, 2014). This section covers land ownership and land management (Section 4.4.4.1), local transportation (Section 4.4.4.2), recreation (Section 4.4.4.3), wild and scenic rivers (Section 4.4.4.4), wilderness (Section 4.4.4.5) and visual resource management (Section 4.4.4.6).

4.4.4.1 Land Ownership and Land Management

Land use in the project area largely reflects ownership of the surface and subsurface resources. Land ownership is complex and has evolved since 2004, with additional surface land now owned by the Kuukpik Corporation (Village Corporation of Nuiqsut) and additional subsurface and surface estate conveyed to Arctic Slope Regional Corporation. Kuukpik also has selected surface acreage and Arctic Slope Regional Corporation has selected subsurface and surface acreage in the vicinity of the proposed GMT2 facilities. East of the NPR-A, the State owns both the surface and subsurface resources of lands not conveyed to Arctic Slope Regional Corporation or the Kuukpik Corporation, as well as the bed of navigable waters such as the Colville River.

As explained in BLM (2004a), BLM continues to manage selections and land ownership options in the NPR-A made under the provisions of Alaska Native Claims Settlement Act and Alaska National Interest Lands Conservation Act. The end result of the selection process is a transfer of ownership and management of the surface estate and subsurface estate to the village and regional corporations, which were established by Alaska Native Claims Settlement Act. In the project area, BLM remains the manager of Kuukpik-selected land and Arctic Slope Regional Corporation-selected subsurface and surface estates until ownership has been conveyed. When the surface and subsurface have both been transferred out of federal ownership, the BLM no longer manages the federal oil and gas leases.

Construction

During construction, land use in developed portions of the project area would change. The intensity of change would be high, temporary in duration, with a common local context. Human presence would be most intense during this phase. Common causes of impacts on land use among the action alternatives include construction of gravel pads, roads, and airstrips; pipelines, including installation of vertical support members; and excavation and transport of gravel at the Arctic Slope Regional Corporation Mine site. Ice roads and ice pads would be constructed to assist in development of the project infrastructure. All of this construction requires a labor force to complete the work, thus increasing human activity.

On the North Slope, the Borough has a land classification system developed through the municipal planning process, and administered by the Zoning Commission and the Borough Assembly. On the Official North Slope Borough Zoning Map, some of the GMT2 Project area is zoned for “resource development,” and some of the project area is zoned for “conservation” (http://www.north-slope.org/assets/images/uploads/b3.pdf). Under the North Slope Borough Municipal Code (North Slope Borough MC Section 19.40.070 [A]), the conservation district encompasses the undeveloped areas of the Borough, and is intended to conserve the natural ecosystem for all the various plants and animals upon which Borough residents depend for subsistence. Subject to this overall intent, the conservation district can accommodate resource exploration and development on a limited scale, but major resource development projects must apply for rezoning to the resource development district.

ConocoPhillips and the North Slope Borough are currently engaged in the process of rezoning the GMT1 Project development areas for resource development. With the proposed project construction and North Slope Borough rezoning, the actual 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), which is consistent with the purpose of the NPR-A. With the project construction, industrial land uses would dominate in the immediate vicinity of the project footprint.

Drilling and Operation

After the construction phase, drilling is expected to take approximately 7 years for Alternatives A and B, and 7.1 years for Alternative C. During the drilling activities, the impact would be high intensity and land use would be reasonably expected to convert to another use after the life of the project. The effected area would be the immediate vicinity of the project footprint. Once drilling is completed, human presence would be determined by operation, maintenance, and inspection needs, which, in turn, is largely determined by the alternative. For Alternative C, an occupied structure pad and air access facilities would be occupied year round and an ice road would be occupied annually resulting in a long-term greater human presence. Proposed activities are within the range of development activities evaluated in the BLM (2004a, 2012).

The BLM has determined the subsurface resources should be offered for oil and gas leasing with requirements for environmental protection and for due diligence to explore for oil and gas to maintain ownership of the lease. When a federal oil and gas lease is renewed, previous conditions are reviewed to see if they comply with current land use plans. For GMT2, federal oil and gas leases AA-081800 (Unit Case File Number), AA-081784, AA-081803, and AA-081781 reflects stipulations in BLM (2008b) (BLM 2014, Section 4.4.4). Surface uses on BLM land must meet the land use plan currently in effect (e.g., those best management practices in BLM [2013a]).

Comparison of Alternatives

All action alternatives include drill site development on Arctic Slope Regional Corporation-selected, federally managed land and construction of aboveground pipelines (from GMT1 to GMT2) that would cross both federal, Native-selected, and private lands (Native patent or interim conveyed). The GMT1–GMT2 Access Road (Alternative A) would cross federal, Native-selected, and private lands (Native patent or interim conveyed). The access road for Alternative B would cross federal and Native-selected lands. An access road would not be constructed for Alternative C. For this alternative, the 0.9-mile Airstrip Access Road would be located on Arctic Slope Regional Corporation-selected land and on federally managed land. The GMT2 drill pad, occupied structure pad, and air access facilities are all on Arctic Slope Regional Corporation-selected, federally managed land. The approximate distribution of federal, Native selected and Native-owned land crossed by components of each action alternative is listed in Table 4.4-7.

Alternative D would not authorize activity on federally managed land, and would not change land use or management in the NPR-A.

Table 4.4-7. Land ownership

Linear Component	Land Owner	Alternative A (Approximate Percentage [%])	Alternative B (Approximate Percentage [%])	Alternative C (Approximate Percentage [%])
Pipeline Length GMT1 to GMT2	Federal BLM	24	51	24
Pipeline Length GMT1 to GMT2	Native Patent or IC	12	None	12
Pipeline Length GMT1 to GMT2	Native Selected	64	49	64
GMT1–GMT2 Access Road (Gravel)	Federal BLM	23	51	23
GMT1–GMT2 Access Road (Gravel)	Native Patent or IC	14	None	14
GMT1–GMT2 Access Road (Gravel)	Native Selected	63	49	63
GMT2 Air Access Facilities *	Federal BLM	None	None	21
GMT2 Air Access Facilities *	Native Patent or IC	None	None	None
GMT2 Air Access Facilities *	Native Selected	None	None	79
GMT2 Airstrip Access Road (Gravel)	Federal BLM	None	None	None
GMT2 Airstrip Access Road (Gravel)	Native Patent or IC	None	None	None
GMT2 Airstrip Access Road (Gravel)	Native Selected	None	None	100
GMT2 Occupied Structure Pad	Federal BLM	None	None	None
GMT2 Occupied Structure Pad	Native Patent or IC	None	None	None
GMT2 Occupied Structure Pad	Native Selected	None	None	100
Subsistence Access Pullouts	Federal BLM	None	33	None
Subsistence Access Pullouts	Native Patent or IC	33	None	None
Subsistence Access Pullouts	Native Selected	67	67	None

The different route and design elements (among the action alternatives) would cause small differences in the area of land use modification, from the current state of near natural to small areas of development for the purpose of hydrocarbon production. Development of GMT2 is consistent with the NPR-A Integrated Activity Plan adopted by BLM in 2013 (BLM 2013a), and the GMT2 oil and gas lease(s) issued to ConocoPhillips.

In addition to differences in ownership of land affected, the use of the land and access would be changed by the construction of the GMT1–GMT2 Access Road (Alternatives A and B). The GMT1–GMT2 Access Road would provide vehicle (e.g., off-road vehicle, truck) access to new areas (with agreements in place for use of the road for subsistence use). Three pullouts are being incorporated into the GMT1–GMT2

Access Road to support access for subsistence activities. The impacts to land use regarding subsistence are addressed in Section 4.4.5, "Subsistence."

Excluding mine site development, the action alternatives would directly impact various amounts of land based on the footprint. The Arctic Slope Regional Corporation Mine site (privately owned; not federally managed land) is ConocoPhillips's preferred material source and is a commercial gravel source that has been operating for more than 15 years. Mining will continue as long as marketable gravel resources are available at the site (Section 2.4.6). Once mining is complete and the material source no longer viable, the Arctic Slope Regional Corporation Mine site would be reclaimed under the terms of the approved reclamation plan, as required by relevant agencies.

For all alternatives, there would be a change in land use from primarily undeveloped land used principally for wildlife habitat, subsistence, research and some recreation to industrial use. There would be an increased access to the project area via gravel GMT1–GMT2 Access Road for subsistence users and members of local communities with Alternatives A and B (see Section 4.4.5, "Subsistence").

Mitigation

ConocoPhillips has included the following design measures as part of the project design to avoid or minimize impacts on land ownership, use and management:

- 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, and
- Avoiding trespass or impact to Native allotment or other private lands.

Potential impacts to land use are also mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and best management practices of BLM (2013a) will reduce the impacts and total area of disturbance; these include: A-1, A-3, A-4, A-5, A-10, C-2, C-3, E-1, E-5, I-1, K-1(e) and K-1(g).

4.4.4.2 Local transportation

All of the action alternatives would result in some level of impact to local transportation during construction, drilling, and operation. These types of impacts are described in BLM (2004, 2012, 2014).

Outside the local community of Nuiqsut, the local transportation system is primarily the industrial use gravel roads and the new Nuiqsut Spur road. Impacts on this local transportation are expected to be low to medium, and are described below, by phase, based generally on qualitative evaluation criteria. The BLM has issued rights-of-way and permits within the project area. For any permitted winter activity, the user would avoid crossing into the proposed project area and would need to reroute their travel. This may add miles to the permitted route activity for a regional extent and a long-term common context. For permitted summer activity, the user would avoid the activity also resulting in a regional extent and a long term duration of common impacts.

Construction

Under Alternatives A, B, and C, construction activities would vary by season, but most construction-related vehicle traffic would occur on industry-constructed ice roads with restricted public access. Impacts to local transportation resulting from these alternatives are anticipated to be low and likely not noticeable. For Alternatives A and B, construction activities would be limited to winter until the GMT1–GMT2 Access Road has been constructed. Construction activities may interfere with some winter travel over frozen tundra, but this would be a temporary impact, occurring only during the two winter construction seasons. Construction of ice roads may also facilitate overland travel; conditional use by local residents would be allowed, based on safety restrictions. Local subsistence travel would generally be allowed on the GMT1–GMT2 Access Road. Travel of local residents would be allowed through construction areas, based on case-by-case conditions, with safety as the principal consideration.

Alternative C would not have year-round road access to the drill site and would rely on seasonally constructed ice roads and aircraft for transportation to support construction. The estimated number of flights that would be required during construction are listed for each action alternative in Chapter 2 flight requirements tables. The primary impact of this air traffic during construction would be to ambient noise, wildlife, and subsistence, addressed in Sections 4.2.3.3, 4.3.4 and 4.4.5, respectively.

Drilling and Operation

Operation of the facilities under the action alternatives would result in lower levels of vehicle traffic than expected during construction. Traffic on the GMT1–GMT2 Access Road would be limited to the transportation of personnel and supplies between GMT2 and CD1/Alpine Processing Facility. These trips would likely be coordinated with operations at GMT1, resulting in effectively increased traffic between GMT1 and GMT2. Traffic on the authorized GMT1 to CD5 road would also increase with the additional traffic to GMT2. The regional and statewide transportation systems have adequate capacity to accommodate the level of activity anticipated during construction and operation of the GMT2 Project. After drilling is completed (approximately Year 9), traffic would drop off considerably in support of long-term operations. During drilling and operation for Alternative C, vehicle traffic would be limited to use of annual ice roads (for access between GMT2 pad and CD1/Alpine Processing Facility) and the 0.9-mile Airstrip Access Road. Outside the ice road season, the infield access road would have no connection to the established road system in the project area.

Summaries of the estimated number of flights that would be required during drilling and operation are listed for each action alternative in Chapter 2 flight requirements tables and provided in Appendix B. These flights are not available for public use and not expected to result in appreciable impact to public airport traffic.

Comparison of Alternatives

In general, all the action alternatives would impact common transportation opportunities and constraints within the region, which include both air and land transportation modes. Transportation components under Alternatives A and B would link GMT2 to existing and authorized GMT1 infrastructure by the GMT1–GMT2 Access Road. The impacts would be expected to be low in intensity, temporary in duration (limited to the construction phase), and would likely impact an area outside the project area. The Nuiqsut Spur Road links Nuiqsut by gravel road to the CD5 road, proposed CD5–GMT1 Road, as well as the CD1/Alpine Processing Facility. Alternative A would increase local access possibilities by the 8.2-mile gravel road from GMT1 to GMT2 while Alternative B would increase by a 9.4-mile gravel road.

There are several hazards commonly associated with roads in the area. Ice fog exacerbated by emissions can impede visibility and whiteouts are frequent in the winter. Heavy industrial traffic on the road can lead to increased accidents involving residents traveling on or across the road, particularly when residents will likely be traveling in smaller passenger vehicles or on snow machines or all-terrain vehicles. Hunters traveling overland by snow machine or all-terrain vehicles may not be able to see if there is traffic on the road before they gain speed to cross it. Without mitigation (e.g., road perimeter markers), the road may not be visible to overland travelers during periods of low visibility.

Under Alternatives C, there would be no GMT1–GMT2 Access Road and access to the GMT2 pad would be by vehicle on the ice road and/or aircraft. The estimated number of flights required during construction and drilling are listed in Table 2.6-4 and Table 2.7-4. A large increase in air traffic would occur at the CD1/Alpine Processing Facility airstrip and in the regional airspace between CD1/Alpine

Processing Facility and GMT2 pad. The increased air traffic to access GMT2 facilities under Alternative C would be mostly small, fixed-wing aircraft. Helicopter flights would more than double, mostly to transport special studies personnel that would otherwise travel by road under Alternatives A and B. These include flights to perform work required by permits or emergency response; most are necessary during the summer season when birds and other wildlife are present. Related impacts of air traffic on these resources are addressed in Sections 4.6.7 and 4.6.8, respectively. Emergency response depending on the severity and the timing of the emergency could increase air traffic under Alternatives C. Overall, impacts to local transportation under Alternatives C are expected to be medium intensity, long-term duration, and of regional extent.

Alternative D would not authorize activity on federally managed land, and would not change local transportation in the NPR-A.

Mitigation

The transportation components of the GMT2 Project are designed to tie into existing transportation infrastructure without additional modification. The GMT1–GMT2 Access Road would allow access to CD1/Alpine Processing Facility, but not to an extensive network (e.g., Spine Road, Dalton Highway). The GMT1–GMT2 Access Road would connect with the CD5 road which connects with the Nuiqsut Spur Road, allowing local residents to travel further into the NPR-A for subsistence hunting and fishing (see Section 4.4.5, “Subsistence”).

Potential impacts to transportation are also mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and best management practices of BLM (2013a) is expected to reduce the impacts and total area of disturbance. These include C-2, E-1, E-5, and F-1.

Conclusions

Overall, impacts to local transportation, including hydrocarbon transportation by pipeline, are expected to be low to moderate in intensity with some noticeable change in air and vehicle traffic. Alternatives A and B would have long-term impacts to local transportation for the duration of the project that would extend beyond the project area. The impacts from Alternative C would be moderate and higher than Alternatives A and B due to the increased requirement for air transportation of personnel and equipment to GMT2 facilities without a GMT1–GMT2 Access Road. This determination includes consideration of transportation of produced hydrocarbon from GMT2, which would have a beneficial impact by assuring continued operations of existing facilities (CD1/Alpine Processing Facility). These impacts are within the range of impacts analyzed by BLM (2004a, 2012).

4.4.4.3 Recreation

All action alternatives would result in minimal impacts to recreation during construction, drilling, and operation. These types of impacts are described by BLM (2004a, Section 4F.4.7) and generally for the Northeast NPR-A (BLM 2008a, Section 4.3.16, 4.4.16, 4.5.16, and 4.6.16) and the entire NPR-A (BLM 2012, Section 4.3.16). The following discussion summarizes the impacts.

There are no public recreational facilities in the project area (BLM 2014). Recreation impacts discussed here are not related to subsistence. Impacts to subsistence use is discussed in Section 4.4.5. Existing recreational opportunities in the project area are a function of the natural setting. Public recreational use in the project area is low intensity and primarily represented by non-local visitors that float the Colville River between Umiat and Nuiqsut. The project area offers opportunity, but limited access, for primitive unconfined recreation (e.g., backpacking, sightseeing, photography, hunting, and fishing).

Limited access and the remote nature of the area inherently restrict the ability of the public and local residents to access outdoor recreational opportunities in the project area, particularly with the vast amount of similar opportunity across the North Slope. Under existing conditions, most recreational access is currently provided by chartered aircraft landing at or near a specific destination. From the landing spot, land access would continue by chartered aircraft during the summer or by snow machine/dog sled during the winter. The Nuiqsut Spur Road extending northward from Nuiqsut provides pickup/car/off-road vehicle travel to the Alpine gravel road system (which can be used by the local population, but not by outside recreational users) for subsistence activities and to the GMT2 pad vicinity under Alternatives A and B. Little recreational use is expected. Except for ice roads, there is no road access between Nuiqsut and the Dalton Highway.

Construction

Most construction of features such as roads, pipelines, gravel pads, and airstrips, would occur during the winter to minimize impacts to the tundra. Very little organized recreation occurs during these harsh winter periods, and only limited recreation occurs in the area during the summer. However, BLM does have one special recreation permittee (wildlife and nature viewing) authorized to conduct activity in the GMT2 area. The permittee would likely not use the immediate area to avoid contact with external entities.

During construction in any of the action alternatives, the extra activity and noise of mobilizing equipment to the site and the outdoor activity associated with gravel mining and construction of road, airstrip, and pads would make the site somewhat more conspicuous to recreational users than during drilling and operation. Overall, construction is expected to result in minimal change to the recreational environment. Impacts from the action alternatives on recreation would be expected to be temporary in duration but could limit recreational activity or potential in the project area, as recreation users would likely avoid the area.

Drilling and Operation

Similar to construction, drilling, and operation would be expected to have minimal change to the recreational environment, but impacts could be expected to be long term in duration and extend through the life of the project. Although minimal, there could be impacts from the action alternatives as recreation users would likely avoid the area.

Comparison of Alternatives

Under all of the alternatives, residents of Nuiqsut would continue to have access to existing Alpine Field facilities including limited access on winter ice roads; little of this use would be expected to be recreational.

BLM has determined that adverse impacts to primitive recreational uses associated with a community generally are indistinguishable to users that are at least 5 miles from a community, and by inference, at least 5 miles from a permanent oil and gas facility (BLM 2012, Section 4.8.7.19, pages 122, 279). Impacts to primitive, unconfined recreation would be expected to have little or no evident change in the recreational environment, recreational opportunities, or quality of the experience beyond five miles of the project area. Within 5 miles of the project area, impacts to recreational users would be long term in duration, but the impacts would be localized and likely low due to limited use of the area.

No alternative would provide year-around surface transportation to the Dalton Highway or additional public airport facilities.

Alternative D would not authorize activity on federally managed land, and would not change recreation in the NPR-A.

Mitigation

In the reasonably foreseeable future, development of oil and gas facilities is unlikely to change the overall number of visitors that would participate in outdoor recreation in the project area.

Best management practices and design features that would reduce the visual impact and noise could also reduce the area of impact on recreation, including: A-1, A-5, C-2, C-3, C-4, E-5, E-6, E-7, E-17, F-1, H-3, I-1, and M-2. Impacts would be expected to be minor and within the range described in BLM (2004a, Section 4F.4.7).

Conclusions

Impacts to recreation would be expected to be negligible to minimal as a result of all the alternatives. Recreation use in the project area could be negatively impacted under all action alternatives due to the presence of permanent facilities and associated noise. However, these impacts would be localized. The duration of impacts would be temporary to long term depending on the activity taking place. A change in the environment, opportunities, or the quality of the experience under the proposed project could be recognizable to a local subsistence user, but not necessarily to an outside recreational visitor.

4.4.4.4 Wild and Scenic Rivers

No designated wild and scenic rivers are found in the project area. The Colville River has been determined to be not suitable for inclusion in the national system; primarily because federal ownership stops at mean high water of the west bank of the Colville River and there is a general lack of support by the State and Native land owners of the river bed and the east river bank (BLM 2014).

No alternative would be expected to have an impact on existing or future potential of the Colville River, Tiŋmiaqsiġvik (Ublutuoch River), or Fish Creek to be added to the National Wild and Scenic Rivers System.

4.4.4.5 Wilderness

The project area is not within a federally designated wilderness area, is not adjacent to an existing wilderness area, and does not include lands recommended for wilderness designation. Therefore, there would not be any effects to designated wilderness areas, or proposed wilderness. Development of infrastructure such as the work pad, roads and a pipeline would introduce man-made structures to the area, thus eliminating the site’s wilderness characteristic of naturalness. During the Integrated Activity Plan revision, the BLM (2012, 2013d) did not recommend existing ConocoPhillips oil and gas leases or other oil and gas ownerships be cancelled so the federally managed lands surrounding GMT2 would still possess wilderness characteristics. Adherence to lease stipulations and best management practices (BLM 2013a) are expected to reduce the impacts to wilderness characteristics in areas adjacent to the developed areas; these include: A-1, A-4, A-5, A-6, C-2, C-3, E-5, F-1, I-1, and M-2.

4.4.4.6 Visual resources

This section discusses potential impacts to visual resources that could result from the proposed project.

Based on BLM (2013a), approximately 8.4 million acres of federally managed land in the NPR-A including the GMT Unit are classified as Visual Resource Management (VRM) Class IV (see BLM 2013a, Map 3). VRM Class IV is the least restrictive visual classification, allowing high relative change to the existing visual character of the area. Developments in VRM Class IV may attract attention and dominate the view, but are still mitigated. The proposed project facilities are located on VRM Class IV land, or private land. A small zone buffering the Colville River is classified as VRM Class III. VRM Class III is more restrictive than VRM Class IV, with the objective of retaining the existing character of the landscape while allowing moderate changes. VRM considerations do not apply to land owned by

Native Corporations within NPR-A. Until transferred from BLM ownership, pending valid selections by Native Corporations continue to be managed by BLM (i.e., VRM considerations will apply).

Oil and gas activities, including the proposed GMT2 alternatives, would change the existing undeveloped visual character of federally managed land in the project area, but still be consistent with VRM Class IV. The BLM (2004b) approved the authorization of the proposed GMT2 Project, and BLM (2013a) assumes that GMT Unit, including GMT2, would be developed under the lease stipulations, and best management practices described in Section 4.7. There has been little change in the existing or prospective use of the project area for oil and gas or other uses that could impact visual resources of federally managed land in the project area that were not considered in BLM (2004a, 2004b) and the subsequent authorizations for construction and operation of production facilities in the Alpine Field that were contemplated in 2004. The BLM (2012; 2013a, 2014) considered the visual resources associated with the development facilities constructed since 2004, and assumed the GMT Unit would be developed by both the GMT1 Project and the GMT2 Project. The proposed GMT2 Project has only been slightly modified from the project authorized for permitting in BLM (2004b).

Construction

Activities such as gravel placement for GMT2 pad construction and GMT1–GMT2 Access Road construction would have negligeable impacts to visual resources in VRM Class IV. Since most construction activities would occur in winter when snow and darkness make viewing these activities difficult, and few people, other than the workforce, are expected to view construction activities, except in a transient way, any impact to visual resources would be temporary.

Drilling and Operation

Under the action alternatives, the drill rig would be the most noticeable and direct impact during the drilling phase. The drill rig would create a noticeable disturbance to visual resources when viewed from a distance of 5 miles or less, resulting in an adverse impact for the duration of time the drill rig is moved and operated. During the summer when there is adequate daylight, the drill rig would introduce vertical lines and dominate the landscape. Pad facilities would introduce a strong contrast with the natural landscape. Most buildings associated with the action alternatives are less than three stories high. However, communication towers can be as much as 200-feet high, in contrast to the predominant horizontal line of the surrounding landform. These facilities would also contrast in color with natural vegetation. Pipelines would repeat the horizontal line of the landform, but would contrast with the colors in the surrounding landscape. Emergency response containers strategically placed along water channels would also contrast with the colors of the surrounding landscape.

Lighting on tall structures could have a negative impact unless design criteria are included, such as directing artificial light inward and downward, rather than upward and outward. BMP E-10 requires artificial exterior lighting to be directed inward and downward from August 1 through October 31.

Nuiqsut, the closest community, is approximately 16.0 miles from the GMT2 drill pad, and may have little, if any, visibility of project development. The greatest impact would be on local residents coming to or near the area for subsistence activity, which is addressed in Section 4.4.5.

Comparison of Alternatives

Alternatives A and B would result in noticeable disturbances to visual resources across much of the project area and up to 2.5 miles from project developments with the impacts being long term in duration. The impacts would be mitigated by the BLM best management practices (2013a). Alternative C would not create the visual impact associated with the GMT1–GMT2 Access Road, but all action alternatives would include an elevated pipeline. Although there would be no visual disturbance from a road under Alternative C would still impact visual resources with the 5,000-foot gravel airstrip, instrumentation for all-weather aircraft use, the occupied structure pad with year-round workforce and camp, the 0.9-mile Airstrip Access Road, and increased air traffic to the site. However, the visual impact of the air access facilities, Airstrip Access Road, and occupied structure pad would be more focused in the GMT2 pad vicinity, and not across the tundra. Due to the remote location of the project, impacts to visual resources would be expected to remain compliant with the objectives of VRM Class IV.

Alternative D would not authorize activity on federally managed land, and would not affect the visual resources in the NPR-A.

Mitigation

The BLM (2013) BMP E-17 address visual resources and requires “At the time of application for construction of permanent facilities, the lessee/permittee shall, after consultation with the authorized officer, submit a plan to best minimize visual impacts, consistent with the Visual Resource Management Class for the lands on which facilities would be located. A photo simulation of the proposed facilities may be a necessary element of the plan.”

Adherence to lease stipulations and best management practices of BLM (2013a) would reduce the impacts and total area of disturbance; these include: A-1, A-3, A-4, A-5, A-6, C-2, C-3, E-5, E-17, F-1, I-1, and M-2.

Conclusions

Overall, construction and operation of all the action alternatives would result in moderate impacts to visual resources. Pad and road construction activities would have a low impact, as these activities would occur in the winter when snow and darkness make viewing more difficult. Summer introduces more daylight and increases the opportunities for viewing operational activities. Facilities and structures (e.g., GMT1–GMT2 Access Road, air access facilities) would introduce a moderate contrast with the natural landscape when viewed from the foreground-middle-ground zone. In Alternatives A and B the GMT1–GMT2 Access Road structure would be visible across the tundra. Whereas in Alternatives C, there would be no GMT1–GMT2 Access Road across the tundra, but the air access facilities, Airstrip Access Road, and occupied structure pad unique to these alternatives would create contrast in the vicinity of GMT2 pad.

For all action alternatives, there would be noticeable disturbances to visual resources that would likely be seen 2.5 miles from project developments. The impacts would range from temporary to long term in duration. For all action alternatives, GMT2 Project would be within the visual objectives of VRM Class IV, the current rating.

4.4.5 Subsistence

Impacts to subsistence areas and uses in the Nuiqsut area are discussed and analyzed in BLM (2014 Section 4.3.5, 4.4.5, and 4.6.10.8), BLM (2004a, 2008a) and BLM (2012, Section 4.3.13, 4.4.13, 4.5.13, 4.6.13, and 4.7.13). Harvest surveys and subsistence use area mapping provide quantitative data, ethnographic and sociocultural studies provide qualitative data, and the residents of Nuiqsut themselves provide original source data.

New information since BLM (2014) includes Stephen R. Braund and Associates’ (SRB&A) caribou use area and harvest data from the Nuiqsut Caribou Subsistence Monitoring Project Years 5, 6, 7 and 8 (SRB&A 2014, 2015, 2016, and 2017a). These reports include geographically specific data and document the types of resources, percent of harvest (for caribou), percent of harvesters, timing of activities, and methods of transportation within the GMT2 Project study area. The Alaska Department of Fish and Game Division of Subsistence conducted a comprehensive harvest survey in Nuiqsut in 2015 (Brown et al. 2016) and data from that survey is incorporated into the description of the affected environment in

Chapter 3 (§ 3.4.5 Subsistence) and in the associated Appendix F, "Overview of Nuiqsut Subsistence Uses."

Subsistence information on the area includes original subsistence use are mapping (Pedersen 1979), surveys by the North Slope Borough Department of Wildlife Management (George and Nageak 1986; Brower and Opie 1996; Brower and Hepa 1998), by Impact Assessment Inc. (1990), and by the Alaska Department of Fish and Game Division of Subsistence (Pederson 1995; Pedersen et al. 2000; Pedersen and Taalak 2001; Braem et al. 2011). This information is the basis for the detailed description of the GMT2 Project's affected environment for subsistence in this document (Chapter 3, § 3.4.5 "Subsistence") and the accompanying "Overview of Nuiqsut Subsistence Uses" (Appendix F).

Original sources considered in analyzing the potential relevance of impacts that could be a result of GMT2 Project include input provided in recent decades by Nuiqsut residents on federally managed land use plans and proposed oil and gas activities. These sources include testimony and recommendations made at BLM scoping and draft EIS meetings, NPR-A Subsistence Advisory Panel meetings since 1998, NPR-A Working Group meetings since 2014, and at Northeast NPR-A Regional Mitigation Strategy workshops, 2015–2016. A description of the extensive additional ethnographic and other research focusing on Nuiqsut is included in BLM (2014, Section 4.4.5, "Subsistence").

The primary impacts to subsistence identified in EISs, ethnographic reports, and testimony of residents in recent decades are reduced access to traditional subsistence use areas, hunter avoidance of industrial areas, disturbance from aircraft and traffic, and reduced availability of subsistence resources

Impacts on subsistence commonly result in increased risks and investments in time, money, fuel, and equipment (BLM 2014Section 4.4.5, "Subsistence"). Similar to the effects of previous development in the Nuiqsut subsistence use area, impacts could last for multiple generations and affect key subsistence use areas and overall Nuiqsut subsistence activities (BLM 2014). The types of impacts are expected to be similar to those identified in BLM (2004, 2012) and, more specifically, those identified in BLM (2014). A 2007 report comparing the alteration of traditional subsistence use areas as a response to development in several regions of the Arctic noted that "expansion of the oilfield infrastructure, for example around Nuiqsut, has increased the significance of physical barriers to access, offsetting or more than offsetting the benefits of increased income," (Haley et al. 2007). These impacts do not affect all subsistence activities equally; the impacts change over time, and individuals themselves, perhaps younger generations in particular, experience impacts differently.

The primary unavoidable adverse impact to subsistence that is directly attributable to oil and gas development (as opposed to the substantial changes that result from globalization, modern transportation methods, economic issues, climate, etc.) is the loss of traditionally used subsistence areas. BLM specialists regularly confirm this through literature reviews, interviews, government-to-government consultation with the Native Village of Nuiqsut tribal council, and computer-assisted analysis of testimony and comments made by North Slope Inupiaq at oil development meetings (see § 4.4.2).

4.4.5.1 Methodology

This supplemental EIS evaluates direct impacts to subsistence activities (e.g., access issues in overland areas where project components are proposed and loss of traditionally used land) while also analyzing indirect impacts to the larger Nuiqsut subsistence use area (e.g., hunter avoidance and increased disturbance from aircraft traffic).

GMT2 Area of Potential Effects for Subsistence

Direct impacts to subsistence were evaluated and quantified using a 2.5-mile buffer around all project infrastructure and activity. The 2.5-mile buffer was established based on displacement distances evaluated in studies of caribou behavioral responses to disturbance (Dau and Cameron 1986; Cameron et al. 1992, 1995; Wolfe 2000; Noel et al. 2004; Haskell et al. 2006; Haskell and Ballard 2008; Wilson, et al. 2012). Another consideration in establishing the buffer distance was access restrictions resulting from safety considerations of hunting near infrastructure. Community interviews indicate some local hunters do not feel it is safe to discharge a large caliber rifle within 2 miles of infrastructure, and the 2.5-mile buffer is large enough to account for direct impacts resulting from safety considerations of hunting near infrastructure (HDR, 2015). The area of potential effects for the construction phase includes all project components, including seasonal infrastructure needed to support construction, i.e., ice roads (see Map 3.3-1). Direct impacts from the drilling and operation phase were evaluated using an area of potential effect that excludes seasonal infrastructure needed for construction (see Map 4.4-1). Potential subsistence impacts are identified based upon the proposed activities associated with (1) construction (2 to 3 years), and (2) drilling and operation (6 years of drilling with concurrent operation, total 30 years of operation). Potential impacts to the community of Nuiqsut are the focus of the impact analysis.

Indirect effects to subsistence resulting from the GMT2 Project could affect land use patterns outside the area of potential effects, thus, indirect impacts were evaluated using the totality of the contemporary Nuiqsut subsistence use areas for all resources.

Evaluating Impacts to Subsistence

Impacts to subsistence are assessed by analyzing Nuiqsut's subsistence uses that have been documented in the GMT2 Project area. Subsistence baseline indicators that are useful in characterizing subsistence impacts include:

Subsistence use areas	Observed change in resources
Travel method	Harvest diversity
Travel routes	Harvest amount
Timing of harvest activity	Harvest participation
	Harvest success
Duration and frequency of trips	Harvest sharing
	Harvest effort

Harvest data have generally been the most reliable and available source of subsistence data in Alaska and provide high-level information regarding whether harvests are increasing or decreasing. In the absence of other data, they are a good measure of the health of the subsistence lifestyle (SRB&A, 2017b). However, they are not the only measure of the health of the subsistence lifestyle, nor are they always reflective of changes in the subsistence lifestyle. Subsistence is important both for its material (e.g., economic, nutritional) and cultural (e.g., cultural, social) value. Harvest data provide information primarily about the material health of the subsistence lifestyle; however, a multitude of other variables provide information about the material and cultural health of the subsistence lifestyle. These include data on subsistence use areas, harvest timing, community participation, and harvest effort (number of trips, duration of trips). For the subsistence lifestyle to be healthy, there must be continued harvests (material value) at continued levels of traditional land use (and identification with traditional land use areas), community and harvester participation, processing, consumption, and sharing (cultural values). These indicators are used in informing subsistence impacts under three primary categories: (1) subsistence use areas and user access, (2) resource availability, and (3) community participation (SRB&A, 2017b). The data for these indicators are drawn from information that has been presented in the affected environment "Subsistence" section (Section 3.4.5.3) and in Appendix F.The GMT2 Project does not have any marine-based components. Thus, the emphasis of this analysis is on mammals, fish, and birds occurring within the terrestrial environment. This review includes subsistence uses of large land mammals (caribou and moose), fish, and migratory waterfowl. Potential impacts to the biological environment for fish, birds, and mammals are reviewed in Section 4.3, “Biological Resources.” In addition to potential impacts associated with new permanent infrastructure, subsistence resources may be disturbed by vehicle traffic (on gravel roads and ice roads), aircraft traffic (fixed-wing and helicopter), construction activities, and odors. GMT2’s direct impacts are presented by the proposed drill pad, road, and pipelines that are located in an area referred to generally as “west of Nuiqsut,” “towards Fish Creek,” or simply “on the west side” by local hunters. In order to characterize the subsistence uses of areas with new infrastructure, BLM removed boat use areas from the analysis of subsistence uses within the area of potential effects because there are no new infrastructure associated with GMT2 occurring in use areas accessed by boat. Except for a new pipeline between CD1 and CD4 that is parallel to an existing pipeline, the only areas of new infrastructure proposed for GMT2 occur southwest of CD5, in an area that is not directly accessible by boat. The project study area includes a portion of the Colville River that is commonly accessed by boat and used for subsistence, but will not be overlapped by new permanent infrastructure associated with GMT2. While boating activities may be affected indirectly through changes in resource availability (see the discussion of “Resource Availability” below), a majority of potential direct impacts (occurring at the same time and place) on subsistence use areas will be limited to inland areas that are not accessed during boating activities.

Alternatives A and B are analyzed together because available information indicates that any differences in impacts to subsistence would be insignificant with the exception of the greater amount of gravel required for Alternative B. Alternative B, described in Section 2.6, “Alternative B,” was developed to have the GMT2 Access Road follow the watershed boundary between Fish Creek and the Tinmiaqsiugvik River drainage basins. This could potentially move the road to higher ground and prevent contamination of two watersheds in the event of a spill. The difference in the case of GMT2 is minimal and Alternatives A and B for the GMT2 Access Road and pipeline do not involve major differences: neither route includes bridges nor is located within the Fish Creek setback. Alternative C is analyzed separately from Alternatives A and B.

Methodology of SRB&A and ADF&G Subsistence Studies

The analysis in this section relies heavily on studies conducted by Stephen R. Braund and Associates (SRB&A) and the Alaska Department of Fish and Game (ADF&G). A brief description of the methodology used to conduct these studies is discussed below.

Stephen R. Braund and Associates Subsistence Mapping and Monitoring Reports

The Nuiqsut Caribou Subsistence Monitoring Project is an ongoing, multi-year program meant to measure impacts and changes over time in Nuiqsut residents’ caribou hunting activities that may result from CPAI Alpine satellite development sites and associated activities. The methodology used for the annual Nuiqsut Caribou Subsistence Monitoring Project (see outline below) includes ongoing community engagement via the Nuiqsut Caribou Panel and the Kuukpik Subsistence Oversight Panel (KSOP). Since the monitoring program was established in 2009, the study team has incorporated additional components to the study design to provide additional context for measuring impacts. The study has two primary components: active harvester interviews, which are conducted with a sample of active caribou harvesters each year and document caribou hunting areas, harvest locations, hunting patterns, health of harvested caribou, and hunting impacts; and household harvest surveys, which are conducted with an attempted census of households in the community and collect data on harvest amounts, participation, sharing, and hunting impacts. For the active harvester interviews, there is an interview and data recording process whereby hunting areas, harvest locations, and impact locations are mapped and digitized and a multi-layered reviews process.

- Respondent Selection: Over the 8 study years, SRB&A has developed a list of 111 active caribou harvesters. The study team initially (in Year 1) obtained a list of active harvesters from KSOP and then developed the list by asking respondents in Years 1 and 2 to recommend (nominate) other active harvesters in the community. The study team kept track of the number of nominations received for each individual and made a special effort to interview individuals with a high number of nominations. Subsequent study years have focused on interviewing individuals who have participated in multiple previous years (to maintain consistency in the sample) while also interviewing new individuals who have been recommended as particularly active (to ensure adequate representation of active harvesters). The study team also has reviewed the list of active harvesters with the Nuiqsut Caribou Panel formed for the study in order to ensure that the list of active harvesters is accurate and thorough. Eligibility for the interview is assessed annually for each harvester. Harvesters are eligible if they went caribou hunting during the previous year, lived in Nuiqsut the majority of the year, and are healthy enough to participate fully in the interview process.

- Interview Process:

    1. Geographic information is recorded on an acetate sheet positioned over a 1:250,000 USGS map. Registration marks are put on clear acetate corresponding to locations on USGS base maps and later registered on identical USGS base maps for digitizing. Geographic data collected includes hunting areas, harvest locations and impact locations.

    2. Each mapped feature is recorded as either a polygon(hunting or impact area), a line (hunting impact location), or a point (impact location or harvest location).

    3. Numbers are assigned to each feature on the map and in the notes about the feature to link them; the numbers are later used to create distinct feature codes in the GIS and Access database.

    4. Interviewers record data next to the relevant questions on the field protocol used to guide the interview, this information is later referenced while entering data to ensure the accuracy of the notes.

- Data Review Process:

    - Draft Report is submitted to CPAI (e.g., Jan. 2015)
    - Comments are received from CPAI (e.g., March 2015)
    - Revised Draft Report is submitted to CPAI (e.g., April 2015)
    - SRB&A team presents results to NSB (e.g., May 2015)
    - SRB&A team presents draft findings to Nuiqsut Caribou Panel (e.g., May 9 2015)
    - Team revises and releases Finalized Report

Alaska Department of Fish and Game Subsistence Reports

ADF&G Division of Subsistence utilizes quantitative and qualitative methods of social science research to document the harvest and use of subsistence resources. Principles of ethical research guide the work to emphasize community approval of research design, informed consent, anonymity of study participants, community review of draft study findings, and the return of findings to study communities. Local Research Assistants are hired in each community to help administer the surveys. Division of Subsistence research generally relies on a standard survey instrument to produce data that are comparable between years and between communities.

The division conducts household surveys in communities to collect harvest information for all finfish, shellfish, wildlife, and wild plants (Fall, 1990). Following community approval, voluntary, confidential surveys are administered, usually in people's homes. Knowledgeable individuals report their household's harvests for the previous year. A census survey is attempted in smaller communities (up to 50 households), and random samples are selected in larger communities. Harvests for home use include all wild resources taken under subsistence, personal use, general, and sport regulations, including harvests that are shared, bartered, or exchanged in customary trade. They include fish removed from commercial harvests for personal use, but not fish that are sold.

4.4.5.2 Summary of Nuiqsut Subsistence Uses

Harvest data for all resources is available for 7 non-consecutive years from 1985-2014 (see Appendix F). While there are fluctuations, in general the data show a sustained yield over time for overall edible pounds of subsistence foods as a whole. The average subsistence harvest in edible pounds for all resources was approximately 200,000 pounds, with a high in 2014 (371,992 pounds) and a low in 1994-1995 (83,228 pounds). Another key indicator of resource availability is harvest pounds per capita. Data on per capita harvest pounds for all resources is available for 3 non-consecutive years; 1985 (399 pounds per person), 1993 (742 pounds per person) and 2014 (896 pounds per person).

Harvest data for caribou is available for 17 non-consecutive years from 1985-2015 (see Appendix F). In general, they show a sustained yield over time in number of animals harvested. The average yearly harvest was 495 caribou, with a low of 258 caribou in 1994-1995, and a high of 774 caribou in 2014. Per capita pounds harvested for caribou is available for 13 non-consecutive years between 1985-2015. In general, per capita pounds have remained relatively stable. The average harvest was 157 pounds of caribou per person, with a low of 102 pounds per person in 2005-2006, and a high of 253 pounds per person in 2014 (see Appendix F).

The GMT2 Project study area overlaps with many of Nuiqsut's most concentrated subsistence use areas (see Figure 3.4-6). A comprehensive discussion of documented harvest locations for Nuiqsut (1979–2013) is provided in the Supplemental EIS for GMT1 (BLM 2014, Section 3.4.5.3), and updated data on harvest areas and on the number of use areas overlapped by the GMT2 Project area are described in detail in Section 3.4.5.3, "Overview of Subsistence Use Areas." Complete data on Nuiqsut subsistence harvests and annual cycle of subsistence activities, as well as maps depicting use areas for each resource, are included in Appendix F.

The importance of particular subsistence use areas that could be impacted by GMT2 can be determined through archaeological and ethnohistorical research and subsistence mapping and harvest studies. The 1979 Nuiqsut Paisangich-Nuiqsut Heritage: A Cultural Plan (Brown 1979) is seen as the foundation for Nuiqsut area management and was created by the community to help inform federal land management decisions. The Paisangich was re-affirmed by the Nuiqsut tribal government in 2005, and is currently being updated. The plan includes a cultural landscape map depicting Nuiqsut's intensive subsistence use area as the land bounded on the west by the eastern side of Teshekpuk Lake, south to Umiat and the lower section of the Anaktuvuk River, east to Prudhoe Bay, and north to include the Beaufort Sea (Brown 1979).

The NPR-A 105 (c) report (based on research conducted in 1977) notes that varying expenses for different subsistence resources create a gradient of access. Whaling is the most expensive and spring hunting for wolf and wolverine is the second most costly. Hunting for caribou is the "bread-and-butter" component of the Nuiqsut subsistence complex (Hoffman et al. 1988) since it is possible to hunt caribou with a relatively small cash outlay. Since the founding of Nuiqsut, there have been some caribou in Fish Creek area each year, throughout the year. Residents of Nuiqsut continue to stress the importance of Fish Creek and undeveloped areas to the west of town in terms of harvesting resources and food security (BLM

2016). This area is only about 12 miles (19 kilometers) from the village and the cost of traveling there by snowmachine is small (Hoffman et al. 1988, pages 18–19).

Recent caribou use areas (2008 –2015) show a changing pattern of use within the GMT2 Project area. The areas of highest overlapping use are still concentrated along the Colville River channels and directly west of the community. More moderate use is to the northwest, and low overlapping use areas are east of the Niqliq channel (SRB&A 2010b, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a). Although there are yearly exceptions, over the 8 study years (2008–2015), the Nuiqsut Caribou Subsistence Monitoring Project has documented a general increase in the percentage of harvests in the area west of Nuiqsut (an area defined by the monitoring project as extending from the Nigliq Channel in the east to the confluences of Fish Creek and Judy Creek in the west, and the Ocean Point area to the south) (SRB&A 2017a). In recent years, this may partially be due to the growing use of four-wheelers that can access overland areas during summer and fall. The monitoring report has also documented a general decrease in the percentage of harvests along the Nigliq Channel. Figure 4.4-1. Nuiqsut contemporary subsistence use areas, all resources, and GMT2 Construction Project Study Area

Note: GMT2 Project area (solid black line) overlain on Nuiqsut subsistence use areas for all resources documented by Pederson from 1973–1986 (dashed lines), by BLM in 2004 (purple line), and by Alaska Department of Fish and Game in 2014 (yellow line). The graded red-yellow shows the highest concentration of overlapping use, documented by Stephen R. Braund and Associates (2010a). shows the GMT2 Project area overlain on Nuiqsut subsistence use areas for all resources documented by Pederson from 1973–1986, by BLM in 2004, by SRB&A for 1995-2006, and by Alaska Department of Fish and Game in 2014.

Tables 4.4-8, 4.4-9 and 4.4-10 provide baseline information about trip length, trip frequency, and changes in harvest activity as reported in Years 1-8 of the Caribou Subsistence Monitoring Report (SRB&A, 2017a).

Table 4.4-8. Caribou Hunting Trip Duration, Study Years 1-8 [a]

Trip Duration	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
More than 2 weeks	0%	1%	0%	0%	<1%	2%	1%	0%
1-2 weeks	1%	1%	1%	1%	1%	1%	0%	0%
2-6 Nights	7%	15%	7%	8%	9%	10%	6%	6%
1 Night	5%	2%	2%	1%	2%	4%	3%	1%
Same Day	87%	81%	90%	90%	88%	84%	91%	93%
Number of Use Areas	135	176	212	193	209	196	190	153

[a] Percentages in all cells refer to the percentage of total caribou use areas accessed by different trip lengths.
Source: SRB&A, 2017a.

Table 4.4-9. Caribou Hunting Number of Trips, Study Years 1-8 [a]

Number of Trips	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
20+	0%	0%	9%	7%	4%	7%	7%	8%
6-20 Trips	30%	28%	21%	28%	16%	19%	21%	20%
4-5 Trips	23%	21%	19%	15%	15%	13%	17%	15%
2-3 Trips	27%	26%	27%	29%	34%	28%	26%	28%
1 Trip	20%	24%	24%	21%	32%	33%	28%	29%
Number of Use Areas	121	174	212	193	210	196	204	153

[a] Percentages in all cells refer to the number of times use areas were visited. For example, in Year 1, no use areas were visited more than 20 times, while 30% of use areas were visited between 6 and 20 times.

Source: SRB&A, 2017a.

Table 4.4-10. Changes in Harvest Activities, Years 1-8 [a]

Type of Change	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Changed Hunting Area [b]	31%	28%	39%	34%	36%	40%	28%	38%
Frequency of Hunting Trips Changed [c]	50%	77%	65%	60%	63%	67%	70%	67%
Duration of Trips Changed [d]	39%	32%	21%	21%	23%	26%	39%	28%
Time of Year Changed [e]	19%	15%	12%	21%	21%	18%	11%	20%
Harvest Amount Changed [f]	75%	85%	68%	72%	54%	63%	82%	57%

[a] Percentages in all cells refer to the percentage of active harvesters reporting each type of change. Changes refer to both increases and decreases. Detailed information on changes in harvest activities was not included in the Year 8 Report; therefore the following footnotes summarize Year 7 results.

[b] Over all seven study years, Personal Factors (49%) were the most commonly cited reasons for a change in use area, followed by Resource Distribution or Migration factors (27%), Environmental Factors (11%), and Development Activities (10%).

[c] In Year 7, 40% of respondents reported taking fewer trips, and 30% reported taking more trips. Over the seven study years, personal factors have been the most frequently cited causes of an increase in trip frequency (55%), followed by resource distribution/migration factors (30%) and development activities (8%).

[d] In Year 7, 19% of respondents reported taking longer trips compared to the previous year, and 19% reported taking shorter trips. Over the seven study years, resource distribution or migration was the primary factor for taking longer trips (61%). Personal factors (lack of time/equipment/money) was the most commonly cited reason for taking shorter trips (58%).

[e] Over the seven study years, Personal Factors were the most commonly cited reasons for a change in harvest seasons (70%), followed by Resource Distribution or Migration factors (19%).

[f] In Year 7, 53% of respondents reported harvesting less than the previous year, 30% reported harvesting more, and 21% harvested about the same amount of caribou. Over all seven study years, resource distribution or migration factors have been the most frequently cited types of causes for harvesting less caribou (36%), followed closely by causes related to personal factors (35%).

Source: SRB&A, 2017a, SRB&A 2016.

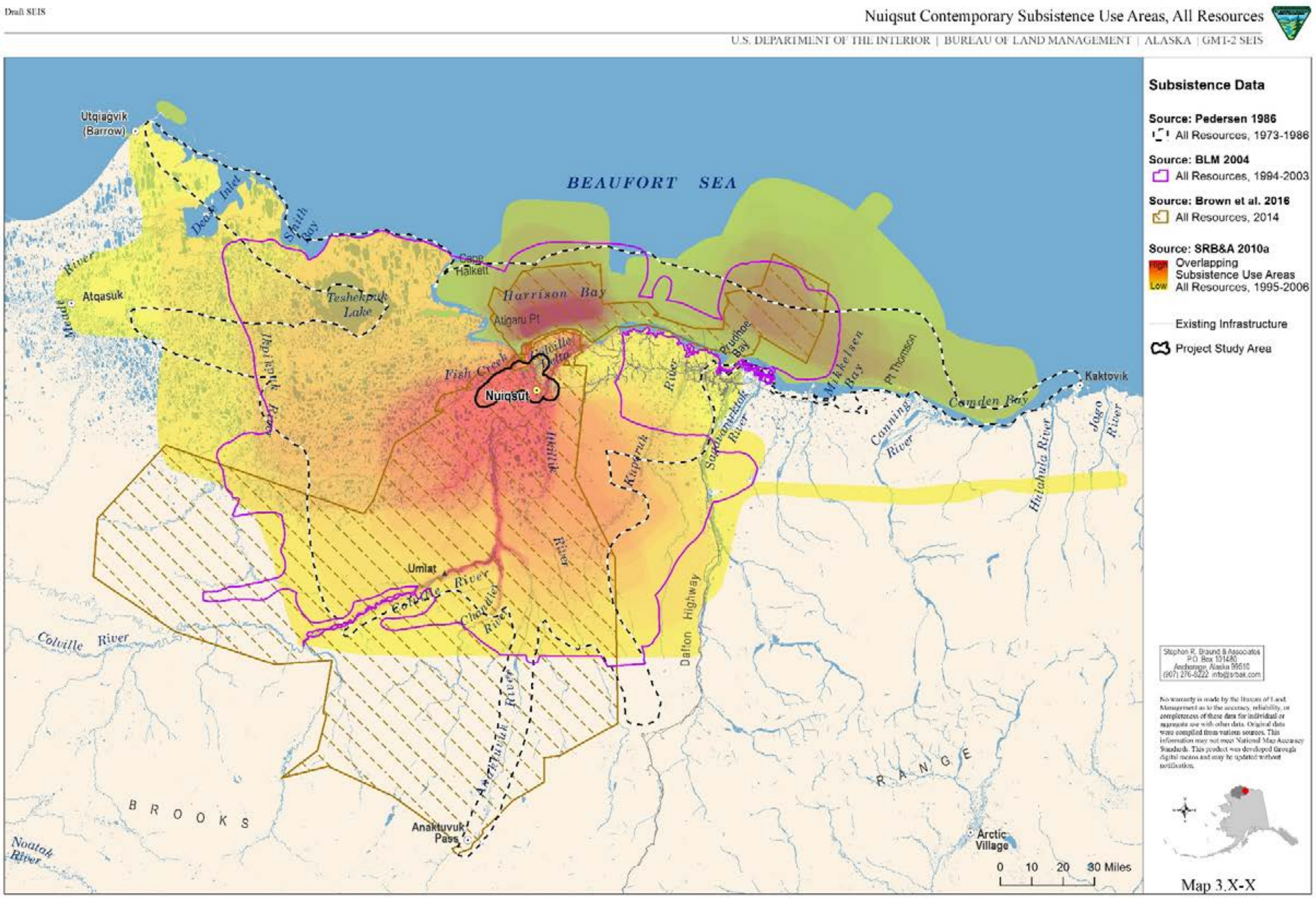

Figure 4.4-2. Nuiqsut contemporary subsistence use areas, all resources, and GMT2 Construction Project Study Area

Note: GMT2 Project area (solid black line) overlain on Nuiqsut subsistence use areas for all resources documented by Pederson from 1973–1986 (dashed lines), by BLM in 2004 (purple line), and by Alaska Department of Fish and Game in 2014 (yellow line). The graded red-yellow shows the highest concentration of overlapping use, documented by Stephen R. Braund and Associates (2010a).

4.4.5.3 Impacts Common to All Action Alternatives

Impacts that are not analyzed separately for the alternatives include oil spills, rehabilitation of infrastructure, and community participation.

Spills

As discussed in BLM (2012, Section 4.3.13.2), impacts to subsistence species that could occur as a result of an oil spill would depend on the size and location of the spill. A history of spills and potential impacts are discussed in Section 4.5 of this supplemental EIS.

Spills contained on a road or pad would likely have little impact to subsistence species because state and federal regulations require spill prevention measures, reporting, and cleanup. Small spills on the tundra could affect a small number of terrestrial mammals or birds in the immediate vicinity of the spill if they were unable to avoid the oil, but population level impacts are not expected. Spills to water resources or that reach water resources, such as fish-bearing streams, could spread and thus have a wider potential impact area. In the case of a large spill, areas that could be impacted include nearshore or marine waters. Spills of this nature could have regional impacts, which could vary in duration based on migration of the spill and feasibility of cleanup.

Subsistence users would be unlikely to harvest subsistence resources near a spill or an area perceived to have been impacted, which could result in additional travel time or energy expenditures for harvesters. Decades after the event, Inupiaq elders who lived in Utqiagvik in 1944 remembered that a spill in Elson Lagoon (20,000 gallons of heavy fuel oil) suffocated seals and birds and deterred the migration of whales from the area for 4 years. This led to suffering for local families who were accustomed to catching small whales in the area for their winter food supply (Perkins 2014).

The potential for spills is present under all alternatives. The risk of a large spill in water is low, and the impacts to subsistence would be major.

Rehabilitation of Infrastructure

If BLM requires the GMT1–GMT2 gravel road (under Alternatives A and B) to be removed upon project abandonment, benefits associated with road-based travel on it by Nuiqsut residents would cease. Removal of the road would also remove hindrances to tundra travel via snowmachine or four-wheeler. Road removal may be an environmental benefit to the extent that rehabilitation is successful in restoring natural conditions, but data are inconclusive on whether that is achievable. The best methods to rehabilitate infrastructure in future decades cannot be known at the time development is planned, and the NPR-A Working Group (2014) asserts that decisions about whether and how to rehabilitate infrastructure should only be made through consultation with local communities.

Community Participation

Impacts on subsistence from GMT2 could result in reduced opportunities to participate in hunting, fishing, cooking/processing, and sharing of subsistence resources, which are the basis of Inupiaq culture. Some hunters are able to afford and are willing to respond to impacts by traveling farther or taking more trips. Some hunters are less likely to bring younger family members along if they anticipate longer and/or riskier trips. Other harvesters may not be able to afford or may not be willing to take more or more distant hunting trips.

Direct and indirect impacts to subsistence are associated with indirect impacts to the community and cultural traditions. When subsistence users' opportunities to engage in traditional activities are limited, transmittal of knowledge about those activities is reduced. If residents decrease use of the project area, the opportunity to transmit traditional knowledge about the area would diminish and could eventually be lost to younger generations. The high level of concern that Nuiqsut residents place on future generations' ability maintain traditional subsistence is described in Section 4.4.2, "Sociocultural Systems." Individuals and families' loss of intimate familiarity with an area could constitute a permanent reduction in Nuiqsut's subsistence use area, and some residents have reported that oil development activities have led to a decline of hunting in areas east of the community (SRB&A 2010a p. 222). If harvests or the number of active participants in harvesting declines, younger generations would have fewer opportunities to learn the skills necessary to hunt, harvest, and process subsistence resources. Fewer opportunities to participate in the sharing and consumption of traditional Inupiaq food would affect the social cohesion of the community. Any changes to residents' ability to participate in subsistence activities, to harvest resources in traditional places at the appropriate times, and to eat traditional Inupiaq foods could have long-term or permanent effects on culture by diminishing social ties within the community that are strengthened through harvesting, processing, and sharing (SRB&A 2010b).

4.4.5.4 Construction

Alternatives A and B: Construction Phase

This section analyzes potential impacts to subsistence activities for the GMT2 action alternatives during the construction phase. Land overlain by the direct footprint of new permanent infrastructure, by temporary construction infrastructure (ice roads and pads), and land within the industry-established drill site safety area would be removed from the subsistence use area during the 2-3 year GMT2 construction phase.

Ice roads would be used to support GMT2 construction activities during 3 winter seasons to access the gravel source and construction areas (e.g., road, drill pad, and pipelines) (see Map 2.5-3). The GMT2 construction ice roads are expected to be open for 80 days (February 1 – April 20), however construction begins in November and clean up extends into late spring/early summer. Due to heavy equipment size and frequency of construction traffic, safety considerations dictate use of separate ice roads for pipeline construction, gravel placement, lake access, and general traffic.

During Year 1–2 of construction, ice pads would be built at the gravel source and along the gravel haul route. During Year 2–3 of construction, ice pads would be built at both ends of the pipeline route, plus an additional pad for construction laydown, see Section 2.5, *Alternative A*, and Section 2.6 *Alternative B*, for more information.

User Access

Overland uses of the GMT2 Project area by Nuiqsut residents occur year-round, with the greatest peak of overland activity occurring in the winter from October through May (see Figure 3.4-19, Table 3.4-17). Overland harvest activity will overlap directly in time and space with construction activity for the GMT2 Project.. During the period November–May, subsistence hunting in the project area is supported by four-wheeler and snow machine. Of Nuiqsut active harvesters interviewed for Stephen R. Braund and Associates' subsistence mapping study, 100 percent reported overland use areas crossed by the GMT2 Project area for one or more resources. Of these respondents, 100 percent of wolf and wolverine hunters and 91 percent of caribou harvesters reported hunting in the GMT2 Project area (SRB&A 2010a). Data from the Nuiqsut Caribou Subsistence Monitoring Project (Stephen R. Braund and Associates 2010b, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a) recorded 1,497 caribou use areas over the 8 study years. Of these 1,497 caribou use areas, 1,309 (87 percent) are overlapped by the GMT2 area. When considering only overland use areas, 374 caribou use areas (25 percent of total use areas) overlapped use areas within the project study area.

Table 4.4-11. Percent of Nuiqsut Harvesters using Construction Area of Potential Effect [a]

Resource Category	Percent of Nuiqsut Hunters Utilizing GMT2 Area of Potential Effect [a]	Overland Use Areas Overlapped by the GMT2 Area of Potential Effect
Wolverine	100%	--
Wolf	100%	--
Caribou	91%	25%
Burbot	77%	--
Geese	76%	--
Arctic cisco	73%	--
Broad whitefish	8%	--
Eiders	7%	--
All Resources	**100%**	**27%**

Source: Stephen R. Braund and Associates (2010a, 2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017).
[a] Boat use areas covered by the area of potential effect are excluded. See 4.4.5.1, Methodology, for more information.

Access to winter overland harvest areas within the project area near the GMT2 drill pad would be restricted during the construction seasons due to physical barriers to tundra travel and/or security restrictions (legal barriers). Blasting of overburden and extraction of gravel at the mine site would occur in winter on the east side of the community; gravel would then be hauled via an ice road to the GMT2 project area during the first winter construction season. Gravel hauling would occur 24 hours per day and no public use of the gravel haul ice road would be permitted.

ConocoPhillips does not require permits for access by local residents to its development area, but does require that residents abide by safety policies when traveling in those areas. In addition to heightened security measures near the drill pad established by ConocoPhillips during construction that affect hunter access to the area, concerns about shooting near traffic, infrastructure, or towards pipelines are all reasons that residents may be restricted from hunting in the GMT2 area during construction, even if resources are present in those areas. Increased risks to hunters can also affect access to an area by presenting physical restrictions on access. For example, after construction of the CD5 road, some hunters managed to navigate around the road entirely by traveling under the bridge on the Nigliq Channel of the Colville on the east side of the road. This route became impassible and dangerous during spring overflow conditions on the river, requiring hunters to backtrack and go all the way around the CD5 pad (Nukapigak 2014).

GMT2 Access Road

During the GMT2 construction phase under Alternatives A and B, the permanent gravel road from the GMT1 drill site to the proposed GMT2 drill site would be under construction for at least 9 months after the ice road for gravel hauling is constructed. During this time, access onto or via the road would be physically and legally restricted. Overland tundra travel through the area would be physically restricted for hunters on snowmachines and four-wheelers who would not be able to cross the road. The GMT1-GMT2 Access Road would intersect several main traditional travel routes that lead to coastal areas west of the community and to the lower Fish Creek area, where subsistence cabins and tent platforms are located (see Figure 3.4-26: Nuiqsut travel routes).

The GMT1-GMT2 Access Road, once it is completed and a road access agreement is finalized, would be open to Nuiqsut subsistence users and could facilitate access to subsistence resources. This would likely occur before the overall GMT2 construction phase is complete. The GMT2 road would be a private, industrial road; it is not designed or intended to be a public road (CPAI 2016). Temporary physical and legal restrictions will result from industrial traffic on the road, including movements of the drill rig and other equipment.

Construction of GMT2 is anticipated to require 172,200 vehicle trips over 2-3 years. Rules and restrictions on use of the GMT1-GMT2 Access Road would apply once the road is open to residents. Relevant restrictions and the longer-term effects anticipated from the GMT1-GMT2 Access Road are discussed below in Section 4.4.5.5, Alternatives A and B: Drilling and Operations Phase.

Air Traffic

During the construction phase of the GMT2 project, fixed-wing air traffic for all alternatives would land at the Alpine Central Processing Facility (APF). Fixed-wing air traffic during the construction of the GMT2 development under Alternatives A and B is expected to consist of 270 flights to facilitate crew changes and is not expected to increase over current levels once construction is completed. Helicopter traffic will occur over the larger GMT2 project area May through September to support environmental studies and ice road clean up, and is expect to total 1032 flights during the construction phase of development. More detail on aircraft traffic is provided in Appendix B, and the impacts of air traffic on subsistence are discussed below as part of the drilling and operations phases of each alternative.

Avoidance

In addition to the restrictions resulting from temporary and permanent infrastructure, traffic, and safety zones described above, subsistence access during construction could be impacted because hunters are likely to avoid the project area. Hunter avoidance could affect access to the area due to concerns over safety, disturbances, and contamination of resources. Hunter avoidance could also result from actual or perceived reduced availability of subsistence resources in the GMT2 area.

The shifting of subsistence use areas away from areas of development at a distance greater than the development footprint is well documented for the community of Nuiqsut (RFSUNY 1984; Impact Assessment, Inc. 1990; Pedersen et al. 2000; MMS 2007; SRB&A 2017a). Subsistence harvesters often avoid areas of industrial construction due to discomfort about hunting near human or industrial activity. Pedersen et al. (2000) provide a detailed analysis of this impact, noting that harvest location information for Nuiqsut from 1993 and 1994 “provide support for the claim of displacement from traditional hunting areas.” The report notes that 80 percent of the community’s 1993 harvest came from areas more than 16 miles from any development, and a similar pattern was noted during the following year in North Slope Borough research. According to Minerals Management Service (2007), oil and gas development has to potential to divert subsistence users a distance of 5 miles to greater than 25 miles from facilities.

Summarizing the results of interviews with 215 active North Slope hunters regarding the impacts and benefits of oil and gas development, Stephen R. Braund and Associates (2009b) reported that 79 percent of active hunters in Nuiqsut cited personal experiences with difficulties in hunting related to oil and gas development, including concerns related to physical and social barriers to hunting, increased effort required, and competition. SRB&A (2017a) also included avoidance questions in the Nuiqsut Caribou Subsistence Monitoring Project for the 2014, 2015, and 2016 study years. The most recent year for which data are available for Nuiqsut (2015) had the highest percentage of observations of avoidance due to development (72 percent of respondents). In general, respondents explained that they avoided those areas even if they are allowed to hunt in them because of infrastructure and traffic (SRB&A 2017a).

Much of the research and conclusions related to harvester avoidance are based on pre-Alpine hunting patterns. While avoidance has continued to occur, and has been documented in the Caribou Subsistence Monitoring Project, it is important to note that as industry has moved closer to Nuiqsut, it has become more difficult for residents to avoid industry. Future research will reveal how harvesters respond when infrastructure is established closer to town or in their core hunting areas. Avoidance may be less of an option as fewer areas without development are present.

The actual footprint of the proposed GMT2 Project overlaps with a small portion of Nuiqsut’s highly used subsistence area (the red area depicted in Figure 4.4-2), but the linear components will be constructed between town and Fish Creek. User avoidance would be most acute near the construction activities for the proposed GMT2 pad and pipeline, but avoidance of the area would be at a greater distance than the footprint. Therefore, the avoidance of subsistence use areas, often characterized by users as loss of an area, could be larger than the direct overlap of the project with documented use areas (NRS 2003; MMS 2007).

Helicopter traffic, an impact that is discussed below, is the most commonly reported disturbance to subsistence hunting (see Appendix K: Aircraft Disturbance Information). Considering only new helicopter flights that would occur in the GMT2 area due to construction of the GMT2 Project, Alternatives A and B would result in:

- 538 new helicopter flights in Years 1-2 of GMT2 construction, and
- 494 new helicopter flights in Years 2-3 of GMT2 construction.

The numbers of additional flights that will result from construction, drilling, and long-term operation of GMT2 under all alternatives are included in this document in Section 2.9.1, "Comparison of Alternatives," Table 2.9-1. Those tables include numbers for helicopters versus all other aircraft and for flights into the GMT2 area versus into Alpine.

Resource Availability

Direct impacts from construction on resource availability would occur primarily from disturbance and displacement of subsistence resources. The effects of construction on the availability and abundance of caribou are described in Section 4.3.4, "Terrestrial Mammals," and are summarized below. The geographic scope of the Terrestrial Mammals analysis contains the entire range of the Teshekpuk Caribou Herd (TCH). Impacts to subsistence are analyzed on a smaller scale and focus on the core subsistence use areas utilized by the community of Nuiqsut. This section discusses potential impacts in the core subsistence use areas.

As noted above, a key indicator of resource availability is per capita harvests within a community. Increases or decreases in these numbers may indicate an increase or decrease in the availability of subsistence resources to local harvesters. Per capita harvest information for all resources is available for 3 non-consecutive years (1985, 1993 and 2014) and shows a general increase in total per capita harvest. More comprehensive data is available for per capita harvest of caribou. Per capita harvest data for caribou is available for 13 non-consecutive years and shows a generally flat trend in per capita harvest (see Appendix F).

It is important to note that subsistence harvests have generally increased in areas where there is no development, and decreased in areas east of the community where development has occurred (see Appendix F). Most hunters have continued to harvest caribou in desired amounts, but many also report avoiding use areas due to development (SRB&A 2017a). Future research will reveal how harvest levels change when infrastructure is established closer to town or in core hunting areas and it becomes more difficult for hunters to avoid development. Resource availability during construction of GMT2 may be affected by the factors described below.

It is highly unlikely that construction activities for Alternatives A and B would reduce the overall population levels of subsistence resources. Some members of the TCH may alter their movement patterns in response to a newly constructed road, but the road would likely not disrupt the overall integrity of the herd's historic range. Altered movement patterns would likely be most noticeable if the leaders of the fall migration are disrupted, but it is difficult to predict these changes on the periphery of the herd's range. Mechanisms of disturbance are not completely understood, but traditional knowledge asserts that disturbance of adult cows initiating and leading fall migration can disrupt traditional migration routes.

Whether the presence of temporary infrastructure and activity associated with the construction period will disrupt lead cows to the extent that availability near Nuiqsut is impacted is unknown (see Section 4.3.4.1, *Terrestrial Mammals)*.

Under Alternatives A and B, direct impacts to subsistence resource availability from disturbance and temporary displacement could occur as a result of placement of elevated pipelines on vertical support members, placement of gravel fill (pad and access road), ice road construction, and concurrent construction and operation of winter ice roads and construction activities. Impacts from road traffic during construction would occur during the months of November to mid-April during ice road construction and operation, when the ice road will be used for gravel road construction and pipeline vertical support member installation. The second construction season would be similar in duration for ice road construction, pipeline, power line, and fiber optic line installations and facilities installation.

Impacts to resource availability could also lead to increased risks, costs, time, and effort because harvesters would have to look elsewhere or spend more time and/or money in search of resources. (see Table 4.4-8 for baseline data on trip length).

Disturbance of subsistence resources is most likely to occur within key subsistence use areas during the two- to-three winter construction seasons when the area is most accessible to Nuiqsut residents hunting overland. Impacts on resource availability related to noise, traffic, and infrastructure is an impact that has been frequently observed and reported by North Slope harvesters (SRB&A 2009b, 2017a). Even localized or limited changes in caribou distribution resulting from displacement can affect the availability of caribou to harvesters because of residents' limited means to access caribou at different times of the year and the fact that caribou are not always available near Nuiqsut. Twenty-five percent of overland use areas for caribou are overlapped by the construction area of potential effect, and 91 percent of caribou harvesters reported using the construction area of potential effect to harvest caribou (see Table 4.4-11).

Indirect effects to resource availability could occur hunting areas accessed by boat within and outside the construction area of potential effect due to deflection. Areas accessed by boat were excluded from the analysis of user access (see 4.4.5.1, *Methodology*); however, hunters utilizing boats may still be affected by changes in resource availability. 65% of caribou hunting areas are accessed by boat in the summer, and many animals are harvested after they cross east through the area of potential effect (see Section 3.4.6.3, *Overview of Subsistence Use Areas*). Construction activity will be much lower during summer compared to the winter ice road season, but work on the GMT2 Project will occur year round and deflection of animals is possible.

Furbearers (wolves and wolverine), may experience local displacement that could affect Nuiqsut subsistence activities. These species could experience a short term or long term displacement due to construction activity, making these resources less available to hunters in traditional locations (see Section 4.3.4, *Terrestrial Mammals*). Residents engage in furbearer hunting in the wintertime, when few other subsistence activities are possible. Wolf and wolverine fur supports the making of art and clothing that can represent a critical source of income for hunters and sewers.

Hunting for wolves and wolverines is an important cultural activity for Nuiqsut. Residents of Nuiqsut have pointed out the particular importance of the GMT2 area (previously known as CD7) for wolf and wolverine hunting since permitting for the ASDP began (BLM 2003). While recent caribou use area data show the GMT2 footprint on the periphery of Nuiqsut's core caribou hunting area, wolf and wolverine use area data show high overlapping use areas throughout the GMT2 area. All wolf and wolverine hunters reported use areas in the project area, more than any other resource. Residents have indicated that furbearers such as wolf and wolverine are particularly sensitive to development activities and noise (SRB&A 2009b, 2010a). It is possible that deflection of furbearers from the GMT2 area, or direct overlap of normal trap lines, will cause hunters and trappers to travel farther looking for these resources. Because these activities occur during winter, traveling further in extreme cold presents additional risks for these hunters and trappers.

Alternative C: Construction Phase

User Access

Impacts associated with construction activities related to the ice roads and gravel installation for pads, vertical support members, pipeline, power line, and fiber optic line placement to subsistence under Alternative C would be similar to Alternatives A and B. Additionally, Alternative C would have air access facilities consisting of a 5,000-foot gravel airstrip and parking aprons. The GMT2 drill pad would be accessed via the 0.9-mile-long gravel airstrip access road from the 18.4-acre occupied structure pad. Alternative C would not include a GMT1–GMT2 Access Road. Increased traffic levels would occur on ice roads because year-round gravel road access would not be available during Year 2 construction.

Under Alternative C, GMT2 facilities would be constructed over two or three construction seasons. In Year 1 of construction, vehicle traffic under Alternative C would be the most intense from January through April to support gravel hauling and construction of gravel pads, the airstrip access road, and the airstrip, and construction of the pipeline vertical support members. Ice road pre-packing and ice road construction would occur in November and December. In the Year 2 of construction, traffic between Alpine facilities and the GMT2 drill pad and occupied structure pad would occur on ice roads.

Air Traffic

Subsistence users and resources would experience increased levels of disturbance from air traffic during construction of GMT2 facilities under this alternative. No airstrip or camp would be available at GMT2 during Project Year 1 and Project Year 2. Construction crews would stage out of Alpine-area camps. Fixed-wing flights to support construction crews during winter of Year 1 would land at CD1/Alpine Processing Facility.

Impacts associated with air traffic are described below in the discussion of avoidance during the life of the project. A complete table of flight numbers is provided in Section 2.7, "Alternative C: Roadless Development," Table 2.7-4. Estimated flight numbers for Alternative C during the construction phase are:

- In Year 1 of GMT2 construction, there would be 647 new helicopter flights at GMT2 and 129 new fixed-wing flights into Alpine; and
- In Year 2 of GMT2 construction, there would be 413 new helicopter and 1,058 fixed-wing flights at GMT2 and 145 new fixed-wing flights at Alpine.

Avoidance.

Avoidance during construction under Alternative C would be similar to Alternatives A and B. Because of winter GMT2 construction activities under Alternative C, subsistence hunters may avoid the GMT2 area, which could result in lost harvest opportunity for those hunters. Increased ice roads, traffic, and gravel hauling under Alternative C would likely result in high levels of avoidance in the winter. The lack of a gravel road being constructed in the area would reduce the physical barriers to access because hunters would not be concerned with problems crossing it.

Resource Availability

The geographic scope of the Terrestrial Mammals analysis contains the entire range of the Teshekpuk Caribou Herd (TCH). Impacts to subsistence are analyzed on a smaller scale and focus on the core subsistence use areas utilized by the community of Nuiqsut. This section discusses potential impacts in the core subsistence use areas. Construction of Alternative C would result in similar types of impacts to resource availability and would be similar in intensity to the impacts expected under Alternatives A and B.

Seasonal construction of ice roads and construction of larger pads under Alternative C would result in different patterns of direct disturbance: there would be no gravel road constructed and thus linear disturbances or barriers to animal movement would be reduced, but the additional pad and airstrip at the drill site have a larger footprint and require more construction activity and gravel.

Summary of Construction Phase Potential Impacts on Subsistence

Construction, particularly of the gravel road under Alternatives A and B, is expected to impact user access to the area and could impede tundra travel (travel methods and travel routes) through the area. In addition to impediments to user access, gravel hauling and other traffic and construction activity would likely result in localized displacement of subsistence resources and would likely cause hunters to avoid the area. Construction of GMT2 would include the direct loss of land used for subsistence purposes by permanent infrastructure, temporary infrastructure, and safety areas surrounding drill sites. Construction activities that could cause disturbance would last two to three winter construction seasons and two to three corresponding summer seasons.

4.4.5.5 Drilling and Operation

Alternatives A and B: Drilling and Operation Phases

The 30-year drilling and operations phase of GMT2 under Alternatives A and B would result in permanent industrial infrastructure and associated activities that overlap with areas documented for multiple types of subsistence activities. Subsistence uses in the GMT2 Project area include large land mammals, furbearers and small land mammals, fish, migratory birds, ptarmigan, and vegetation. Impacts from drilling and operation, including impacts to hunter access, hunter avoidance, and reduced resource availability, are expected to last the life of the project, but impacts could last longer if GMT2 infrastructure is used for future projects. See Maps 2.5-1 and 2.6-1 for more detail on project infrastructure

User Access

Land overlain by the direct footprint of new permanent infrastructure would be removed from the subsistence use area during the 30-year GMT2 drilling and operations phase. Land overlain by wintertime (ice road and pad) infrastructure would be temporarily removed from the subsistence use area. Table 4.4-12 shows current subsistence use areas that are overlain by the drilling and operations area of potential effect.

Table 4.4-12. Percent of Nuiqsut Harvesters using Drilling and Operation Area of Potential Effect [a]

Resource Category	Percent of Nuiqsut Hunters Utilizing GMT2 Area of Potential Effect [a]	Overland Use Areas Overlapped by the GMT2 Area of Potential Effect
Wolverine	88%	--
Wolf	87%	--
Caribou	84%	13%
Burbot	7%	--
Geese	67%	--
Arctic cisco	70%	--
Broad whitefish	4%	--
Eiders	0%	--
All Resources	**100%**	**23%**

Source: Stephen R. Braund and Associates (2010a, 2010b, 2011, 2012, 2013, 2014, 2015, 2016, 2017).
[a] Boat use areas covered by the area of potential effect are excluded. See 4.4.5.1, Methodology, for more information.

In addition to new permanent infrastructure, the drilling phase would include a 10-acre ice pad for each year of drilling. Access to the GMT2 drill site and surrounding safety area is restricted during the entire construction and drilling and operation phase. Access and discharge of firearms are prohibited in the safety area. The footprint of drill sites and facilities constitute approximately 10 percent of areas restricted by industry safety zones: the GMT2 pad is 14 acres; the safety area is approximately 142 acres.

GMT2 Access Road

During the drilling and operations phase (30 years), the gravel road from GMT1 to GMT2 would be open to local use for access to subsistence areas. The GMT2 road would include three subsistence pullouts for temporary parking on the road and ramps to facilitate snow machine and four-wheeler access to the tundra for overland travel.

Residents see certain roads, especially the community's currently planned Colville River Access Road, as critical for facilitating access for hunters. The Colville River Access Road and the Kuukpik Spur Road are also valued for providing emergency evacuation routes. These factors are all considered in evaluating the overall potential impacts of roads, while this section focuses on the potential beneficial and negative impacts on subsistence of the proposed GMT1–GMT2 Access Road (referred to hereafter as the GMT2 road).

Roads in and of themselves can facilitate hunter access, especially during certain times of the year (e.g., spring, when rivers are not open, but travel by snowmachine is no longer possible) and for hunters who only have road vehicles or who are less active (e.g., have less time to go on longer hunting trips). For all subsistence resources, boat use constitutes the most common travel method, followed by snowmachine use and then foot travel (see Figure 3.4-6). For caribou harvest in particular, hunting by boat constitutes the travel method most utilized to access caribou subsistence use areas, followed by snowmachine use and then four wheeler use. Historical trends in travel method for caribou harvest are below in Table 4.4-13.

Table 4.4-13. Travel Method Used to Access Caribou Use Areas, SRB&A Caribou Subsistence Monitoring Reports

Travel Method	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Boat	74%	80%	74%	80%	74%	77%	70%	65%
Snowmachine	22%	9%	16%	12%	8%	10%	15%	8%
Four-wheeler	4%	9%	9%	9%	17%	11%	14%	18%
Truck	2%	2%	< 1%	0%	1%	1%	1%	8%

Source: SRB&A, 2017a.

The GMT2 road would be a private, industrial road; it is not designed or intended to be a public road (CPAI 2016). Temporary physical and legal restrictions would result from industrial traffic on the road, including movements of the drill rig and other equipment. Other relevant restrictions to subsistence access on the road would include:

- Subsistence hunters under the age of 18 would not be allowed to use the road unless accompanied by an adult.
- Road users would be required to stop at all safety stations to receive travel advisories and show valid driver's license and/or proof of Kuukpik authorization to access Kuukpik land.
- Brief stops for subsistence purposes would be permitted at designated pullouts or parking areas. Any vehicle stopped on the roadway must leave their flashers on. If hunters intend to leave a vehicle unattended for more than a brief period, they are requested to advise the safety station before they depart.

- Hunters would not be allowed to shoot while on the driving surface of the road, across the road, or from a vehicle.

- ATVs (four-wheelers) and snowmachines on the gravel road would be required adhere to the same access rules as road vehicles (CPAI 2016).

Access to the GMT2 road by road (as opposed to reaching the GMT2 road via overland tundra travel on off road vehicles) will require hunters to comply with Kuukpik Corporation rules for the Kuukpik Spur Road. The Kuukpik Spur Road is also known as the Nuiqsut Spur Road, the Kuukpik Road, or simply the Spur Road and is owned and managed by the Kuukpik Corporation (the ANCSA native corporation for the community of Nuiqsut). The Kuukpik Spur Road is not part of the GMT2 development, and access to the Kuukpik Spur Road is considered only in its ability to affect the utility of the GMT2 road for subsistence users.

The Spur Road is a private road, surrounded by Kuukpik Corporation land, and use is by permission only: use is considered a privilege and not a right (Kuukpik 2016). Spur Road rules are largely the same as those for the GMT2 road with the following restrictions that may be relevant for subsistence hunters:

- Everyone using the Spur Road (drivers and passengers of road and off-road vehicles) must have permission and sign the Waiver of Liability and Road Rules.

- ATVs (four-wheelers) must stay on the Spur Road; access to the tundra from the Spur Road by ATV is prohibited. Tundra damage caused by driving off the road surface will be reported to the North Slope Borough by Kuukpik and the driver will be responsible for such damage.

- Travel by snowmachine on the Spur Road is allowed only after a sufficient new snowfall and before plowing of the Spur Road.

All rules and legal restrictions for use of the GMT2 road described above would apply for the duration of the operation phase. (Kuukpik has discretion to change Spur Road rules, or rules applying to Kuukpik lands, at any time.) Subsistence access to areas west of the community would increase after construction because some hunters would use the GMT2 road to reach the area and many would most likely continue to travel overland via off-road vehicles. Some Nuiqsut hunters would use the GMT2 road to scout for, harvest, and transport subsistence resources (primarily caribou but also geese in the spring). Hunters may use snowmachines or four-wheelers on the road from town (snowmachine travel on the Spur Road is restricted to after sufficient snowfall and before plowing), or they may load these off-road vehicles onto trucks or trailers, transport them onto the road, and then offload them for overland use. Hunters who have the appropriate vehicles and permission from the Kuukpik Corporation to use the Spur Road would likely benefit from this facilitated access. Hunters who lack appropriate vehicles or permission, or who choose not to use the road, would not benefit from it.

The GMT2 road would also have some direct impacts to subsistence access by introducing physical barriers or obstructions to travel through the area by snowmachine or four-wheelers. These impacts could occur during summer, fall, or winter caribou hunting, winter furbearer hunting and trapping, and spring geese hunting. Nuiqsut residents have increasingly reported subsistence impacts related to man-made structures in recent years. Impacts related to man-made structures were the second most commonly reported impact in 2014 (SRB&A 2016), before ramps had been constructed to cross the new CD5 road. Several hunters reported that man-made structures blocked access when traveling overland. Ramps were not in the initial design for the CD5 road; ramps were eventually constructed but were too steep and narrow for some travelers to use and sometimes difficult to locate or not in convenient locations. People traveling to check their Arctic Cisco nets on the Nigliq Channel, for example, have reported that the CD5 road is too high and too steep and that the ramps are not wide enough to accommodate a snowmachine towing a sled. One resident, attempting to reach his fishing site on Fish Creek, could not cross the new CD5 road and said he would have had to go around CD5 to get there (SRB&A 2016 p. 107). In the first winter after its construction, several travelers tried and failed to cross the CD5 road, then went around the road on the Nigliq Channel side (under the bridge). In the spring, however, overflow on the river made that route too risky and travelers then backtracked to travel around CD5 to continue (Nukapigak 2014). The GMT2 road would continue to act as an impediment to travel throughout the operation phase for snowmachine users traveling overland (not using the road). Users will likely be able to cross the road using the ramps, but may have to reroute based on the location of the ramps.

It is likely that ramps newly constructed for the CD5–GMT1 Road and proposed for the GMT2 road will be better than those built for the CD5 road. Ramps for the GMT1 and proposed GMT2 roads were included in the road design and should be wider and less steep than the ramps that were added to the CD5 road after construction. Concerns remain that with the new GMT1 road and the proposed GMT2 road, an inability to cross the road would effectively box people in if they were traveling overland in any westerly direction. The ramps would help mitigate this impact, but concerns remain that even with ramps, the traffic on the road, especially in times of reduced visibility, would make it difficult or dangerous to cross. Hazards commonly associated with roads in the area include heavy industrial traffic, fugitive dust in the summer, and ice fog exacerbated by emissions that impedes visibility in the winter.

Data emerging from use of the new (2014) Kuukpik Spur Road indicate that some hunters are using it and some are avoiding it (SRB&A 2017a). In 2015, two individuals mentioned avoiding the newly constructed Spur Road area, while several individuals reported using the road and a couple commented that the road was a benefit to community hunters (SRB&A 2017a). Use of the Spur Road was much heavier than use of the CD5 road (SRB&A 2017a). Residents have indicated that the Spur Road is substantially lower than the CD5 road and therefore it is easier for hunters to travel on and off the road to harvest caribou (as noted above, access to the tundra by four-wheeler from the Spur Road is prohibited).

There are several reasons that preliminary data on the benefits of increased access provided by the Kuukpik Spur Road should not be used to predict the impacts of the GMT2 road. Data gathered by SRB&A on use of the Spur Road reflects hunter reports on impacts and benefits of the Spur Road before there was any development west of it (i.e., the GMT1 road or proposed GMT2 road), and the roads themselves are different.

The location of the GMT2 road may have the potential to deflect caribou to a greater extent, and with greater consequences, than the Spur Road. It is likely that construction and subsequent use of the larger industrial GMT2 road (with adjacent pipelines) located generally west of the Spur Road would deflect caribou that are migrating west to east towards the Spur Road. (See the discussion of Resource Availability with additional citations below). Concerns about this potential deflection have already been expressed by community residents (SRB&A 2017a). If caribou are deflected from crossing the GMT2 road, the current benefits of the Spur Road may be reduced. Some individuals may increase their use of the GMT2 road in order to access areas farther to the west of the community.

The Spur Road is much lower compared to ground level than the newly constructed Alpine to CD5 and CD5 to GMT1 roads. The height of the conceptual GMT2 road will be approximately the same as the CD5–GMT1 Road, and the road height is the primary concern cited by Nuiqsut residents. Hunters have noted that the lower Spur Road is easy to cross and does not block caribou as has been observed at the new CD5 road (SRB&A 2017a). Gravel roads 4 feet or more in height create a visual barrier that can lead to delay or deflection of caribou movements (Wolfe et al. 2000), and the GMT2 road would be approximately 5 to 8 feet high. In addition to its height and location, the GMT2 road would be a large industrial road actively used by heavy equipment for several decades, whereas most industrial traffic is prohibited on the Spur Road.

The consequences of the Spur Road deflecting caribou are less impactful to hunters than deflection of caribou farther away from Nuiqsut would be. The Spur Road is very close to town, and any caribou deflected by the Spur Road likely remain close to town where people with limited resources depend on finding them. By contrast, the GMT2 road would be approximately 15 miles away from Nuiqsut and extend 14 miles into the edge of a high use fall migration corridor for Teshekpuk Caribou Herd. Caribou deflected by the GMT2 road may remain west of the GMT2 road and would require significantly more time and effort to harvest. (See the discussion of Resource Availability with citations below).

As noted above, several ramps along the proposed GMT2 road would allow crossing the elevated road from one side to the other and provide egress off the road and access back onto the road by four-wheelers and snow machines. Repeated passes in a single location by four-wheelers (or other wheeled vehicles) during non-frozen periods would likely result in trail braiding, breaking the tundra mat, ruts and channeling of water into vehicle tracks, and exposure of frozen soil with potential localized permafrost thawing and thermokarsting near the ramps (see Section 4.2.1.1, *Phsiography and Geomorphology/Soils and Permafrost*.)

These effects could eventually increase the risk and reduce the feasibility of overland access by four-wheeler in the area. Increasing injury rates and demand for search and rescue operations have been documented in arctic Canada (Clark, Ford et al. 2016). The subsistence use of four-wheelers, according to Ray Bane, “is a particularly complex and sensitive issue. Access to renewable natural resources is crucial to a subsistence based economy and lifestyle. However, such access must not degrade the environment and resource base for the sake of short-term convenience. Ultimately, this imperils the opportunity for future generations to continue a subsistence lifestyle,” (Bane 2000 p. 71-72).

The GMT2 road would therefore initially facilitate subsistence access via four-wheeler, but that type of access could be restricted in overland areas near the road within the life of the project. It may become physically restricted due to rutting, subsidence, and thermokarst, and/or it may become legally restricted to prevent such damage. With appropriate ramp design, snowmachine users may not experience problems during the winter. However, the frozen period when overland travel by snowmachine is feasible is shorter than in the past and predicted to shorten in the future (Richter-Menge, Overland et al. 2017). Recent documentation of current impacts to subsistence activities in Alaska and a forecast model indicate a net reduction in the availability of subsistence resources over the next 30 years caused primarily by climate-related challenges in access, rather than changes in abundance or distribution of resources (Brinkman et al, 2016).

The impacts described above may only affect some hunters and may change over time. Users who cannot or who chose not to use the road would have their access restricted throughout the drilling and operation phases. In the longer-term, access to the tundra off the road may be restricted. Anticipated negative effects include direct overlap with a use area, impediments to overland access, hunter avoidance, hazards, dust, traffic, noise, emissions, ice fog, interference with scouting for caribou, localized deflection of caribou, and possible restricted overland four-wheeler access in areas near ramps due to tundra damage.

Air Traffic

In preparing for development of Alpine, Nuiqsut residents and the Kuukpik Corporation perceived that industrial roads would result in the type of impacts that they wished most to avoid. Alpine was developed with a roadless design that was seen by many stakeholders as a significant evolution in reducing the footprint of development. Since the construction of those fields, disturbance from aircraft traffic has become the most commonly reported impact on subsistence activities (see Appendix K: Aircraft Disturbance Information).

Under Alternatives A and B, fixed-wing aircraft would typically utilize the existing CD1/Alpine Processing Facility airstrip and helicopters would base out of CD1/Alpine Processing Facility. Flights would support personnel and equipment transport required for construction and the start of drilling. Under Alternatives A and B, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel GMT2 road, once it is constructed. Helicopter landings, to support environmental studies and ice road cleanup, would occur from May through September.

Aircraft traffic results in unique and substantial impacts for Nuiqsut hunters. Impacts from infrastructure, road traffic, and drill pad noise, odors, and activity are impacts that hunters expect to occur near the actual site of development. These known impacts can be avoided if hunters choose to hunt elsewhere. In contrast, impacts from aircraft traffic are more difficult to forecast or avoid and can cause more acute stress and disruption to both animals and harvesters.

Section 4.6.7, “Acoustical Environment” discusses existing natural and man-made noise in the GMT2 Project area and potential impacts on noise-sensitive resources include wildlife, recreation, subsistence activities, and local residents and communities.

Aspects of air traffic disturbance considered in this analysis include:

- The frequency with which aircraft traffic is cited as a negative impact on subsistence uses on the North Slope.
- The unique nature of helicopter noise associated with human disturbance, and
- The increasing amount of helicopter traffic in key Nuiqsut subsistence use areas and the amounts estimated to result under GMT2 Alternative A.

The traditional knowledge, hunter observations, and scientific data that indicate that aircraft noise disturbs animals are discussed below under “Resource Availability.”

Residents across the North Slope perceive aircraft traffic as a substantial impact on subsistence hunting. The Iñupiat Community of the Arctic Slope (the umbrella Tribal government of the North Slope Iñupiat) passed a resolution in 2014 requesting assistance from the BLM and all agencies and entities that participate in aviation on the North Slope “to alleviate the high air traffic, low flying aircraft, airplanes, and helicopter use from diverting the caribou migrations to our villages.”

The community of Nuiqsut requested research on aircraft disturbance to corroborate this common complaint. An initial study collected summer sound- and noise-level data at 20 sites identified by the community near Nuiqsut, Fish Creek, and along the Colville River with a passive acoustic monitoring project in 2016 (Stinchcomb 2017). This research quantified human-caused noise attributable to aircraft activities at the sites:

> “A total of 7,465 aircraft noise events were captured over 21-84 days of recording during peak caribou harvest season. Aircraft activity reached 11-15 overflights per day near Nuiqsut and the surrounding industrial complex, approximately six times greater than activity levels in undeveloped areas. Aircraft sound disturbance decreased incrementally with distance from human development. Aircraft traffic around developed environments compared to local operations at U.S. airports where the average population is 908 times larger than that of Nuiqsut,” (Stinchcomb 2017 p. 57). (Research methods and a map showing study site locations are included in Appendix C).

At its 2016 Oil and Gas Forum, the North Slope Borough organized a session on “Reducing Impacts from North Slope Air Traffic.” The annual Oil and Gas Forum is a high-level, three-day event held in Anchorage and the air traffic forum was one of only eight breakout sessions. In his opening remarks in the session’s panel discussion, North Slope Borough Senior Wildlife Biologist Robert Suydam stated that aircraft conflicts with locals are a major concern in every village. Suydam noted that some people, out of extreme frustration, have threatened to shoot planes in the air, and the consequences could be tragic (North Slope Borough 2016).

North Slope subsistence users’ negative experiences with helicopter traffic are amplified by the widespread belief that their food security is impacted by it (see Appendix K: Aircraft Disturbance Information). Inupiaq hunters are not unique in their general reactions to helicopters, which are particularly annoying to many humans. Federal Aviation Administration research on this issue finds that helicopter noise is unique in several ways, including:

- It is more noticeable than other types of noise.
- It often creates more annoyance in humans than fixed-wing aircraft noise, even when it is not as loud as fixed-wing noise.
- Some people regularly exposed to helicopter noise develop a substantially heightened reaction to it (even when the noise or incidents do not increase, and even compared to louder fixed-wing aircraft noise).
- A subset of the population is very sensitive to low-frequency noises in the range often created by helicopters and they are quite bothered and disturbed by this noise almost as soon as it crosses the threshold of audibility.
- Community attitude is an important modifier of annoyance: when the party that generates the noise maintains very good community relations and convinces the community that everything possible that can be done is being done to reduce the noise, it creates less annoyance.
- People often feel that their privacy is being invaded when a helicopter flies low or hovers near them (Federal Aviation Administration 2004).

The Iñupiat Community of the Arctic Slope resolution, the summary of the 2016 North Slope Borough Oil and Gas Forum aviation disturbance session, and aviation recommendations made by the BLM NPR-A Subsistence Advisory Panel, are included as Appendix K in this document. These sources establish that adverse impacts from aviation are experienced by residents of all North Slope communities. Aircraft traffic has been cited as justification for opposing research activities in both Point Lay and Wainwright in recent years, and there is an annual summertime spike in complaints from several NSB communities. To attempt to avoid conflict, thorough community consultation and engagement of local liaisons is standard practice for many aviation-based BLM-permitted activities in Atqasuk and Wainwright.

The amount of aircraft activity in the Nuiqsut area far exceeds amounts in these other communities. The most commonly reported Alpine-related impact during the 8 years of the Nuiqsut Caribou Subsistence Monitoring Project is associated with helicopter traffic. In Years 7 and 8, reports of helicopter traffic impacts decreased, and some harvesters attributed the decrease in impacts to construction of the Spur and CD5 roads and resulting decrease in helicopter traffic associated with development. Helicopter traffic has actually increased, and residents continue to voice frustration that the roads have not eliminated air traffic in the Nuiqsut area. Harvesters have noted that helicopter and plane traffic tends to divert caribou or cause skittish behavior, resulting in reduced harvest opportunities (SRB&A 2009b). In comments and testimony on the GMT1 Supplemental EIS from North Slope residents, there was near-universal opposition to development options that include more airstrips due to the belief that roadless options result in increased air traffic[15].

The numbers of additional flights that will result from construction, drilling, and long-term operation of GMT2 under all alternatives are included in this document in Section 2.9, “Comparison of Alternatives,” Table 2.9-3.

Considering only new helicopter flights that would occur in the GMT2 area during drilling and operation of the GMT2 Project, Alternatives A or B would result in 90 new helicopter flights per year during 6 years of drilling and subsequent 23 years of post-drilling operations. Over the lifetime of the GMT2 Project, Alternatives A or B would result in 3,642 additional helicopter flights in the GMT2 area. See Section 4.6.8.8, “Subsistence,” for information on cumulative flight numbers and anticipated impacts to subsistence.

Discussion of the effects of air traffic on caribou is below under Resource Availability. Data available from North Slope hunters indicates that most hunters believe that helicopter traffic negatively affects caribou movement and harvest success (see Appendix K: Aircraft Disturbance Information and (Stinchcomb 2017). Nuiqsut hunters continue to harvest caribou in regular numbers, thus these impacts to date are not affecting overall harvest success. However, the effort required to harvest resources and the experience of subsistence hunting is acutely disturbed by helicopter traffic.

Assessing potential impacts of aircraft traffic associated with Alternatives A and B on subsistence uses in the Nuiqsut area, this analysis considers Inupiaq hunters’ traditional knowledge and observations, the consistent North Slope Borough-wide opposition to aircraft traffic during the caribou hunting season, research on aircraft noise effects on animals, and research on helicopter noise effects on humans. This body of evidence indicates that aircraft traffic disrupts subsistence hunting practices on several levels. The baseline amount of helicopter traffic in the Nuiqsut subsistence use area at present constitutes a significant impact to subsistence uses and the additional traffic resulting from Alternatives A or B would exacerbate this impact substantially.

Avoidance

Avoidance as a general impact is addressed above under the discussion of construction. Under Alternatives A and B, the avoidance effect may be decreased by facilitated access provided by the GMT2 road, discussed in detail above. Under Alternatives A and B, avoidance of the GMT2 Project area would likely to be exacerbated by helicopter traffic, discussed below. Development of GMT2 would result in permanent infrastructure in the subsistence use area, which has historically resulted in increased avoidance. As noted above, it has become more difficult for residents to avoid developed areas as industry has moved closer to Nuiqsut. Future research will reveal how harvesters respond when infrastructure is established closer to town or in their core hunting areas. Avoidance may be less of an option as fewer areas without development are present.

Although there are yearly exceptions, over the eight study years (2008–2015), the Nuiqsut Caribou Subsistence Monitoring Project has documented a general increase in the percentage of harvests in the area west of Nuiqsut and a general decrease in the percentage of harvests along the Nigliq Channel. This decrease in harvest success along the Nigliq Channel is likely caused by increased industrial activity in areas along the Nigliq Channel; the increase harvesting success west of the community likely reflects and a shift of residents’ hunting patterns to avoid developed areas where harvesting chances have decreased.

[15] In deliberations over GMT1 development and construction, many residents were under the impression that permanent roads would lead to an overall decrease in aircraft traffic than the area had previously experienced, not simply less of an increase than would result from roadless development.

From 2013-2015, 58-61 percent of respondents in the Nuiqsut Caribou Subsistence Monitoring Project indicated that they no longer hunted in or generally avoided certain areas that they previously used. The Alpine/Alpine Satellites areas were the most frequently mentioned for reasons related to development infrastructure, activities, safety concerns, and security restrictions. From 2013–2015, when asked about places they avoid, over one-quarter of Nuiqsut caribou harvesters interviewed identified the Alpine/Alpine Satellite areas (SRB&A 2017a). Other areas avoided due to development-related causes included Kuupaqullurak (near the new bridge crossing), Tamayayak River, and the Colville Delta in general (SRB&A 2016). In 2015, residents also reported avoiding Nanuq, Colville Delta, East channel, Nigliq Channel, East of Nigliq Channel, Oliktok Point, East of Colville Delta, West of Nuiqsut, and Tingmiagsigvik (Ublutuoch) due to development-related causes (SRB&A 2017a).

The Alaska Department of Fish and Game Division of Subsistence 2015 comprehensive survey in Nuiqsut found that similar percentages of hunters were reporting impacts (not necessarily avoidance). When asked if Alpine-related activities in 2014 made caribou hunting more difficult and when asked for any additional comments, 57 percent of the households indicated adverse effects on their household’s 2014 subsistence season attributed to surrounding development (Brown et al. 2016).

Residents have explained that they are wary of hunting in the presence of man-made structures, even when caribou are present, due to fear of damaging infrastructure or company property. Nuiqsut hunters also explained that they feel forced out from traditional areas: many no longer use traditional areas near Alpine and CD5 and expect that the same effect will happen with GMT1 and GMT2. Nuiqsut hunters also noted that they have had to move hunting activities upriver to avoid development and that their hunting area is shrinking due to development (SRB&A 2017a).

Contamination or perceived contamination associated with the proposed project also could result in avoidance by subsistence users. The availability of subsistence resources depends not only on their abundance in traditional use areas but on their health or quality (either actual or perceived). A main concern of North Slope subsistence users is the potential impacts on subsistence resources of contamination, including from air pollution, related to development (SRB&A 2009b). Contamination or perceived contamination of subsistence resources could result in reduced availability of subsistence resources considered healthy enough for consumption.

Resource Availability

Impacts from drilling and operations on resource availability would primarily result from displacement (localized deflection) of subsistence resources away from areas where they are normally harvested by Nuiqsut hunters. Impacts related to resource availability related to noise, traffic, and infrastructure have been frequently observed and reported by North Slope Borough harvesters (SRB&A 2009b). Disturbance to and localized displacement of resources (caribou, furbearers, and waterfowl) could result from project infrastructure (habitat loss), road and aircraft traffic, odors, other industrial activity (i.e., pad and road construction and well drilling), and from hunting pressure.

The geographic scope of the Terrestrial Mammals analysis contains the entire range of the Teshekpuk Caribou Herd (TCH). Impacts to subsistence are analyzed on a smaller scale and focus on the core subsistence use areas utilized by the community of Nuiqsut. This section discusses potential impacts in the core subsistence use areas. Caribou migratory patterns relevant to the GMT2 project involve both the Teshekpuk Lake Caribou Herd (TCH) and, to a lesser extent, the Central Arctic Caribou Herd (CAH). Specifically relevant are the portions of animals from the TCH and CAH that are accessible to hunters from Nuiqsut during caribou hunting seasons.

Annual TCH movement patterns are described in Section 3.3.4.1. In general, their distribution and movement patterns are driven by high quality forage availability prior to and during calving, and insect harassment during summer. At the onset of fall migration, some members of the TCH move east across the coastal plain and migrate south along the Colville River in the vicinity of Nuiqsut. The GMT2 Project area bisects this fall migration corridor. Some members of the TCH remain on the coastal plain through winter, which contributes to Nuiqsut hunters' understanding that caribou can usually be found west of the Project area in the vicinity of Fish Creek.

The proposed GMT1-GMT2 road is on the eastern edge of the TCH range. Five percent of GPS-collared caribou crossed the proposed GMT2 road alignment during fall migration between 2005 and 2017 (Lawhead et al. 2015, L. Parrett pers. comm.). Annual collared caribou crossing of the proposed GMT2 road alignment ranges from 0% to 31%, and crossing rates are highly variable, low overall but persistent over time. While use of the migration corridor directly west of the Colville River is low when considered relative to the herd's migratory movements as a whole, caribou utilizing migration routes on the eastern edge of the herd's range are most easily accessible by Nuiqsut subsistence hunters. Thus, the small portion of the herd that use this eastern migration route is particularly important to the community. Localized displacement is possible, especially initially, and Nuiqsut is vulnerable to changes in TCH distribution.

The GMT2 Project area is located at the western edge of the CAH range. The majority of the CAH remains east of the Colville River and calves primarily in the Colville East survey area (Map 3.3-10). CAH use of the NPR-A is low, the Alpine Satellite Development Plan Study Area does contain areas of high density utilization by the CAH, specifically during the mosquito and oestrid-fly seasons (Map 3.3-10). In 2014 more CAH animals remained in the eastern portion of the Alpine Satellite Development Plan Study Area during midsummer than in other years since 2004 (see § 3.3.3.1 for a detailed description of the range of both herds). The Colville River Delta is in the peripheral range of both the Teshekpuk and Central Arctic herds, and Nuiqsut harvesters are particularly vulnerable to changes in the distribution and/or behavior of caribou in these herds

Drilling of 48 wells on the GMT2 pad is anticipated to occur over 7 years (years 3-10). Drilling activities may result in reduced caribou and furbearer availability. Studies show that caribou, especially cows with calves, generally avoid drilling sites, and those caribou that do approach drilling sites spend less time feeding and lying down (NRS 2003). Wolverines and wolves are sensitive to noise impacts, and activity associated with the drilling and operations phase of GMT2 may reduce availability of these resources in the area of potential effect (see Section 4.3.4.1 *Terrestrial Mammals)*.

Deflection of Resources by Loss of Habitat

Loss, alteration, and disturbance of habitat (including indirect habitat impacts outside the gravel footprint due to physical changes caused by gravel spray or dust deposition, snow drifting and piling, thermokarst, and altered hydrology) would result in reduced local availability of caribou and furbearers. A detailed discussion of these impacts is in Section 4.3.4.1 (Environmental Consequences: Terrestrial Mammals). Habitat loss will not substantially reduce availability of caribou for subsistence harvest in the area of potential effect.

Deflection of Resources by Infrastructure and Road and Air Traffic

A primary concern about the GMT2 road is that both the height of the road and the industrial traffic on it will deflect caribou from their local migration paths (BLM 2003, SRB&A 2017a). The analysis of potential impacts to caribou (§ 4.3.4.1) finds that road traffic supporting the GMT2 Project would most likely affect caribou of the TCH and possibly some animals from the CAH during the fall migration period because the GMT2 road extends about 14 miles into the edge of a high-use fall migration corridor for the TCH. This area is the eastern periphery of normal caribou migration paths in the eastern periphery of the TCH. In addition to traffic, the GMT2 road and drill site will present physical obstacles that may deflect some caribou. Gravel roads 4 feet or more in height create a visual barrier that can lead to delay or deflection of caribou movements (Wolfe et al. 2000). Gravel roads associated with the proposed project would be a minimum of 5-feet thick (height above surrounding grade). Greater deflection of caribou would be anticipated during periods of migration that coincide with high use.

Local hunters frequently report deflection of caribou from industrial roads. In 2014, one respondent for the Stephen R. Braund and Associates Nuiqsut Caribou Subsistence Monitoring Project noted that traffic on the CD5 road had disrupted caribou migration paths (2016). In 2015, three project respondents noted that traffic on that road continued to disrupt caribou migration (SRB&A 2017a). The GMT2 road (and traffic and pipeline) could act as a barrier or deterrent to caribou as they travel through the area (from the west to areas closer to town). If the road has a tendency to prevent caribou from coming closer to town, then hunters who are not able to—or prefer not to—use the road to hunt from will be at a distinct disadvantage compared to hunters who have vehicles and can use the road.

Much of the general research on aircraft impacts on wildlife focuses on low-level military jets. However, the scientific evidence indicates that the short-term effects of aircraft on caribou behavior can negatively affect hunting success and harvest (Davis et al. 1985; Harrington and Veitch 1991; Luick et al. 1994; Maier et al. 1998; Wolfe et al. 2000; Vistnes and Nellemann 2007). A 2000 publication by Wolfe et al. reported that caribou response to aircraft is variable depending on the season, degree of habituation, type of aircraft, altitude, airspeed, weather conditions, frequency of overflights, and the sex and age composition of the caribou groups. The reaction was strongest during calving, calves being the most reactive, habituated caribou reacted less often, and caribou were more responsive to helicopter than to small fixed-wing overflights only at low (<100 m above ground level) altitudes.

Fullman et al. (2017) investigated the movement patterns of caribou in response to non-local sport hunting and environmental features in Noatak National Preserve, Alaska: a study initiated by a hypothesis that aircraft disturbance and associated hunting activity influenced caribou movements and migration. Local hunters in the area primarily access the area by boat while sport hunters typically use small, commercially operated transporter aircraft. The results of the study showed that caribou movements did not appear to be influenced by aircraft borne hunters at the movement scale they were able to address (caribou collar location every 8 hours), and that migratory movements were influenced more by environmental features. This finding tend to corroborate previous findings that responses to aircraft tend to be short-lived. However, findings from this research do not refute the potential that those short-lived responses can have impacts on subsistence hunters.

The NPR-A Working Group’s General Principles for Development of Infrastructure in Northern Alaska (2014) notes, “Local and traditional knowledge and direct experience tell us that aircraft pose one of the greatest potential negative impacts to the success of subsistence hunters and that such flights can also impact caribou movements over the long term.” A thorough discussion of the impacts of aviation on caribou movement and hunters, based on research in Nuiqsut, is included in a recent University of Alaska thesis (Stinchcomb 2017: Social-Ecological Soundscapes: Examining Aircraft-Harvester-Caribou Conflict in Arctic Alaska). Methods and study sites of that research are included in Appendix C.

Data on caribou hunting activities collected during the Nuiqsut Caribou Subsistence Monitoring Project (SRB&A 2010a, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a) display a shift in timing of caribou hunting activities in the GMT2 Project area: a smaller percent of caribou use areas in the project area are accessed during the winter months and a slightly higher percentage (30 percent) are accessed in September. Aircraft activity in the larger GMT2 project study area could result in skittish and escapist behavior in caribou that makes harvesting them more difficult. Increased helicopter activity in overland areas west of town is expected to have a particularly large effect on harvesting activities because more hunters are harvesting caribou in that area during the helicopter season than have in the past.

Drilling noise, industrial and human activity on the pad, and road and aircraft traffic in the GMT2 area are expected to exacerbate any deflection of resources that could result from the physical obstacles posed by the road and pad.

Deflection of Caribou by Hunting Pressure

Caribou deflection may also occur because of increased hunter pressure from hunters whose ability to access the GMT2 project area, particularly overland areas west of town, would be facilitated by the road. Frequently cited Inupiaq traditional knowledge is that harvest or disturbance of lead animals during migration can divert or delay an entire herd, although the Iñupiat have strong cultural traditions and success discouraging this. Hunters who would use the road would likely have greater success than those who would not, particularly during fall because the road extends into the edge of the Teshekpuk Herd’s high-use fall migration corridor. Using the road would likely allow those hunters to reach the herd earlier, perhaps before other members travel further eastward and are accessible to river-based hunters.

Increased hunting pressure could exacerbate the localized deflection of animals that may already occur from drilling noise, aircraft traffic, the road itself, and industrial traffic and activities on the road and pad. Particularly because the Teshekpuk Herd does not need to cross the road to migrate to other areas, animals from the herd would likely be deflected to routes further west and south and away from areas closer to the Colville River and Nuiqsut, where they are traditionally harvested. Hunters who would not use the road would therefore be at a distinct disadvantage; this would be particularly true for hunters who do not own four-wheelers and who largely hunt caribou in the fall along rivers by boat. In effect, the road may create a situation where hunters feel forced to use it to ensure adequate harvests and, if they are not able to use it, they may be waiting for animals to migrate towards the Colville River with a road, traffic, and hunters on four-wheelers west of them potentially deflecting or delaying those animals.

Deflection of Furbearers

Wolf and wolverine use area data show high overlapping use areas throughout the GMT2 area. One hundred percent of wolf and wolverine hunters reported use areas in the project area, more than any other resource. Residents have indicated that furbearers such as wolf and wolverine are particularly sensitive to development activities and noise (SRB&A 2009b, 2010a). Deflection of furbearers from the GMT2 area would likely cause hunters to travel farther looking for these resources.

As noted above, hunting for wolves and wolverines is an important cultural and economic activity for Nuiqsut and one of the few subsistence activities feasible in the wintertime. Residents of Nuiqsut have pointed out the particular importance of the GMT2 area (then known as CD7) for wolf and wolverine hunting since permitting for the ASDP began (BLM 2003).

Deflection of furbearers from the GMT2 area, or direct overlap of normal trap lines, will cause hunters and trappers to travel farther looking for these resources. Because these activities occur during winter, traveling further in extreme cold presents additional risks for these subsistence users.

Community Participation

The potential decrease in or substantially altered nature of use of the GMT2 Project study area for subsistence purposes may reduce the opportunity to transmit traditional knowledge to younger generations about that traditional use area. The project could also alter hunting methods, not just use areas. If younger hunters become more accustomed to roadside hunting and less accustomed to longer trips on the land, this could potentially affect the Nuiqsut Cultural Landscape (Brown 1979) due to reduced use of an area and subsequent loss of knowledge of that area.

Alternative C: Drilling and Operations Phases

Alternative C is the limited access, year-round drilling GMT2 alternative under consideration. Under Alternative C, there would be pipelines but no gravel road connecting the GMT2 drill pad to GMT1 and the Alpine Field. Access to the GMT2 Project would be by aircraft and, during the winter, by annually constructed ice roads.

Alternative C would have a larger gravel footprint because a 47.3-acre airstrip and apron would be required. Alternative C would also require an occupied structure pad for material storage and personnel housing. A new mud plant and bulk cement facility would be required for year-round drilling because the existing plant at CD1/Alpine Processing Facility must remain in place to service drilling operations at the other satellites. On-site wastewater and solid waste treatment or management would be required in addition to numerous additional facilities (see Section 2.7.3).

This alternative would result in greater amounts of water withdrawn to construct the ice roads (691 million gallons over the life of the project as compared to 395 million gallons under Alternative A). Alternative C would also increase the amount of heavy industrial traffic during the winter.

User Access and Avoidance

After construction, to access the drill site by vehicle, a 7.0-mile ice road would be constructed each year from the GMT1 drill pad to GMT2. Hunter use patterns in this area during the winter months could be impacted by disturbance and displacement of resources during construction of the ice roads for operation. When drilling begins, ongoing vehicle traffic along the ice roads from GMT1 to GMT2 would be at levels greatly reduced from the two previous construction years. However, lack of permanent (year-round) gravel road access would increase the amount of industry traffic on the ice road needed to support drilling and operations, and this concentrated industrial traffic could deter subsistence uses.

Under Alternative C, there would be no impacts to access from a high gravel road that is difficult to cross for subsistence users traveling overland by snowmachine or four-wheeler. There would be no year-round facilitated access via road vehicle to the surrounding subsistence use area because there would be no permanent road. If there were few barriers to using the ice road, residents would potentially benefit from use of the annual winter ice road to facilitate access to the area. Physical barriers to access under Alternative C would be limited to any restrictions on use of the ice road, areas where the pipeline is drifted with snow, the larger pad(s) and airstrip and the corresponding larger safety area (approximately 920 acres) where access and discharge of firearms are prohibited by industry safety guidelines.

Air Traffic

As described above, air traffic is the most frequently cited impact of development by Nuiqsut hunters. Alternative C would result in increased air traffic in the GMT2 Project area, and most importantly would result in larger, fixed-wing flights taking off and landing at GMT2 (whereas under Alternatives A and B all additional fixed-wing flights would continue to land at and take off from Alpine). A complete table of flight numbers is provided in Appendix B. Estimated flight numbers for Alternative C are:

- During drilling Years 4–10 and 23 years of operation, 143 new helicopter flights per year at GMT2
- During drilling Years 4–10, 1,210 new fixed-wing flights at GMT2
- During 23 years of operation, 270 new fixed-wing flights at GMT2

Subsistence users would experience increased levels of disturbance from air traffic during operation of GMT2 facilities under this alternative as compared to Alternatives A and B.

Avoidance

The presence of the pipeline, the larger pad(s), the new airstrip, larger restricted safety area, increased aircraft traffic and increased human presence at the GMT2 site under Alternative C would likely contribute to hunter avoidance of the area. Factors that may decrease avoidance compared to Alternatives

A and B include the lack of road traffic in the summer and fall and the associated road dust and human presence that hunters may prefer to avoid. Hunter avoidance may result in lost harvest opportunities and changing use patterns.

Resource Availability

Under Alternative C, there would be fewer physical barriers, particularly the high, linear infrastructure presented by a permanent gravel road, inhibiting caribou movement through the area. There would be increased aircraft traffic, which has the potential to disturb animal movements at least on a localized scale that makes harvesting them more difficult. On the seasonal ice roads, vehicle traffic disturbances could occur to wildlife and subsistence resources. Activity levels during winter use are greater than Alternatives A and B, and may be more distracting to Nuiqsut hunters who may continue to access the area using traditional overland methods, such as snowmachines, during the winter.

Community Participation

The potential decrease in or substantially altered nature of use of the GMT2 Project study area for subsistence purposes may reduce the opportunity to transmit traditional knowledge to younger generations about that traditional use area.

Alternative D: No Action (Construction, Drilling, and Operations)

Under Alternative D, the no-action alternative, the GMT2 Project and associated infrastructure and activities would not be permitted. Therefore, no additional adverse effects or impacts to subsistence would be anticipated to occur under Alternative D.

Lease Stipulations and Best Management Practices

Every record of decision for an NPR-A Integrated Activity Plan and/or EIS released since 1998 has established that exploration, development, and production of oil and gas resources will be conducted in a manner that prevents unreasonable conflicts between industry and subsistence activities (BLM 1998, 2004, 2008, 2013, 2015). While recognizing that oil development has had and will continue to have impacts, BLM’s objectives are to protect subsistence uses and access to traditional subsistence hunting and fishing areas and minimize the impact of oil and gas activities on the air, land, water, fish, and wildlife.

The magnitude of many of the impacts discussed in this section would likely be reduced through the continued application of previously established mitigation measures and the implementation of new mitigation measures. Best management practices and lease stipulations in the NPR-A seek to protect specific resources and subsistence practices with approaches that include:

- Establishing spatial buffer zones around facilities and infrastructure.
- Scheduling disruptive activities when there is the least potential for conflict with other users.
- Including community residents in project planning.
- Monitoring impacts on subsistence resources.
- Making efforts to minimize the interference of oil and gas exploration and development activities and structures with subsistence resources and users.

The BLM recognizes that numerous impacts to subsistence are unavoidable and adverse: they are impacts that persist despite traditional mitigation measures. Helicopter traffic is the most commonly reported disturbance to subsistence in many surveys. However, BLM specialists have confirmed through computer-assisted analysis of public meeting transcripts (see § 4.4.2), interviews, government-to-government consultation with the Native Village of Nuiqsut tribal council, and literature reviews that the primary unavoidable adverse impact to subsistence for residents of Nuiqsut is the loss of traditionally used subsistence areas.

Stipulations and Best Management Practices on Subsistence Species

Many of the protective measures established in previous NPR-A EIS records of decision are intended to minimize the surface impacts of oil and gas activities and to otherwise ensure the continued health of wildlife and subsistence resources. For a complete description of the measures under Alternative A that are designed to mitigate impacts to fish, see Section 4.3.2, “Fish.” Measures designed to protect birds are described in Section 4.3.3, “Birds,” and measures designed to protect marine mammals are described in Section 4.3.4, “Mammals.” Measures that are particularly relevant to subsistence species include:

- A-4 minimizes the impacts of contaminants on fish, wildlife, and the environment.
- A-11 mandates the design and implementation of a study to monitor contaminants in subsistence foods for all permanent development.
- Measures that would minimize disruption of caribou in the GMT2 Project study area include E-7, which dictates pipeline height at a minimum of 7 feet and a minimum distance of 500 feet between roads and pipelines and K-6, which establishes a buffer zone within 1 mile of the coast.
- To protect fish habitat, B-1 and B-2 regulate water withdrawals and C-2 to C-4 protect streams and prevent additional freeze down of deep-water pools.
- K-1 establishes a 3-mile setback along the lower Fish Creek, a 0.5-mile setback from Judy Creek, and a 0.5-mile setback from the Tinmiaqsigvik (Ublutuoch) River.
- E-10 minimizes the chances that migrating waterfowl will strike oil and gas facilities during low light conditions.
- K-2 prohibits permanent infrastructure within 0.25 miles of deep water lakes.

Stipulations and Best Management Practices on Avoiding Conflict

Many protective measures are explicitly aimed at minimizing conflicts between subsistence users and oil and gas activities. Setbacks for development on subsistence rivers are an important measure to protect many traditionally used areas. These stipulations are intended to prohibit permanent oil and gas facilities (e.g., gravel pads, roads, and airstrips and pipelines) within the buffer zone. BMP H-2 is intended to prevent unreasonable conflict between subsistence activities and seismic exploration by mandating that an applicant for seismic exploration shall notify local search and rescue operations of current and recent seismic surveys and shall notify in writing all potentially affected cabin and camp users. BMP I-1 requires lessees to provide cultural orientation for all oil and gas workers to minimize cultural and resource conflicts with local inhabitants. Lease stipulation K-6, mentioned above as a measure to reduce impacts to caribou, is also designed to reduce conflict by implementing a setback of 1 mile from the coastline and by mandating the use of previously occupied sites for industrial development whenever possible.

A measure that is particularly relevant to subsistence harvest patterns involved with the GMT2 Project is BMP E-1, which requires that all roads be designed to protect subsistence use and access to traditional hunting and fishing areas. Several subsistence users experienced significant access issues with the CD5 road in recent years because the road was too high and too steep for hunters to cross with snowmachines or all-terrain vehicles. BMP E-1 is a particularly significant measure for the GMT2 Project because the road route (in Alternatives A and B) will transect several main travel routes between Nuiqsut and areas to the northwest, and subsistence access will have to be assured. One way that access would be provided under those alternatives would be via the GMT1–GMT2 Access Road itself (using the Kuukpik Spur Road to gain access to the CD-5 and GMT1 roads). However, the design of the road will have to allow for access by subsistence users who need to cross it or need to descend from and ascend onto the road. The construction of ramps concurrent with the construction of the road (under Alternatives A and B) should minimize this problem initially. However, the ramps will concentrate off-road vehicle use because they will be the only way on and off the elevated roadway. While snowmachine users may not experience problems during the winter, repeated passes by four wheelers during the spring snow thaw and in the summer months would likely result in trail braiding, breaking the tundra mat and exposing the frozen soil with potential localized permafrost thawing and thermokarsting near the ramps, making the area impassible. The four wheeler trails spoking away from the ramp areas would be susceptible to trail braiding from repeated vehicle passes until far enough away from the access ramp to disperse four wheeler use cross-country. Over time, hardening to allow continued use for subsistence access around the access ramps would possibly need to be considered.

Related measures that reduce conflict over subsistence uses and access are E-2, E-3, E-6, and E-8, which maintain subsistence use and access to traditional subsistence fishing sites. H-3 prohibits hunting and trapping by lessee or permittee employees and contractors while those individuals are on work status.

Aircraft Traffic Mitigations

As described above and in Appendix K, disturbance from aircraft is one of the greatest impacts to subsistence users. The numbers of flights anticipated for GMT2 show that Alternatives A and B will result in a greater number of flights than are currently occurring in the area. Because disturbance from aircraft will increase under all GMT2 alternatives and cumulatively from other activities in the area, BLM anticipates that concern over the inability to significantly reduce the number of flights will increase. BLM, industry, and other permitted aviation users must therefore increase efforts to reduce the number of flights needed and the disturbance those flights cause.

By mandating minimum flight altitudes for industry and research, BMP F-1 mitigates the effects the low-flying aircraft on wildlife. This is effective when practicable and when obeyed; however, enforcement is not feasible. Furthermore, the BLM has no authority over private aircraft or aircraft used by projects that do not have BLM permits; these private aircraft have frequently been the source of reported impacts by hunters (SRB&A 2010b, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a). BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use in the NPR-A; therefore, the BLM is not able to effectively mitigate the wider problem. In the Nuiqsut area, a large percentage of flights are accounted for by ConocoPhillips, but the flights are necessary to meet required lease stipulations (e.g., ecological monitoring). The mitigation measures that BLM has implemented in the past are not experienced as completely effective for the community of Nuiqsut because the aviation impacts are cumulative: there are comparable levels of aircraft traffic around Nuiqsut on non-federally managed land and on federally managed land where increasing development exploration activities have consistently required more aircraft traffic.

As the GMT2 applicant and primary oil development company in the Nuiqsut area, ConocoPhillips management has made substantial efforts to mitigate these impacts by coordinating some helicopter-based studies with other regional oil development companies, by establishing dedicated ice road cleanup crews and modifying the ice road cleanup program to reduce helicopter flights, by implementing a daily call in service that allows people to listen to updates on aircraft activity, and by providing a weekly summary of helicopter activity that they share with stakeholders. The effectiveness of these measures and other new aviation mitigation measures will continue to be evaluated throughout the life of the project.

NPR-A Subsistence Advisory Panel

BMP H-1, which established the NPR-A Subsistence Advisory Panel in 1998, is designed to prevent unreasonable conflicts between subsistence uses and oil and gas development by requiring that, before submitting an application to BLM, a prospective lessee/permittee consult directly with affected communities to discuss the timing, location, and methods of their proposed activities. ConocoPhillips must document consultation efforts as part of the plan of operation and must submit the plan of operations to the NPR-A Subsistence Advisory Panel for review and comment. ConocoPhillips must submit these plans sufficiently early to provide time for review by Subsistence Advisory Panel members and those members' Native Tribal Governments and, if necessary, for government-to-government consultation between BLM and the Tribal Government. Among other items, the operations plan must describe methods the applicant will use to monitor the effects of the activity on subsistence and must describe how the applicant will keep potentially affected individuals and communities up-to-date on the activities and locations of possible conflicts with subsistence users.

Subsistence Advisory Panel meetings are public and are held in all NPR-A communities on a rotating basis. The Subsistence Advisory Panel meetings ensure that BLM management maintains regular communication and outreach with residents and that residents are notified of upcoming activities in their areas. Management is updated on any new concerns Subsistence Advisory Panel members and the public have regarding development. The BLM maintains a spreadsheet of the recommendations that the Subsistence Advisory Panel has made throughout the years and BLM responses to those recommendations. BLM has implemented nearly all the recommendations made by the Subsistence Advisory Panel that it had the authority to implement. In 2010, the Subsistence Advisory Panel expanded its purview to include reviewing science and research-based permitted projects. Since 2011, the BLM produces a spreadsheet of each permitted project in the NPR-A in a calendar year for distribution to the Subsistence Advisory Panel and interested public. The BLM produces transcripts of each meeting and a summary of the presentations and concerns. The summaries (along with notices for meetings) are distributed to a broad email list of about 250 North Slope residents. In summary, the Subsistence Advisory Panel is effective at maintaining a minimum of dialogue, at assuring that many residents are aware of activities that are being permitted, and at familiarizing Subsistence Advisory Panel representatives with the NEPA process.

The effectiveness of the Subsistence Advisory Panel is limited by several factors that are shared by most similar subsistence advisory boards, which have a long history on the North Slope. Residents have a hard time keeping the numerous boards straight and some tend to lump all of them (whether state, federal, or regional) together. Some residents treat all public hearings as an opportunity to voice a wide range of concerns, whether or not they are project-specific or matters for which the agency holding the meeting is responsible (RFSUNY 1984, BLM SAP 2016). Frustration is a persistent issue because a large percentage of the long-standing recommendations and concerns that the Subsistence Advisory Panel and residents have are matters that BLM has no authority on which to act.

BLM was able to respond effectively to a long-standing community request by establishing a BLM Arctic District Office Utqiagvik (formerly Barrow) Field Station staffed by a local Inupiaq subsistence hunter. This position (natural resource specialist) is currently held by Roy Nageak. Nageak is able to communicate local concerns to BLM management and explain land management decisions and ongoing development permitting projects to local residents. Nageak provides translation services at BLM North Slope meetings and has invaluable knowledge of the land and resources of the North Slope. He has relations with most residents of the North Slope and has served on numerous government and subsistence panels throughout his career.

4.4.5.6 Mitigation

Existing Mitigation Fund Programs

In determining whether it is appropriate to consider compensatory mitigation for any impacts that are expected to persist after the adoption of measures that are aimed at avoiding or reducing such impacts, BLM will take into account other compensatory mitigation programs that are applicable to the project and project area, including the U.S. Army Corps of Engineers' compensatory mitigation program under section 404 of the Clean Water Act and the State of Alaska's NPR-A Impact Mitigation Grant Program funded from the State of Alaska's 50 percent share of Federal oil and gas revenues from NPR-A pursuant to 42 U.S.C.§6506a(l). Under the NPR-A Impact Mitigation Grant Program, the State uses its share of NPR-A revenues to grant funds to communities in or near NPR-A to pay for projects that address residual impacts of oil and gas development in NPR-A to their communities per AS 37.05.530. To date, the State has awarded over $140 million in funding for such projects. This amount is anticipated to increase substantially going forward as production of Federal oil comes online.

State of Alaska NPR-A Impact Mitigation Program

NPR-A revenues are paid to the U.S. Treasury, which then pays 50 percent of the revenues to the State of Alaska for the NPR-A Impact Mitigation Fund, managed by the State of Alaska Department of Commerce, Community and Economic Development. The NPR-A Impact Mitigation Grant Program is managed under Alaska Statute AS 37.05.530 which requires annual reports to the Alaska Legislature, including the history of the program and a list of all the grantees, projects, and amounts granted by the State since the program began receiving money in fiscal year 1983. The Federal Government has no ability to influence the management of the fund or State-run grant program. Activities that are eligible to receive NPR-A grant funding from the State are limited to three categories: (1) planning; (2) construction, maintenance, and operation of essential public facilities; and (3) other necessary public services provided by a municipality. Many subsistence projects are funded as "planning" or as "other necessary public services." Fund levels change every year because they are based on lease sales and production royalties.

Priority is given to those communities most directly or severely impacted by oil and gas development. This has historically meant those communities located within the NPR-A (Utqiagvik, Atqasuk, Nuiqsut, and Wainwright). Because the North Slope Borough is an umbrella organization that has received and distributed a significant percentage of this grant money, all the North Slope Borough communities benefit, including Kaktovik, Point Lay, and Point Hope. Tribal governments are not municipalities and are not qualified to submit applications to the State of Alaska-administered NPR-A Impact Mitigation Grant Program.

The State of Alaska Division of Community and Regional Affairs has an application selection committee made up of three people familiar with issues in NPR-A communities. This committee scores and ranks the proposals, and provides that list to its commissioner for a determination on which projects to fund.

Examples of Nuiqsut projects funded by NPR-A impact mitigation funds include:

- Natural gas distribution system in Nuiqsut
- Renovation of community centers
- Gravel acquisition for Colville River Access Road
- Piuraagvik Recreation Center addition
- Village power plants/electrical distribution
- Police officers in villages
- Upgrades to search and rescue equipment

As described in Section 3.4.4, "Economy," the City of Nuiqsut and the City of Atqasuk have experienced problems maintaining compliance with State of Alaska eligibility requirements for the NPR-A Impact Mitigation Fund. Neither of these communities have had their fiscal year 2018 grant proposals recommended for funding by the State of Alaska. City of Nuiqsut administration officials believe that the

City could remain eligible and secure more mitigation grant funds for the community if proposals to fund accounting work and grant writing were accepted by the State's selection committee.

ConocoPhillips estimates that, over the lifetimes of the two projects, royalties from GMT1 and GMT2 (if GMT2 is permitted and sanctioned) will result in an estimated $350 million available to the State of Alaska NPR-A Impact Mitigation Fund (ConocoPhillips 2016).

ConocoPhillips Subsistence Mitigation

As part of the North Slope Borough's permit for ConocoPhillips's development of CD4, ConocoPhillips established a fund to mitigate subsistence impacts on local residents. The fund was managed by the North Slope Borough with assistance from representatives of the City of Nuiqsut, the Native Village of Nuiqsut, and the Kuukpik Corporation. The North Slope Borough CD4 permit required annual payments of $50,000 for 10 years and the last payment was made in 2013 (ConocoPhillips 2014).

In 2008, as part of an agreement with the Kuukpik Corporation "to progress NPR-A activities including CD5 and GMT1," ConocoPhillips agreed to make annual payments to a mitigation fund administered by a joint committee of the City of Nuiqsut, the Native Village of Nuiqsut, and Kuukpik Corporation of $50,000 per year per Alpine satellite pad in the NPR-A and for the Nigliq Channel bridge (ConocoPhillips 2014). These funds are distributed in the form of fuel vouchers and household payments. ConocoPhillips reports that from 2017–2050, Kuukpik Subsistence Mitigation payments (including payments for CD5) will total $10.5 million (ConocoPhillips 2016).

GMT1 Compensatory Mitigation Fund

With the 2015 record of decision permitting the GMT1 Project, the BLM required the permittee to contribute $8 million to BLM to establish a compensatory mitigation fund to offset identified impacts. As established by the measure, ConocoPhillips contributed $1 million within 60 days of the record of decision being issued for the development and implementation of a landscape-level Regional Mitigation Strategy for the Northeastern NPR-A Region. Two additional contributions totaling $7 million are being contributed to the fund itself ($3.5 million within 30 days after installation of first gravel and $3.5 million within 30 days of completion of road, pad, and pipeline). The Nuiqsut Trilateral Committee on GMT1 compensatory mitigation funds finalized an implementation plan for the first $3.5 million in early 2017 and ConocoPhillips contributed the first installment in February 2017. An implementation plan to decide on uses for the second installment is forthcoming. Because the mitigation actions established by the Nuiqsut Trilateral Committee on GMT1 funds have not yet been put in place, it is not possible to evaluate their effectiveness at mitigating impacts at this time.

Other Mitigation

ConocoPhillips also pays property taxes to the North Slope Borough, which are used by the Borough to finance schools, public services, training programs, planning, and wildlife management. Based on the approach described in Section 4.4.4, "Economy," it is estimated that the proposed GMT2 Project would generate total property tax revenue to the North Slope Borough of $209 million (in 2015 dollars) through 2050.

Both Kuukpik Corporation and Arctic Slope Regional Corporation would benefit economically from development of GMT2, and these earnings could result in continued or larger dividends paid to shareholders. As a regional Native Corporation, Arctic Slope Regional Corporation must, according to sections 7i and 7j of Alaska Native Claims Settlement Act, share a portion of the royalties it receives from the petroleum produced from lands where it has subsurface ownership with other Alaska Native Claims Settlement Act regional Native corporations. Thus, development of GMT2 would benefit all Alaska Natives to the extent that they benefit from financial earnings of their regional Alaska Native Claims Settlement Act corporations.

Suggested Mitigation Measures which BLM Will Not Implement for GMT2

Federal agencies are not generally required to adopt mitigation. The standard BLM must follow regarding what new potential mitigation measures must be considered and evaluated in an EIS is found in the BLM NEPA Handbook Q&A, number 19(b). This standard provides that all relevant and reasonable mitigation measures that could improve the project should be identified if they are within jurisdiction of the agency. If BLM finds that a potential mitigation measure is not within BLM's jurisdiction to implement, or should not be implemented for some other reason, the measure would not be adopted in the record of decision that is issued after the final supplemental EIS. The record of decision will contain a section in its appendix for "Potential Mitigation Measures Not Adopted," which will document BLM's rationale for not adopting them. The primary mitigation measure supported by Nuiqsut hunters is to lower the height of the GMT2 Access Road, but the design of the road is required to support industrial traffic with the smallest practicable footprint, which results in a high, steep-sided road.

Another long-standing subsistence concern that BLM has limited or no authority to act on is allowing people who have Native allotments in areas impacted by oil development to select new allotments in other areas. Such an action would require an Act of Congress; thus, BLM has no jurisdiction to implement such a program.

Potential Mitigation Measures

In addition to the lease stipulations and best management practices that apply to all oil and gas activities in the NPR-A established by the NPR-A Integrated Activity Plan/EIS (BLM 2013), an extensive set of subsistence mitigation measures for the GMT1 project was established with the 2015 GMT1 Record of Decision. Similar mitigation measures are proposed for GMT2 and additional potential mitigation measures will be developed through close consultation with stakeholders.

Potential Mitigation Measure 1: GMT2 Road Right of Access Agreement

Objective: Ensure that residents will have the right to use the GMT2 Access Road throughout the life of the project and ensure that residents are aware of the policies regarding use of project-associated roads for subsistence activities to reduce misunderstandings and ensure the safety of project workers and local residents using the roads.

Requirement/Standard: The permittee will produce a clear and legally binding right of access agreement that will provide the community of Nuiqsut with concise policies regarding use of the roads associated with the project and hunting prohibitions, if any, along the roads and near project components. Permittee will insure that this agreement is disseminated throughout the community. The agreement should also be provided to BLM for their records.

Potential Benefits and Residual/Unavoidable Impacts: Clear policies regarding use of project roads for subsistence activities will likely reduce misunderstandings about whether and to what extent local harvesters can use and/or hunt from the road. Residents will be more likely to use project roads if they are well informed about company policies and security restrictions.

Potential Mitigation Measure 2: Suspend Non-essential Helicopter Traffic during Peak Caribou Hunting Season

Objective: To reduce the impacts of helicopter traffic on Nuiqsut caribou hunters.

Requirement/Standard: Via ongoing consultation with the City of Nuiqsut, the North Slope Borough Department of Planning, Native Village of Nuiqsut, Kuukpik Corporation, and the Kuukpik Subsistence Oversight Panel, Inc., the BLM will establish an approximately 1-month-long period during peak caribou hunting when non-essential helicopter flights will be suspended within a predetermined distance of rivers that have been documented as caribou subsistence use areas, or limit helicopter traffic during this time to established flyways. The consultation results should be documented, distributed to BLM and other stakeholders, and clearly identify actions to be implemented based on the consultation.

- Ongoing (multi-year, already planned) scientific/environmental studies that depend on access to study sites that are already planned could continue if there is no alternative access to sites.
- Suspension dates can be revised every 3 years upon review of peak caribou season.

Potential Benefits and Residual/Unavoidable Impacts: Reducing helicopter traffic or limiting the geographic area affected by helicopter traffic would reduce the incidence of conflicts between GMT2-related helicopter traffic and Nuiqsut subsistence activities. However, other operators on the North Slope may continue to fly during the suspension period.

Potential Mitigation Measure 3: Consultation Regarding Aircraft Communication Protocols

Objective: Ensure that current communication protocols related to helicopter and fixed-wing air traffic by the permittee are adequate in addressing Nuiqsut concerns about the impacts of air traffic on their hunting activities.

Requirement/Standard: In consultation with local hunters and local organizations, the permittee will continue to facilitate, improve, and expand communication protocols to inform subsistence users of daily flight patterns and identify potential conflict areas during peak hunting times. This consultation should include efforts to advertise these communication protocols within the community so that Nuiqsut subsistence harvesters are aware of them and confirmation that existing minimum altitude requirements are adequate. The consultation results should be documented, distributed to BLM and other stakeholders, and clearly identify actions to be implemented based on the consultation.

Potential Benefits and Residual/Unavoidable Impacts: Strong communication protocols with the community of Nuiqsut regarding the timing, altitude, and location of air traffic should reduce the frequency of these impacts on subsistence users. However, such protocols will not remove impacts of air traffic altogether.

Potential Mitigation Measure 4: Aircraft Monitoring Data Requirements

Objective: Monitor aircraft patterns and the impacts of aircraft associated with the GMT2 Project on subsistence hunting activities in the project area.

Requirement/Standard: Permittee will be responsible for funding and providing data to BLM for a monitoring study of aircraft flight patterns and impacts related to aircraft traffic on subsistence activities. The permittee will provide the BLM with data from the monitoring study in a manner that facilitates meaningful analysis of activities and impacts.

The permittee will provide BLM with clear and detailed quarterly flight reports that include the timing, flight path, and purpose of each flight in the project area.

The reports will highlight all flights that represent deviations from BLM’s best management practices and include explanations for any deviations.

The permittee will provide data related to altitude of flights patterns. Noise data associated with altitudes will be cross-referenced to determine minimum altitudes for flights in the project area, to reduce impacts on wildlife and subsistence activities.

The aircraft monitoring plan will differentiate to the greatest degree practicable between the various purposes of flights (i.e., flights that are conducted for exploratory drilling operations, offshore pipeline baseline studies, and other scientific research broken down by species and researcher).

Reports will include statistical analyses on flight patterns, including how often actual flights and patterns deviate from the flight plan currently submitted to BLM under existing BMP F-1.

Monitoring undertaken to provide baseline data or to monitor effectiveness of mitigation measures must meet the approval of the authorized officer. As the authorized officer deems it appropriate, the data collection process and product shall be consistent with standards established by BLM's Assessment, Inventory, and Monitoring Program.

Background, Potential Benefits, and Residual/Unavoidable Impacts: Improved monitoring and analysis of flights, flight purposes, and other flight patterns will assist BLM to estimate the impacts of proposed actions or to formulate appropriate plans to reduce impacts. A monitoring study would provide a better understanding of how many aircraft are being used for different purposes, whether and how industry could reduce flights, and how aircraft and flight altitude affect subsistence activities and wildlife and in the project area. It is anticipated that such a monitoring plan will be significantly useful for the permittee and could direct the permittee to greater cost savings and efficiencies. It is anticipated that if aircraft traffic is not the reason for failed hunts, such a plan may be able to substantiate that. Data collected from this study will help BLM to adapt management decisions to changing conditions and circumstances and make better decisions for future research studies and development projects in the NPR-A.

Potential Mitigation Measure 5: Reduce Flights by Utilizing Unmanned Aerial Vehicles

Objective: To reduce the impacts of aircraft traffic on Nuiqsut subsistence activities.

Requirement/Standard: The permittee will begin to employ unmanned aerial vehicles to conduct monitoring activities that otherwise require helicopters (i.e., pipeline inspections, studies, and other appropriate activities). The permittee will consult with the authorized agency every 3 years to determine feasibility of this technology and appropriate monitoring activities for its use.

Background, Potential Benefits and Residual/Unavoidable Impacts: Much of the ecological monitoring required of lessees and permittees is supported by/requested by local residents, but there is less understanding and little support for the number of helicopter flights that are required to conduct those activities. The potential for using unmanned aerial vehicles for baseline monitoring was discussed at the September 2013 NPR-A Subsistence Advisory Panel meeting when a representative of Shell Oil announced that that company was experimenting with using them. The Subsistence Advisory Panel was supportive of their use to decrease impacts from helicopters. Unmanned aerial vehicles have been utilized for oil field studies at Prudhoe Bay, and have the potential for use in the NPR-A. Residents of Nuiqsut have requested that the latest technology be used for such studies as soon as and to the greatest extent possible in order to alleviate the high number of aircraft flights. BLM would not have the authority to implement this best management practice on lands that are not managed by the BLM in the Nuiqsut area, where much of the disturbance from aircraft occurs.

Potential Mitigation Measure 6: Subsistence Monitoring Studies

Objective: Monitor the impacts of GMT2 Project on subsistence harvests and activities for the community of Nuiqsut.

Requirement/Standard: The permittee will monitor, through the life of the project, changes in subsistence activities in the community of Nuiqsut. The permittee will fund a study to quantify changes in subsistence use and harvest levels. The study would identify changes resulting from the proposed project, and at a minimum, monitor impacts to caribou, fish, and bird harvests.

Potential Benefits and Residual/Unavoidable Impacts: A subsistence monitoring study would help identify the impacts of GMT2-related activities on Nuiqsut subsistence activities. The 8 years of data from the Nuiqsut Subsistence Caribou Monitoring Project (SRB&A 2017a) is a valuable resource for evaluating impacts. The permittee may continue the Nuiqsut Caribou Subsistence Monitoring Project (initiated in 2008 and proposed for a total length of 10 years) on an annual basis until 2024 and on a biennial basis after that. The Subsistence Fishery Monitoring on the Colville River Project may be expanded to include Fish Creek and extended on a biennial basis. After 2033, the authorized officer and the permittee may agree on adjusting the focus and duration of these subsistence monitoring studies. The results of an expanded subsistence monitoring project could be used to develop future mitigation measures aimed at lessening the impacts of GMT2 on Nuiqsut harvesters. Subsistence monitoring studies will continue throughout the life of the project, or until the authorized officer determines such studies are no longer necessary or prudent.

4.4.5.7 Summary and Comparison of Alternatives

Under Alternatives A, B, and C, development of GMT2 would result in direct and indirect impacts to Nuiqsut's subsistence uses. Temporary and permanent infrastructure and associated activities would affect subsistence areas that are predominantly used for caribou and furbearer hunting, but also for geese hunting and fishing (see § 3.4.5 Table 3.4-8).

The types of impacts (e.g., impacts to a subsistence use area, restrictions on user access, user avoidance, reduced resource availability, potentially reduced community participation) are similar to those identified for the Alpine Satellite Development Project (BLM 2004) and for GMT1 (BLM 2014). Impacts are associated with a 2- to 3-year construction phase, 7 years of drilling, and 23 years of routine operations. Direct and indirect impacts are expected to last 32 years (the total life of the project) although development further west that includes use of the GMT2 Access Road and pipeline system would extend the timeframe of many impacts.

The GMT2 Project would introduce industrial infrastructure and activity into subsistence use areas west/southwest of the community, reducing the area in which residents can hunt and fish without the presence of nearby industrial infrastructure. This would be considered a substantial loss of traditional lands by many residents. The GMT2 Project would also, as discussed under Environmental Justice (§ 4.4.7) and Economy (§ 4.4.3), develop resources owned by and result in profits to Inupiaq entities, which, in addition to other mitigation described above, will benefit residents and hunters but will not eliminate these impacts.

Primary impacts during construction under all alternatives include restricted subsistence access, reduced availability of subsistence resources, hunter avoidance, and hunter disturbance by aircraft traffic.

Primary impacts under Alternatives A and B during drilling and operation include varying effects on subsistence access and hunting patterns due to the permanent GMT2 road and impacts to resource availability due to the likelihood that caribou and furbearers will be deflected from areas where they are normally harvested. The anticipated effect of the GMT2 Access Road is that facilitated access may be outweighed by adverse impacts, including direct overlap with a use area, impediments to overland travel, hunter avoidance (by hunters who cannot or chose not to use the road), eventual restricted overland access during the summer and fall by four wheeler in areas near ramps due to tundra damage, hazards, dust, road and aircraft traffic, noise, emissions, ice fog, and localized deflection of caribou and furbearers.

Alternative C would not include facilitated access via a permanent road, would require a substantially larger footprint, and would require the annual construction of ice roads. Alternative C would also result in greater emissions and increased air traffic in hunting areas west of the community, including a new source of fixed-wing air traffic that did not exist before.

These impacts are not anticipated to affect all hunters equally, and these impacts are expected to change over the life of the project. In terms of overall impacts to subsistence uses, Alternative A would likely have the fewest impacts. Under Alternative A, less gravel would be required for construction of GMT2 than either Alternative B or C, the road would be shorter than under Alternative B, and the road route would result in greater revenues to the Kuukpik Corporation. Compared to Alternative C, Alternative A would not require annual construction of ice roads during operations, would involve a smaller increase in aircraft traffic, and hunter access by road to the project area would be facilitated.

Appendix L of this document is the draft evaluation of potential impacts to subsistence uses and needs for each of the four alternatives considered in the GMT2 Draft Supplemental EIS as required under Section 810(a) of Alaska National Interest Lands Conservation Act (ANILCA) for any federal action on public lands. The draft Alaska National Interest Lands Conservation Act Section 810 evaluation finds that development of GMT2 under any of the action alternatives may significantly restrict subsistence uses for the community of Nuiqsut and the cumulative scenario may significantly restrict subsistence uses for the communities of Nuiqsut, Anaktuvuk Pass, Utqiagvik, and Atqasuk. Due to these draft findings, public subsistence hearings will be held in the potentially affected communities.

Input from subsistence hunters gathered during those hearings, any additional new data on subsistence in Nuiqsut collected in the interim, and the effects of existing and potential new mitigation will be considered in the final Alaska National Interest Lands Conservation Act Section 810 analysis and in the Final GMT2 Supplemental EIS.

4.4.6 Public Health

The initial Alpine Satellite Development Plan Environmental Impact Statement (BLM 2004), which this current analysis supplements, did not include a public health analysis. The NPR-A Integrated Activity Plan (BLM 2012, Section 4.3.21) did include a broad analysis of potential impacts to public health in North Slope Borough and Northwest Arctic Borough from potential future oil and gas development in the NPR-A. The following discussion of potential impacts to human health and community welfare associated with the proposed development of GMT2 incorporates recent data and, where data is available, focuses on potential direct and indirect impacts of nearby oil development on the community of Nuiqsut. A more detailed description can be found in Appendix G: Baseline Human Health Summary GMT2 Project.

4.4.6.1 General Impacts to Public Heath

Impacts to public health related to nearby oil development could occur due to changes in diet and nutrition, environmental exposures, infectious disease, acculturative stress, economic impacts, and the capacity of local health care services. An influx of outside workers could increase exposure to communicable diseases, although the probability is low because oil field workers are segregated from the community, other outsiders regularly travel in and out of Nuiqsut, and Nuiqsut residents travel in and out of town. Because of nearby oil development, Nuiqsut has a seasonal road connection to the Dalton Highway that leads to noticeable increases in the trafficking and use of alcohol and drugs (Paskewitz 2014). That seasonal road connection also facilitates road travel for medical purposes and provides a potential alternate evacuation route.

Economic security substantially reduces chronic stress and Nuiqsut, because of oil development, has a more secure economic base than most Native Alaska villages. . In 2014, the estimated median household income in the NSB was $74,609; for Alaska it was $71,829 and for Nuiqsut, $85,883 (Table 2, Appendix G). This number includes both Inupiaq and non-Inupiaq household income. Economic indicators demonstrate 3% of Nuiqsut residents live below the poverty limit (U.S. Census ACS, 2014). Data on household income and its potential to reduce chronic stress must be considered in light of the cost of living in Nuiqsut. Food costs are between 2-3 times as high as food costs in Anchorage (NSB, 2016).

One aspect of stress described by local residents of Nuiqsut is the chronic risk of and uncertainty over how to be made aware of and respond to accidents that could occur at oil development sites, namely a well blow-out or pipeline rupture and oil spill. In the past few years, relatively minor blowouts have occurred at oil exploration and development sites on the North Slope, including one fairly close to Nuiqsut.

Numerous concerns that are predominantly related to subsistence hunting and fishing and the loss of undeveloped traditional subsistence use areas are described in Section 4.4.5. Several of those potential impacts either directly affect or are indirectly connected to public health in Nuiqsut. An example is the increased risk of injury and accidents while on the land due to some hunters' tendency to avoid developed areas.

Although, instances where hunters utilize roads and infrastructure may help facilitate access to subsistence resources and indirectly mitigate potential impacts from injury and accidents, further described in Section 4.4.5.3 "Summary of Subsistence Uses of the GMT2 Project Area."

Social issues for Nuiqsut are described in Section 4.4.2, "Sociocultural Systems," and further explored in the cumulative effects analysis for sociocultural systems, Section 4.6.10.2. Many of those issues either directly affect or are indirectly connected to overall public health in Nuiqsut.

The Alaska Department of Fish and Game in 2015 conducted a comprehensive harvest study in Nuiqsut and found that 12 percent of Nuiqsut households worried about having enough food at one or more times during 2014. When compared to statewide percentages, Nuiqsut had a higher percentage of food secure households (90 percent) and lower very food insecure households (2 percent), compared to 2014 estimates for the entire state (88 percent food secure, 4 percent very food insecure).A summary of general public health impacts associated with oil and gas activities is listed below. These potential impacts would be common to all action alternatives.

- Localized activity may impact subsistence hunting. Nuiqsut hunters who already avoid large areas of traditional land to the northeast of the village could experience further limitation in their access to lands to the west of the village if oil and gas development occurs there. Avoidance of subsistence hunting areas may affect access to subsistence resources, which could affect dietary and nutritional outcomes (BLM 2012, page 345).
- Noise from air traffic and other sources could also create a nuisance around individuals' camps and cabins, possibly reducing their use as a base for subsistence harvests.
- Fixed oil and gas production sites, particularly those near villages or in areas of heavy subsistence use (e.g., near rivers) may lead to avoidance by hunters. In turn, this could increase travel times and costs for subsistence activities, and could potentially decrease harvests and increase risk of injury and accidents.
- Community infrastructure has had several upgrades, including water and sewer projects funded by the NSB, in addition to electrical utilities and telecommunications (ACOE Point Thomson EIS, 2013)
- Revenue to the North Slope Borough and village corporations will provide continued funding of existing health and social programs and the preservation of the current high level of direct and indirect employment.

- The NPR-A Impact Grant Fund has made available revenues from NPR-A lease sales, rentals, bonuses and royalties on leases issued to North Slope communities, including Nuiqsut. It is estimated that $165 million has been administered through the NPR-A Impact Grant Fund since 1987. The payments are made to the North Slope Borough and other North Slope communities for projects that range from funding local caribou monitoring efforts, purchasing gravel to build roads near Nuiqsut, funding local government services, improving community infrastructure (water, sewer, telecommunications), funding youth, workforce development and cultural programs, and more (DCCED, 2015).
- New jobs for North Slope and Nuiqsut residents in the oil and gas sector will increase with oil and gas exploration and development activities.

4.4.6.2 Air Quality

Nuiqsut residents' primary public health concern regarding the GMT2 Project is air quality. Residents raised concerns during scoping that episodes of poor air quality associated with dust (including from gravel mine overburden blasting and from traffic on the gravel roads), emissions from GMT2 (including from industrial vehicle exhaust), and increased flaring of natural gas at Alpine pose a health hazard for at-risk populations, such as children, the elderly, or those suffering from respiratory disease. This belief in the negative impacts of development on air quality leads to stress and anxiety over exposure to hazardous air pollutants in any amounts, even at levels generally considered safe for all populations by the EPA.

Residents regularly express anxiety over the effects of oil development on air quality in general, and specifically increased risks from flaring and blowouts. Public Health Implications of Emissions Resulting from the GMT2 Project

Regular air quality monitoring, air quality models that predict emission levels likely to result from development, and several investigations of pollution and associated public health in Nuiqsut, have not found any evidence that air pollution levels exceed air quality standards or are causing negative health effects in Nuiqsut. The Alaska Department of Health and Social Services investigated air pollution and respiratory illness in Nuiqsut in response to community concerns in 2003 and 2012. Air pollution data from the ConocoPhillips monitoring station were reviewed by the Alaska Department of Environmental Conservation and the Alaska Department of Health and Social Services. Health data were collected from inpatient and outpatient visits for respiratory illness. Air pollution was not found to be associated with respiratory illness in these investigations (Alaska Department of Health and Social Services SOE 2003, 2012).

Air quality modeling was conducted to assess both project-level impacts of the GMT2 Project as well as cumulative air quality impacts resulting from development within a 50 kilometer radius of GMT2. The modeling assessed emissions of the following pollutants that impact human health:

- **Criteria Pollutants:** Criteria pollutants are six common pollutants that occur all over the U.S. and are listed in the Clean Air Act for regulation. The EPA sets standards for allowable ambient concentrations of these pollutants, called the National Ambient Air Quality Standards. The national standards are set at a level that protects sensitive populations (children, the elderly, and people with compromised respiratory systems) with an ample margin of safety. The National Ambient Air Quality Standards are required to be reviewed periodically and adjusted if new scientific information exists that indicates a change is necessary to protect public health.
- **Air Toxics/Hazardous Air Pollutants:** In addition to the six criteria pollutants, the EPA is required to regulate other hazardous air pollutants that are known or suspected to cause serious health effects or adverse environmental effects. There are 187 air toxics identified by the EPA, which are regulated by establishing limits on emissions based on the maximum achievable control technology (for stationary

industrial sources). The EPA reviews standards for each air toxic every 8 years, and adjusts allowable emission levels based on the best available control technology. Air toxics can also be emitted from mobile sources.

Air quality modeling conducted for the GMT2 Project found that all action alternatives were below applicable air quality standards for all project phases. No adverse impacts to human health are expected as a result of air pollutants emitted from GMT2 or surrounding development. Cancer risk was assessed for five common air toxics as part of the GMT2 analysis, with an overall cancer risk of 1 in 100 million for a maximally exposed individual. Table 4.4-6 shows the maximum predicted impact to air quality as a result of GMT2 and surrounding development. For complete results of air quality modeling, see Section 4.2.3.2, “Air Quality.”

4.4.6.3 Construction

The Arctic Slope Regional Corporation Mine site is the proposed gravel source for all alternatives. The Arctic Slope Regional Corporation Mine site is an existing commercial gravel source on the East Channel of the Colville River, approximately 6 miles southeast of CD4, 21.0 miles east of GMT2, and 4.5 miles east-northeast of Nuiqsut. During the construction phase of GMT1, blasting at the Arctic Slope Regional Corporation Mine site for GMT1 gravel occurred on a daily basis for 42 days in winter 2017, and similar occurrences are expected for the construction of GMT2.. Local residents also raised health and safety concerns about the increased overall industrial activity associated with construction so close to the community, especially the large amount of heavy equipment traffic from the Arctic Slope Regional Corporation Mine site to the location of the road and pad construction (Native Village of Nuiqsut Consultation 2017). Impacts from construction are concentrated during the ice road season, from January to early May, and impacts resulting from gravel extraction occur during the first winter of construction.

4.4.6.4 Drilling and Operations

A frequent public health concern raised by local residents associated with the drilling and operations phase, other than impacts to air quality, is the possibility of an industrial disaster, such as a blowout, a fire, or a large-scale spill. An example of this occurred during the spring of 2015 when high water on the Colville River during break-up threatened development sites in the Colville Delta, resulting in the temporary evacuation of staff from the CD4 satellite site to the Alpine Central Processing Facility.

4.4.6.5 Comparison of Alternatives

The majority of the impacts discussed above would be relevant for all GMT2 action alternatives. These impacts are primarily applicable to the community of Nuiqsut, the closest community to the proposed GMT2 Project. These impacts are similar to the impacts discussed in detail in the recent Point Thomson Project Final EIS (U.S. Army Corps of Engineers 2012) and the GMT1 Supplemental EIS (BLM 2014). The draft supplemental EIS findings for GMT2 are that development of GMT2 would have no measurable impacts to water and sanitation and infectious disease; low impacts to specific health issues related to accidents and injuries; ;);; and increased access to health care and facilities.

Most impacts discussed above for GMT2 Alternatives A and B are relevant for Alternative C. Alternative C would result in greater overall emissions of air pollution, and it would result in more vehicle traffic near the community for the life of the project to construct annual ice roads. The risk of vehicle accidents on access roads would be reduced during summers under this roadless alternative, but it is likely that equivalent risks are associated with use of the ice roads during the winter season. The increased air emissions anticipated under Alternative C (Section 4.2.3.2, “Air Quality”) due to the presence of additional power generation onsite and increased flights to GMT2 could potentially lead to increased adverse impacts to public health; however, emissions of air pollutants are not expected to exceed any applicable standard. Public health in Nuiqsut is inherently connected to the continuation of subsistence hunting and high levels of community participation in subsistence activities. Potential impacts to subsistence are discussed in Section 4.4.5.

No changes from current public health conditions would be expected to result from Alternative D because no action would take place under this alternative. Cumulative effects are discussed in Section 4.6.10.9.

4.4.6.6 Mitigation

BLM (2012, Section 4.3.21.5) outlined several potential mitigation measures to minimize potential adverse health impacts associated with the alternatives of that NPR-A leasing plan. Mitigation measures implemented with the 2013 NPR-A Integrated Activity Plan Record of Decision, which therefore apply to the currently proposed GMT2 Project, include contaminant monitoring of subsistence species, providing air quality data to the North Slope Borough and local communities in a timely manner, and actions to minimize the negative effects of an oil spill on public health.

BLM considered and applied new mitigation measures for public health in the GMT1 Supplemental EIS (BLM 2015), and it is recommended that similar supplemental best management practices be applicable to GMT2. BLM will determine whether to adopt the new potential mitigation measures in the record of decision. The new potential mitigation measures are discussed below.

Potential Mitigation Measure 1—GMT2 Industrial Disaster Response Plan for Nuiqsut
Objective: To minimize the indirect effects of stress, and direct effects to public health resulting from large-scale health and safety incidents at GMT2 or associated facilities.

Requirement/Standard: An emergency contingency plan and associated evacuation plan specific to responding to an industrial disaster in close proximity to the community of Nuiqsut should be created to identify the appropriate response by the community to a variety of health and safety events that could occur at the GMT2 Project. The North Slope Borough should be consulted and the City of Nuiqsut, Native Village of Nuiqsut, and Kuukpik Corporation should be directly involved in the creation of both plans. Ideally, the plan would be created in consultation with other industrial operators in the Nuiqsut vicinity, so that it is applicable for any potential industrial disaster within a 50-mile radius of the community.

Potential Benefits and Residual/Unavoidable Impacts: The emergency contingency plan and associated evacuation plan will alleviate stress and will be a resource to be utilized by the community of Nuiqsut should a large-scale industrial health and safety event occur.

Potential Mitigation Measure 2—Minimize Undue Idling of all Vehicles
Objective: Reduce air emissions and protect human health.

Requirement/Standard: 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.

Potential Benefits and Residual/Unavoidable Impacts: Prohibiting unnecessary vehicle idling will reduce emissions associated with vehicle use, such as carbon monoxide, fine particulate matter, and volatile organic compounds. Additionally, this measure will decrease noise impacts associated with the GMT2 Project. Emissions associated with GMT2, including vehicle exhaust emissions, are within the range of Alaska Department of Environmental Conservation air quality regulations and are subject to Alaska Department of Environmental Conservation permitting regulations.

Potential Mitigation Measure 3—Public Health Monitoring

Objective: To minimize the effects of harmful oil and gas development-related changes to population health and increase community understanding of public health and steps to improve it.

Requirement/Standard: A public health monitoring program should be created at a regional level to track health indicators that are vulnerable to impacts from oil and gas activities. These indicators should focus on health outcomes and/or determinants of local concern that can be tied to oil and gas activity. Where possible, indicators should include threshold levels and specific actions should be developed for when thresholds are surpassed. The State may be responsible for the development and implementation of the monitoring program; however the North Slope Borough and the Alaska Native Tribal Health Consortium should be consulted in the identification of appropriate indicators, thresholds, and responsive actions.

Potential Benefits and Residual/Unavoidable Impacts: The public health monitoring program will expedite the detection of unacceptable changes in population health caused by oil and gas activity. The sooner health changes are detected, the greater the likelihood of avoiding controversial and devastating impacts. A monitoring program will detect, but not eliminate, any negative changes in public health that may result from oil and gas development.

4.4.7 Environmental Justice

This analysis of impacts related to environmental justice considers if implementation of the proposed GMT2 alternatives would result in disproportionately high and adverse environmental effects to the community of Nuiqsut. The community of Nuiqsut, as discussed in Section 3.3.2.4, meets the demographic characteristics to be qualified as a minority population, and requires evaluation for disproportionate impacts under environmental justice.

Executive Order No. 12898 (February 1994), discussed in Section 3.4.7, directs federal agencies, to the greatest extent practicable and permitted by law, to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of proposed federal actions on minority and low-income populations. The NEPA analysis of environmental justice is also informed by CEQ guidance, as follows:

"Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low income population, minority population, or Indian tribe does not preclude a proposed agency action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such an effect should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population." – CEQ 1997, pg. 10.

Federal agencies also are required to give affected communities opportunities to provide input into the environmental review process, including the identification of mitigation measures. The BLM has assured meaningful community representation in the process by holding public meetings, having a subsistence specialist spend time in the community, inviting the Native Village of Nuiqsut to participate as a cooperating agency on the GMT2 Supplemental EIS, and holding regular government-to-government consultation via teleconference with the Native Village council. The BLM has also consulted with Nuiqsut's Alaska Native Claims Settlement Act Native corporation, Kuukpik, and their regional Native Corporation, the Arctic Slope Regional Corporation.

Following Council of Environmental Quality guidance on evaluating environmental justice within NEPA (1997), the analysis should recognize if the question of whether agency action raises environmental justice issues is highly sensitive to the history or circumstances of a particular community or population (CEQ, 1997, pg. 8). The historical context within which environmental justice issues are considered for the Iñupiat of the North Slope is discussed in the 2012 NPR-A Integrated Activity Plan/EIS (Section 4.4.5). Tiering from that discussion, BLM recognizes the interrelated cultural, social, occupational, historical, or economic factors that are likely to amplify the natural and physical environmental effects of the GMT2 Project. Council of Environmental Quality guidance also directs the BLM to consider any multiple, or cumulative effects, to human health and the environment even if certain effects are not within the control or subject to the discretion of the agency (CEQ, 1997, pg. 9).

The BLM therefore considered the following factors in determining whether the environmental effects of GMT2 will be disproportionately high and adverse: Whether there is or will be an impact on the natural environment that significantly and adversely affects Native residents of Nuiqsut. Such effects may include subsistence, ecological, cultural, human health, economic, or social impacts to Tribal members when those impacts are interrelated to impacts on the natural and physical environment.

The analysis of environmental justice in the context of the GMT2 Project is particularly complex. Standard environmental justice issues involve outsider-driven industrial activities that disproportionately affect minorities. The GMT2 Project would develop subsurface minerals that belong to the Alaska Native Claims Settlement Act regional Native Corporation, and the land where GMT2 would be constructed has been selected by the Alaska Native Claims Settlement Act village corporation for Nuiqsut (Kuukpik Corporation). This environmental justice analysis must consider that the GMT2 Project is partly driven by Inupiaq entities and Iñupiat would benefit economically as shareholders in their Native corporations. Alaska Native Claims Settlement Act corporations were established to promote development of their resources that benefits their shareholders. Analyses in this draft supplemental EIS for economy, sociocultural systems, and subsistence (Section 3.4.2, 3.4.3, 3.4.5, 4.4.2, 4.4.3, and 4.4.5) describe several ways that Inupiaq residents of Nuiqsut who hold dissimilar values and opinions and/or who are economically disadvantaged would disproportionally experience negative impacts associated with development of GMT2. In particular, the democratically elected Tribal council for Nuiqsut (Native Village of Nuiqsut) has taken several steps to clarify that their own Alaska Native Claims Settlement Act corporations do not necessarily speak for them on development issues. Federal agencies are required to consult with Alaska Native Claims Settlement Act corporations on the same basis as Tribes, but this does not diminish in any way the relationship and consultation obligations with Tribes. To the extent concerns differ between Tribes and Alaska Native Claims Settlement Act corporations, USDOI gives due consideration to the right of sovereignty and self-governance of federally recognized Tribes.

Effects to the minority community that have been identified in the preceding sections include:

- Employment opportunities.
- Royalties to Arctic Slope Regional Corporation and Kuukpik Corporation.
- Tax revenues to the North Slope Borough and Kuukpik Corporation.
- Increased State of Alaska NPR-A Impact Mitigation funds that eligible municipal governments can apply for.
- Opposition by the democratically elected Tribal government (Native Village of Nuiqsut) to permitting GMT2 until GMT1 is complete and impacts analyzed.
- Perceived inadequacy of compensation systems.
- Distress associated with disruptions to the Nuiqsut cultural landscape.
- Social conflict associated with income disparity.

- Impacts to subsistence, including:
    - Project footprint's direct and indirect impact to subsistence use areas.
    - 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 (resource availability).
    - Potential decreased community participation and transmission of knowledge.

4.4.7.1 Construction

Construction crews would be housed at the Alpine Processing Facility, at commercial housing in Nuiqsut, or at a temporary camp at the drill site or on an ice pad. Construction at the site would not bisect any communities would not adversely affect access between communities. Because of the predominance of Alaska Natives in the North Slope Borough, minority individuals form "the broader community" of the area. Construction of the proposed project would not isolate minority or low-income individuals from the broader community.

Construction of the GMT2 Project is expected to increase employment opportunities for residents who take advantage of the local hire program sponsored by ConocoPhillips and its contractors. Local residents who work at the GMT2 facility would benefit from jobs and increased income. Although the number of jobs the GMT2 Project generates for local residents would not be known until after contracts are awarded and construction begins, it likely that positions for local residents would be available. However, based on the history of past development projects on the North Slope, the construction of the GMT2 Project would likely have a minor impact on overall North Slope Borough resident employment. Nonresident workers who would leave the area between shifts will likely fill the majority of positions created by the project.

During construction, an increase in employment and in cash income from both employment and dividends to shareholders who live in the community would help local residents, especially those of working age, to stay in the area and maintain their culture and community characteristics. It is expected that residents will experience economic benefits through indirect effects of increased tax income for the North Slope Borough government. Section 4.4.3, "Economy" provides additional discussion of impacts to employment, income, and the North Slope Borough tax base.

Health impacts related to GMT2 construction are a primary concern for local residents and governing entities (Section 4.4.6.1). There would be limited interaction between workers at the site and the local community, thereby having minor impacts to food, nutrition, subsistence, and social determinants of health. Exposure to hazardous materials through emissions of air pollutants or spills of hazardous materials would be regulated for protection of human and environmental health. Issues associated with environmental security (fear of a blowout, lack of an evacuation plan, and air quality) are serious concerns for the Native Village of Nuiqsut Tribal government.

4.4.7.2 Drilling and Operation

The effects of drilling and operation of the GMT2 Project on the minority community of Nuiqsut would be less acutely impactful than those described above for construction, but would be of a much longer duration. Fewer workers would be employed to drill and maintain the wells than to construct the facility.

The 2012 North Slope Borough Baseline Community Health Analysis Report notes that a recent study examining air quality in Nuiqsut has not found evidence of [air] pollution at levels expected to have significant health effects (North Slope Borough 2012, page 98 and 184). That North Slope Borough Report also notes that 24 percent of Iñupiat heads of household in Nuiqsut reported a shortage of subsistence food at some point during the year. This situation could be exacerbated if there was an adverse impact on the availability of subsistence resources due to GMT2 Project drilling and operation.

4.4.7.3 Comparison of Alternatives

The gravel access road constructed under Alternatives A and B could provide increased access for Nuiqsut residents to subsistence use areas. Disturbance from aircraft traffic has emerged as the most commonly reported impact on subsistence activities: this impact would increase under all action alternatives, but the increase would be greater under Alternative C. While the nature of impacts associated with aircraft traffic affects the relative intensity of other impacts (namely, roads), it does not affect the degree of intensity of other impacts. The GMT2 Access Road and the ease of general road access to the area will likely decrease the quality of the area (compared to no development), increase the local hunting pressure in the area, and could deflect caribou from areas closer to town. Potential access issues have been identified for subsistence hunters attempting to cross the existing CD5 and GMT1 roads. BLM mitigation measures require that road design will not impede access for subsistence activities. Although impacts to sociocultural systems and subsistence have been identified as likely to result from either Alternative A or B, the degree of intensity of these impacts is less under Alternatives A or B than it would be under Alternative C.

Alternative C, as described in Section 4.4.2, "Sociocultural Systems" and Section 4.4.5, "Subsistence", would involve the most substantial environmental justice issues for Nuiqsut. This alternative would result in increased air traffic and associated noise directly over the residents' subsistence hunting areas and would include a larger footprint for the project components, including an airstrip and a permanent camp at GMT2. There would not be a road linking GMT2 to the other Alpine Satellite facilities and Nuiqsut that would facilitate residents' access to subsistence use areas. Aircraft would be used approximately 9 months of the year (May through January) to access GMT2 from Alpine Processing Facility or Nuiqsut; ice roads would provide access approximately 3 months of the year (February through April). Noise impacts from aircraft operations between Alpine Processing Facility and GMT2 would disturb caribou and subsistence hunting activities. Landings and take-offs of large aircraft, combined with other activity at the GMT2 drill pad, could deflect caribou (most notably animals from the Teshekpuk Lake herd during its fall migration) from areas closer to town where they are traditionally harvested. Alternative C does not reflect the GMT2 configuration that most members of the identified environmental justice population who have testified or submitted comments have preferred due to the impacts they experience..

Alternative D, the no-action alternative, would result in none of the negative impacts to subsistence that are anticipated from the action alternatives. However, the no-action alternative would also result in none of the anticipated economic benefits of GMT2 Project. No additional impacts to the Nuiqsut cultural landscape would occur. The Native Village of Nuiqsut has expressed a preference for the no action alternative, and requested the BLM delay permitting of the GMT2 Project until GMT1 was built and its impacts could be evaluated. The BLM is required to issue a permit for the GMT2 development (see Section 2.8, *No Action Alternative*.)

Under all action alternatives, residents of the minority community of Nuiqsut could experience disproportionally high and adverse impacts as the result of negative impacts to sociocultural systems and disturbance to subsistence activities in highly valued, nearby traditional subsistence use areas. Resource availability could be impacted in the immediate vicinity of the project and caribou could be deflected away from areas closer to town.

4.4.7.4 Mitigation

Prior planning documents covering the proposed project study area, described in BLM (2004, 2008b, 2012, 2013, 2014), have provided opportunities for public involvement for low-income and minority populations. BLM has carefully considered community views when developing and implementing mitigation strategies to reflect the needs and preferences of these populations, to the extent practicable. These planning documents have made some lands unavailable for oil and gas leasing, including a large portion of the coastal plain within the NPR-A used by Nuiqsut subsistence users. See Chapter 5 for consultation activities associated with this supplemental EIS.

These efforts also include ways to adapt management of these lands to better meet resource and use objectives, including adopting measures to protect subsistence resources, protect access to those resources, protect public health, and monitoring the activities of lessees/permittees to ensure compliance with requirements. The NPR-A Subsistence Advisory Panel provides a forum for Tribal representatives to propose mitigations to BLM, and the BLM conducts regular government-to-government consultation with the Native Village of Nuiqsut council. In addition, the 2013 NPR-A Record of Decision required BLM to establish the NPR-A Working Group, made up of representatives of the North Slope local government, Native corporations, and Tribal entities, in order to facilitate and provide for meaningful and regular input by local communities. Preferences expressed by the local community in past consultations with BLM are as follows:

- Local residents should be consulted regarding local uses. This information and traditional knowledge should be incorporated into study plans before they are started.
- There should not be a pipeline towards Fish Creek; it is important for different types of fish in the fall, fall caribou hunting, and spring geese hunting.
- Nuiqsut needs better coordination with industry.
- The cumulative effects of oil and gas development need to be addressed and prioritized.

There are too many meetings in the community, and this prevents residents from engaging on issues of importance to them. In the Alaska National Interest Lands Conservation Act Section 810 analysis documented in BLM (2004a, 2012), BLM concluded that the authorized developments (Alternative F and B-2, respectively, both of which include the GMT2 Project) "include reasonable steps to minimize adverse impacts on subsistence uses and resources."

Potential impacts to subsistence activities and resources are mitigated by design and operational features included in Section 4.6 and the following protective measures of BLM (2013: A-4, A-5, A-6, A-7, A-11, A-12, B-1, B-2, C-3, C-4, C-5, E-1, E-2, E-6, E-7, E-19, F-1, H-1, H-3, I-I, K-1, K-2, and M-1). The effectiveness of lease stipulations and best management practices for sociocultural systems are discussed in Section 4.4.2. The discussion concludes that while measures to protect the biological resources and human health have proven effective, measures in effect to date do not completely mitigate the social and cultural impacts of development. The effectiveness of lease stipulations and best management practices for subsistence is discussed in Section 4.4.5. Numerous potential mitigation measures, designed in collaboration with the Native Village of Nuiqsut council and other community members, are proposed that will likely decrease the intensity of impacts to subsistence.

4.4.7.5 Conclusions

The analysis of impacts related to environmental justice considers if implementation of any of the proposed GMT2 Project alternatives would result in disproportionately high and adverse environmental effects to the minority community of Nuiqsut. The potentially affected resource in the environmental justice analysis is the community of Nuiqsut. It is understood that although the majority of residents are Inupiaq and thus Nuiqsut qualifies as an environmental justice population, there are sub-populations within this minority population that will likely experience the impacts of GMT2 differently than other sub-populations within the community. Lower economic status households and households that are more dependent on harvesting subsistence resources from impacted use areas will likely experience more intense impacts.

The finding of the Alaska National Interest Lands Conservation Act Section 810 subsistence evaluation (Appendix L) for the proposed project under all action alternatives is that development of the GMT2 Project may significant restrict subsistence uses for the community of Nuiqsut.

Under Alternatives A and B, the permanent access (after construction) to subsistence use areas is expected to have a long-term, moderately countervailing (beneficial) effect for many residents of Nuiqsut. The road is also expected to diminish the traditional 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. Alternative B would not include the same level of countervailing economic benefits that would occur under Alternative A. Alternative C would result in increased aircraft disturbance in the project study area and would not include the mixed effects of the road, therefore resulting in greater negative impacts to the community, including a higher degree of negative impacts to sociocultural systems. Impacts resulting from Alternative D are expected to include a lack of any of the economic benefits anticipated from GMT2 Project, negligible additional negative impacts to sociocultural systems, and no additional impacts to subsistence use areas and activities.

4.5 Impacts of Oil, Saltwater and Hazardous Materials Spills

This section summarizes the impacts that might result from releases of oil, saltwater, and hazardous substances associated with the proposed GMT2 Project. This analysis tiers to the information presented in the Alpine Satellite Development Plan EIS (BLM 2004, Section 4.3), the NPR-A Integrated Activity Plan EIS (BLM 2012, Section 4.2.2), and the Alpine Satellite Development Plan GMT1 Supplemental EIS (BLM 2014, Section 4.5), and provides an updated analysis using the most current spill information from the Alaska Department of Environmental Conservation spills database of spills related to operation of the Alpine Field.

4.5.1 Potential Impacts

The Alpine Satellite Development Plan EIS (BLM 2004 Section 4.3.3 and Section 4.3.4) provides a detailed analysis of the potential impacts of spills for a variety of spill scenarios. Spills can occur from pipelines, storage tanks, production facilities and infrastructure, drilling rigs, and heavy equipment or vehicles. Impacts from spills vary based on what material was spilled, the size of the spill, and what time of year the spill occurred. For this document, materials that could be spilled are categorized as process water, crude oil, non-crude oil, and other hazardous substances.

Process water is produced water mixed with crude oil and saltwater or brine. Salt in the seawater and brine can negatively affect plant growth and survival at relatively low concentrations when spilled on tundra. These effects can be persistent, because salts are not broken down by chemical or biological processes in the soil. Spills of process water can change the salinity in freshwater bodies, which may be toxic to sensitive species.

Crude oil is oil separated from the produced water. Crude oil spilled on the tundra can cause damage to plants by coating the surface of leaves or causing hydrophobic soil conditions, reducing the supply of water to plant roots. Non-crude oil includes diesel, gasoline, hydraulic fluid, transmission oil, waste oil, and other refined petroleum products. Refined petroleum products, particularly diesel and gasoline, are generally more toxic to plants, microbes, and animals (including humans) than crude oil.

Other hazardous substances that may be onsite include methanol, glycols, corrosion inhibitor, scale inhibitor, drag reducing agents, biocides, and drilling muds. Methanol and glycols are toxic to animals, and are completely soluble in water. Other hazardous substances have different toxicities and behave differently when spilled. Drilling muds are complex mixtures that may contain bentonite clay, saline substances, or mineral oil. Drilling muds and fluids can affect tundra by changing soil salinity and alkalinity, as well as smothering plants due to burial (Alaska Department of Environmental Conservation

Tundra Treatment Guidelines 2010). Other hazardous substances have different toxicities and behave differently when spilled.

4.5.2 Spills History

4.5.2.1 North Slope Spills History

The Alaska Department of Environmental Conservation Summary of Oil and Hazardous Substance Spills by Subarea (October 2007) provides a detailed analysis of spills from 1995 to 2005. The analysis shows process water spills were 8 percent of the total number of spills, but 75 percent of the total volume. Crude oil spills were 12 percent of the total number of spills, and 5 percent of the total volume. Non-crude oil spills were 49 percent of the total number of spills, accounting for 7 percent of the total volume. Hazardous substance spills were 31 percent of the total number of spills, and 13 percent of the total volume. More than half (59 percent) of the spills were less than 10 gallons. Approximately 98 percent of the total volume released resulted from spills larger than 99 gallons.

Data from the Alaska Department of Environmental Conservation Spills Database for spills related to oil development on the North Slope from 2012 to March 2017 was analyzed, and shows similar results to the 1995 to 2005 data. From 2012 to March 2017, process water spills were 8 percent of the total number of spills, representing 41 percent of the total volume. Crude oil spills were 8 percent of the total number of spills, and 16 percent of the total volume. Non-crude oil spills were 53 percent of the total number of spills, and 15 percent of the total volume. Hazardous substance spills were 30 percent of the total number of spills, and 26 percent of the total volume. Spills of less than 10 gallons accounted for 68 percent of the total number of spills. Approximately 65 percent of the total volume released resulted from spills larger than 99 gallons.

Structural or mechanical issues, including corrosion, leaks, cracks, valve failures, or equipment failures, caused 75 percent of the spills, and human factors such as overfilling, unsecured cargo, or other human errors caused 15 percent of the spills.

There have been three documented spills of greater than 100,000 gallons on the North Slope. In 1997, approximately 994,400 gallons of seawater was spilled in East Prudhoe Bay.

In March of 2006, approximately 201,000 gallons of crude oil was spilled from a transit pipeline at the BP Exploration, Alaska (BPXA) Western Operating Area. The spill was a result of internal corrosion, which caused a 0.25-inch hole in the pipeline. The cleanup effort included removal of 64,596 gallons of free flowing oil, 10,786 cubic yards of oil contaminated snow and soil, and 484 cubic yards of contaminated gravel. A survey of the site determined 1.93 acres of tundra and frozen lake were impacted by the spill. Soil sampling results confirm that site meets the clean-up criteria after the removal actions were completed, and the site was been backfilled and covered with transplanted tundra mats to rehabilitate the area.

In December of 2006, approximately 255,152 gallons of produced water and 126 gallons of crude oil was spilled from a tank at the BPXA Western Operating Area. The spill was caused by a mechanical failure involving the agitation jets used to suspend solids near the bottom of the tank. Misalignment of a jet caused a hole to erode through the bottom of the tank. While the tank was releasing produced water from the hole in the bottom of the tank, the crude oil was skimmed off through a drain line. Fresh water was pumped into the tank to give the oil greater retention time to increase the effectiveness of the skimming operation. When most of the oil was removed, the tank was allowed to drain. Vacuum trucks were used to remove the produced water and crude oil from secondary containment. The oil was returned to the pipeline and the produced water was re-injected into the formation. The spill was confined to the gravel pad secondary containment area. No impacts to tundra were identified.

Other recent spills include the Repsol Q-6 spill in 2013 and the BPXA H Pad Well 8 spill in 2014. The Repsol Q-6 release occurred on the Qugruk #6 pad, approximately 18 miles northeast of Nuiqsut, in July of 2013, when a hose ruptured on a line between the well and a storage tank during a well flowback operation. The hose was under pressure when it failed, causing the fluids to spray out onto the pad and snow-covered tundra. Additional product was released into the lined secondary containment cell when the fluids in the storage tank drained back through the ruptured hose. An estimated 3,822 gallons of fluids (60 percent stimulation fluids, 35 percent diesel, and 5 percent crude oil) was released. The majority of the product was contained within the secondary containment area. Approximately 1.2 acres of snow-covered tundra and frozen lake were misted with fluids. Spill responders used shovels to remove the thin surface crust of contaminated snow. Sample results show that the snow removal activities effectively removed the misted fluids, and the presence of snow and ice cover protected the underlying tundra and water bodies from the release.

The BPXA H Pad Well 8 spill occurred in the BPXA west operating area in Prudhoe Bay. In April 2014, a pressurized line ruptured and natural gas, crude oil, and produced water were released. The spill is estimated to be 700 gallons of fluid, which sprayed an oily mist over approximately 33 acres of snow-covered tundra and 2 acres of gravel pad. Approximately 1,600 cubic yards of impacted snow was removed. Inspections during the summer of 2014 did not reveal any spill-related impacts to the tundra. Surface water sample results show that surface water bodies were not impacted.

4.5.2.2 Alpine Spills History

The Alaska Department of Environmental Conservation Spills Database lists 252 spills reported within the Alpine Oil Field for the entire operating period, from 1998 through March 2017. Total volume of spills for the operational period is approximately 15,975 gallons. Of the total volume spilled, 48 percent was non-crude oil and 35 percent was process water.

Spills prior to October 2013 at the Alpine facility are discussed in detail in the GMT1 EIS (BLM 2014, Section 3.1.3). There have been 62 reported spills from October 2013 to March 2017. The total volume of spills from this time frame is 4,103 gallons, including one spill of 3,000 gallons of diesel in December of 2013 as a result of an overfill. All 3,000 gallons were contained in secondary containment.

Of the total volume spilled during this time frame, non-crude oil spills accounted for 92 percent, process water spills were 7 percent, hazardous substances, were 2 percent, and crude oil was less than 1 percent. Spills of less than 10 gallons accounted for 74 percent of the total number of spills. Structural or mechanical issues caused 71 percent of the spills, and human factors caused 23 percent of the spills.

Of the 62 spills from October 2013 to March 2017, over half of the spills occurred in February (15 spills) and March (18 spills). There were eight spills reported in April, six in December, and three each in January, May, June, and September. August had two spills, and November had one. There were no reported spills in July or October.

The ConocoPhillips Oil Discharge Prevention and Contingency Plan for the Alpine Development Area (ConocoPhillips 2013) includes a summary of spills to tundra and water from 1999 to January 2012. There are 51 spills listed, with a total volume released to tundra or water of 380 gallons. The three largest spills were 252 gallons of diesel (May 1999), 35 gallons of hydraulic fluid (March 1999), and 20 gallons of hydraulic fluid (February 1999). These spills all occurred when there was snow on the ground which was removed to recover the spilled materials. The remainder of the spills were less than 10 gallons.

4.5.3 Construction

As described in the GMT1 Supplemental EIS (BLM 2014), spills related to construction activities are anticipated to be relatively small in volume, primarily related to vehicle and construction equipment fueling and maintenance. A tanker truck accident or fuel storage tank failure are the most likely source of a large construction spill. Construction related spills are anticipated to be non-crude oil products.

4.5.4 Drilling and Operation

As described in the GMT1 Supplemental EIS, spills that could occur during drill and operation could result in larger volume spills than construction activities. Spills from pipelines, bulk storage tanks, production facilities and infrastructure, blowouts, and heavy equipment and vehicles could occur. Pipelines include a 20-inch produced fluids pipeline (crude oil, gas, and water), a 14-inch injection water pipeline (seawater or produced water), a 6-inch gas pipeline, and a 6-inch miscible injectant pipeline. Bulk storage tanks for diesel and wastewater may be used during drilling and operations, and other hazardous substances may be present and stored onsite.

4.5.5 Comparison of Alternatives

In general, the potential impacts due to spills of oil, saltwater, or other hazardous materials as described earlier in this section are similar for each action alternative. Alternative A (described in Sections 2.4 and 2.5) and Alternative B (described in Sections 2.4 and 2.6) include a drill pad, gravel access road, and pipelines, with differing road and pipeline alignments. The pipelines follow the proposed road alignments, allowing easy year-round access for monitoring and repair. Spill response equipment would be staged as described in Section 2.4.10, and the access road would allow rapid response from the medial, fire, and spill response personnel from CD1/Alpine Processing Facility.

Alternative C (described in Sections 2.4 and 2.7) includes a drill pad, an occupied pad, an airstrip and associated facilities, a local access road, and pipelines. There is no gravel access road from GMT1 to GMT2 or the rest of the Alpine Field development area. Access would be by aircraft and ice road (winter only). A 2-inch diesel pipeline and additional bulk storage tanks would be required for this alternative, which increases the opportunity for spills to occur. Pipeline inspections would be conducted by road during the ice road season, and by aircraft during the rest of the year. The lack of road access under this alternative would complicate spill response, as discussed in Section 2.4.10 and Section 2.7.8.

Alternative D is the no action alternative. Under this alternative, there would be no impacts from spills of oil, process water, or hazardous substances.

4.5.6 Mitigation

Several best management practices (best management practices) have been developed to minimize impacts from spills in the Alpine Satellite Development Plan EIS (BLM 2004, Section 4.3), the NPR-A Integrated Activity Plan EIS (BLM 2012, Section 4.2.2), and the Alpine Satellite Development Plan GMT1 Supplemental EIS (BLM 2014, Section 4.5). The GMT1 Record of Decision (BLM 2015) included supplemental BMPs A-3 and A-4, which were modified to include additional requirements for secondary containment, warm storage or deicing of response equipment, and having response equipment designated to arctic conditions. See Section 4.7 for additional discussion of best management practices.

Spill prevention and response, training requirements, fuel and chemical storage, and waste handling and disposal are discussed in Sections 2.4.10, 2.4.11, and 2.4.12. These were developed in accordance with State and federal regulations and industry standards. A list of the State of Alaska environmental protection statutes and BLM best management practices and regulations can be found in Appendix J. ConocoPhillips also maintains a current Oil Discharge Prevention and Contingency Plan with the Alaska Department of Environmental Conservation for the Alpine Facility that will be updated to include GMT2.

4.5.7 Conclusions

The direct impacts of oil, process water, and hazardous substance spills are similar under the three action alternatives. A review of the spill history at Alpine shows the majority of the spills are less than 10 gallons, and occur in February and March. Most of the spills have occurred to a pad area or containment and resulted in minor impacts with low intensity, short duration, and limited extent (GMT1 SIES, BLM, 2014).

4.6 Cumulative Impacts

The cumulative impact analysis considers impacts of a proposed action and its alternatives that may not be consequential when considered individually, but when combined with impacts of other actions, may be consequential (Council on Environmental Quality 1997b). As defined by Council on Environmental Quality regulations (40 CFR 1508.7 and 1508.25[a][2]), a cumulative impact is:

> …the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The purpose of this cumulative impacts analysis is to determine if the impacts of the actions considered in this supplemental EIS, together with other past, present, and reasonably foreseeable future actions, have the potential to interact or accumulate over time and space, either through repetition or combined with other impacts, and under what circumstances and to what degree they might accumulate.

4.6.1 Background

The cumulative impacts analyses described in BLM (2004, Section 4.G, pages 1233–1333), BLM (2008, Section 4.7, pages 4-631–4-929), BLM (2012, Section 4.8, pages 1–296), and Point Thomson EIS (U.S. Army Corps of Engineers 2012, Section 4.2, page 4-2) provide a broad cumulative impacts analysis of existing and potential oil and gas-related activities on the North Slope. The cumulative impacts analyses for this supplemental EIS begins by reviewing the cumulative impacts summary and conclusions in BLM (2004) and BLM (2012), followed by an identification and evaluation of changes (e.g., new actions, new data) relevant to analysis of cumulative impacts of developing the proposed GMT2 Project.

4.6.2 Methodology

This cumulative impacts analysis follows the methodology outlined in BLM (2014) and tiers to two previous analyses, although the overall scope of the analysis and project area are narrower. The analysis of cumulative impacts follows guidance provided in Considering Cumulative Effects under the National Environmental Policy Act (Council on Environmental Quality 1997b). The supplemental EIS will identify and describe actions—past, present, and future—that may impact the elements of the environment, including people, that may be impacted by the proposed project. These include not only the proposed project, but also actions undertaken by others within and outside the project study area. The supplemental EIS also provides the geographic and temporal scope of the analysis and addresses additive, synergistic, and countervailing impacts among the cumulative impacts.

This analysis involves the following steps:

- Define the time frame and geographic scope for each resource/issue analyzed in this supplemental EIS.
- Identify past present and future actions within the geographic area.
- Characterize response to changes and evaluate cause-and-effect relationships.

- Determine the magnitude of cumulative impacts from current conditions and if any thresholds of significance would be exceeded.

In this supplemental EIS, both the time period and geographic scope of the cumulative impacts analysis vary according to the resource/activity under consideration. Generally, the appropriate timeframe for cumulative impacts analysis spans from the 1970s through 2050 (through the duration of the proposed project). Geographic scope generally encompasses the Harrison Bay and Lower Colville River watersheds. Specific timeframe and geographic scope restrictions are located in Section 4.6.2.

- *Time Frame for Relevant Past and Reasonably Foreseeable Future Actions:* While relevant past projects date back to the 1940s, the general timeframe used in this cumulative impacts analysis reflects more recent oil and gas activities. Unless otherwise specified, the general timeframe ranges from the 1970s through the duration of the proposed project until roughly 2050. Projections of projects beyond this time frame (or 30 to 35 years) become speculative. Resource-specific time frames are presented in Table 4.6-2.
- *Geographic Area of Relevant Past and Reasonably Foreseeable Future Actions Actions:*
    - Unless otherwise specified, the geographic extent for the cumulative impacts analysis is limited to the Harrison Bay and the Lower Colville River Watersheds (see Map 4.6-1.).
    - Resource-specific geographic areas are presented in Sections 4.6.4, 4.6.9, and 4.6.10.
- *Impact Evaluation:* Unless specified otherwise, the impact criteria for magnitude (intensity), duration, context, and geographic extent described in Sections 4.2 and 4.3 are used for determining the cumulative impact analysis of each respective resource/activity (e.g., impact criteria and conclusions for vegetation and wetlands [Table 4.3-1] have been used in the cumulative impacts evaluation). The analysis also considers the interaction among the impacts of the proposed action with the impacts of various past, present, and reasonably foreseeable future actions as described below:
    - *Additive*; the impacts of actions add together to make up the cumulative impact.
    - *Countervailing*; the impacts balance or mitigate the impacts of other actions.
    - *Synergistic*; the impacts of the actions together is greater than the sum of their individual impacts.

Impacts from past, present, and reasonably foreseeable future actions within these timeframes and geographic areas were combined with those from GMT2 to determine if a threshold of significance would be exceeded. BLM considers mitigation and monitoring requirements to determine if these supplemental protective measures would avoid or minimize impacts.

Facilities with very small footprints such as the U.S. Geological Survey Fish Creek Meteorological Station located approximately 2.3 miles northwest of the GMT1 pad are expected to have a negligible contribution to cumulative impacts and are not included in the cumulative impacts analysis. Likewise, activities that have the potential to adversely impact paleontological and cultural resources are required to have professional inventories and reports filed with the appropriate agencies prior to starting the proposed action, including potential gravel sources, cross-country winter travel routes, ice road and ice pad locations, and temporary summer camps. These requirements provide assurances that adverse impacts to paleontological and cultural resources will be minimized, if not eliminated. Accordingly, paleontological and cultural resources are not discussed further.

The following cumulative impacts discussions use the same impact criteria discussed in Sections 4.2, 4.3, 4.4, and 4.5 of this supplemental EIS. Table 4.6-1 describes the time frame, geographic scope, and direct and indirect impacts of the proposed development.

Table 4.6-1. Summary of resource/issues time frame and geographic scope

Resource or Issue	Time Frame (through duration of proposed project	Geographic Scope
Terrestrial Environment	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Aquatic Environment	1940s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Soil Resources	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Atmospheric Environment	1970s through 2050	Nuiqsut area to North Slope
Noise	Intermittent from 1970s through 2050	The range of impact from noise depends on the source and atmospheric conditions; certain sources under certain conditions can be heard as far as 20 miles away; the geographic area for noise was set at 20 miles from the Arctic Slope Regional Corporation gravel pit and the Alpine Central Processing Facility airstrip
Vegetation and Wetlands	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Fish and Fish Habitat	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Birds	1970s through 2050	Species dependent, but would include distribution area of birds being analyzed
Terrestrial Mammals (caribou)	1970s through 2050	Species dependent, but would include distribution area of animals being analyzed
Marine Mammals	1970s through 2050	Beaufort Sea from Cape Halkett to Milne Point
Threatened and Endangered Species	1970s through 2050	Species dependent, but would include distribution area of animals being analyzed
Sociocultural Systems	1970s through 2050	North Slope communities, particularly Nuiqsut
Public Health	1970s through 2050	North Slope communities, particularly Nuiqsut
Economy	1970s through 2050	North Slope Borough and Arctic Slope Regional Corporation
Subsistence	1970s through 2050	Primarily the Nuiqsut Subsistence Use Area
Environmental Justice	1970s through 2050	Nuiqsut
Land Use and Ownership	2013 through 2050 (2013 Integrated Activity Plan/EIS is base year)	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Recreation	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) Watersheds
Visual Resources	1970s through 2050	Viewshed near development area
Transportation Systems	1970s through 2050	Harrison Bay and Lower Colville River (from Umiat north) watersheds and Umiat Road between Dalton Highway and Umiat
Oil, Saltwater and Hazardous Materials Spills	1940s through 2100	Harrison Bay and Lower Colville River (from Umiat north) Watersheds, and coastal regions

4.6.2.1 Assumptions

Key assumptions used for the cumulative impacts analysis in this supplemental EIS are:

- Development of the oil and gas resources of the GMT Unit is consistent with the Secretary of the Interior's most recent decisions to offer federal oil and gas leases in the NPR-A.
- As a stand-alone production facility in the GMT Unit, cumulative impacts from GMT2, including abandonment and final reclamation, would extend 30 to 50 years. Development and production at the Willow prospect requires GMT2 to be operational and would extend the period of some cumulative impacts at GMT2 for an additional period to coincide with abandonment and final reclamation at the conceptual Willow Development.
- BLM has approved a substantial number of winter exploration wells in the area known as the GMT Unit. Newly-identified and economically recoverable oil resources resulting from these or other future drilling projects in the GMT Unit may further extend the cumulative impacts of GMT2 based on BLM policy to minimize the number of permanent facilities such as gravel roads and elevated pipeline systems to the maximum extent practicable.
- Approval of a permit to drill at GMT2 would likely result in the transfer of selected land within the GMT2 Project area to the Kuukpik Corporation. Conveyance of surface ownership would also result in the transfer of associated mineral resources to Arctic Slope Regional Corporation.
- Alternatives A, B, and C would meet the purpose and need identified in Section 1.3.
- Alternative D would not meet the purposes and need identified in Section 1.3.
- Alternative D would deny the production of economically viable oil resources in the GMT Unit that are 8 to 16 miles from existing oil production and transportation facilities connected to the Trans-Alaska Pipeline System in the Prudhoe Bay area. Prohibiting a project in the GMT Unit that otherwise appears to meet the requirements contained in federal oil and gas leases, as amended in 2008, and the requirements of BLM (2013), may result in industry uncertainty and concern that proposed developments meeting the requirements of the lease and land use plans would be denied. This uncertainty could reduce industry interest in development on federally managed lands in the NPR-A.

4.6.2.2 Past, Present and Reasonably Foreseeable Future Actions

Table 4.6-2 summarizes projects to be considered in the cumulative impacts analysis within the Harrison Bay and Lower Colville River Watersheds for a period extending to about the year 2050. A discussion of activities outside the Harrison Bay and Lower Colville River Watersheds that may contribute to cumulative impacts follows the table.

Table 4.6-2. Past, Present and Reasonably Foreseeable Future Developments

Category	Production Unit/General Location	Project/Activity	Description	Past, Present, or Future Project [a]?	Approximate straight-line distance to Nuiqsut (miles)
Oil and Gas Exploration and Development	Colville River Unit	Alpine (CD1, CD2)	Exploratory wells first drilled in 1994. CD1 pad developed and produced first oil in 2000. Alpine development includes a central processing facility, an airstrip and 3 miles of gravel road. Total surface development 97 acres. Two drill pads with approximately 140 wells, connected to Kuparuk pipeline system by 34 miles of pipeline.	Present	8
		Qannik	Expansion of CD2 Drill Pad. 18 wells were added in 2007 - routine infill drilling ongoing	Future	8
		Fjord (CD3)	Drill pad with airstrip built 2005-2006. CD3 is not connected to other infrastructure via road and builds a yearly ice road.	Present	14
		Nanuq (CD4)	Existing drill pad with road built in 2005-2006	Present	5
		Alpine West (CD5)	Drill pad constructed in 2014, currently in drilling phase. 6 miles of road and four bridges. Connected by pipeline to Alpine Facility	Future	8
		Fjord West (CD2, CD3, CD5)	This reservoir will be accessed from CD2, CD3, and CD5 with drilling expected to begin from CD2 in Q1 2020. Up to 32 wells will be added to CD2 via a 5.8 acre gravel pad expansion - routine infill drilling	Future	8 (from CD2)
	Greater Mooses Tooth Unit	GMT1 (CD6)	12 acre drill pad, 33 wells to be drilled from 2019-2022. Project includes a 7.6 mile road from CD5 to GMT1 drill pad	Future	12
		Rendezvous	Exploratory wells - discovery wells for GMT2 development, drilled in 2000	Past	16
		Tinmiaq/Willow	2 exploratory wells in 2016, 4 exploratory wells planned for 2018 and may do additional appraisal wells in 2019. Unspecified development plans, including whether or not to have a production facility. Estimated 300M barrel oil find	Present/Future	27

Category	Production Unit/General Location	Project/Activity	Description	Past, Present, or Future Project [a]?	Approximate straight-line distance to Nuiqsut (miles)
Oil and Gas Exploration and Development	Kuparuk River Unit	Meltwater	Exploratory well that became drill site 2P in 2001, currently has 15 wells drilled.	Present	17
		Palm (Drill Site 3S)	Exploratory well that became drill site 3S in 2002, now in production	Present/Future	23
		Tarn	Exploratory wells that became drill sites 2L and 2N in 1998, now in production	Present	17
		Kuparuk	3 central processing facilities, a seawater treatment plant, 47 eleven-acre drill pads with over 1,150 wells. Approximately 520 acres of surface development. Originally built from 1979-1981, production is ongoing and more development is planned.	Present/Future	28 (from CPF2)
		Tabasco	This reservoir is being accessed from drill site 2T, which started production in 1998. Currently producing	Present	25
		Shark Tooth (Drill Site 2S)	New gravel pad with up to 24 wells, new powerlines and pipeline and 14 new wells drilled on existing pad. Construction began in 2014, facility currently in production.	Present	20
		West Sak/NE West Sak	Drill site 1H expanded by 9 acres to accommodate 18 additional wells, drilling will commence in Q3 2017 and will last approximately a year and a half - routine infill drilling	Present/Future	35
	Bear Tooth Unit	Cassin	2 exploratory wells drilled in 2013. Currently being evaluated for development potential	Present/Future	29
	Pikka Unit	Qugruk	Three existing exploration wells drilled in 2013	Present	18
		Nanushuk	Proposed project scheduled to begin construction in 2018. Project includes 3 drill pads with 78 wells, 1 operations pad and CPF. Project includes 25 miles of gravel road and 4 pads totaling 288 acres of gravel fill. Estimated project life 30 years	Future	12
	Ooguruk Unit	Oooguruk	6-acre gravel island with 40 wells constructed in 2007-2008, ongoing development drilling. Project connected to onshore infrastructure via subsea flowline bundle connected to onshore tie in pad connected to Kuparuk. Estimated project life 30 years (2038)	Present/Future	26

Category	Production Unit/General Location	Project/Activity	Description	Past, Present, or Future Project [a]?	Approximate straight-line distance to Nuiqsut (miles)
Oil and Gas Exploration and Development	Ooguruk Unit	Nuna	Planned onshore well pads that will tie into Kuparuk infrastructure. Two well pads are planned, one has been constructed. Project will have associated roads and pipelines. Start date 2018 or later.	Future	22
	Placer Unit	Placer	3 exploration wells drilled in 2016, unspecified future development plans	Present/Future	17
	Southern Miluveach Unit	Mustang	Exploratory well, plans to develop on hold pending additional investors. Mustang will include up to 11 production wells, 20 re-injection wells, and an operations camp. Start date TBD, company looking for investors.	Present/Future	17
	Nikaitchuq Unit	Eni Nikaitchuq	Two drill pads with 52 planned wells. One pad onshore at Oliktok Point and one pad on 11 acre artificial gravel island (Spy Island) pads connected by 3.8 mile underwater pipe bundle. Construction began in 2008, 23 wells have been drilled to date. Project currently in production with further drilling planned in 2017. Estimated project life 30 years (2041)	Present/Future	36
	No Unit	Pipeline from Smith Bay	Potential pipeline route to cross impact zone, unknown project start date	Future	
	No Unit	Stony Hill	Exploratory well planned for 2018 located approximately 7.5 miles SSW of Nuiqsut	Future	7.5
	No Unit	Putu	Proposed exploratory wells located in the vicinity of Nuiqsut, delayed until 2018	Present	5
	No Unit	Horseshoe	Exploratory wells drilled in 2017, unspecified plans to develop resources	Present/Future	12
	Various Locations	Seismic Exploration	Seismic surveys will occur in multiple locations within the cumulative effects area boundary	Future	N/A
Transportation	Community of Nuiqsut	Colville River Access Road	Proposed gravel road from water source lake to Colville River. Road permitted in 2016.	Future	Within Community
		Nuiqsut Airport	Single runway airport with 4,589 ft x 100 ft gravel runway built in 1983. Proposed extension and paving of runway under consideration, no start date identified.	Present/Future	Within Community
		Intra-village roads	Gravel road system located within Nuiqsut, including access to landfill and water source lake, totaling approximately 10 miles	Present	Within Community

Category	Production Unit/General Location	Project/Activity	Description	Past, Present, or Future Project [a]?	Approximate straight-line distance to Nuiqsut (miles)
Transportation	Community of Nuiqsut	Nuiqsut Spur Road	Existing gravel road from Nuiqsut to CD5 Access Road built in 2014	Present	Within Community
Gravel Mines	Vicinity of Nuiqsut	ASRC Mine Site	Active gravel mine with planned expansion. Expansion proposing 300+ additional acres of mining beginning in 2018 is currently under consideration at USASCE	Present/Future	4.5
Utilities	Community of Nuiqsut	Nuiqsut City Powerplant	Pipeline from Alpine CPF to community of Nuiqsut built in 2009, includes six generators	Present	Within Community
	Community of Nuiqsut	Nuiqsut Landfill	Built in 1986 with four cells, the landfill currently operates with three cells. The landfill facility includes a salvage area, burn cage, septic tank/honey bucket lagoon, and a used drum storage area.	Present	Within Community

[a] Past = a project that is no longer in operation, but whose impacts are still felt in the environment and will overlap in time and space with the impacts of GMT2. Present = a project that is currently in operation, whose impacts will overlap with GMT2. Future = a reasonably foreseeable future project, defined as a project for which there is an existing proposal, a project currently in the NEPA process, or a project to which a commitment of resources (such as funding) has been made.

Other Activities That May Contribute to Cumulative Impacts

In addition to projects that are physically located in the Lower Colville River and Harrison Bay watersheds, there are several projects whose impacts may overlap with GMT2 that are located outside this geographic area.

Liberty Project

The proposed Liberty Oil and Gas Development Project is currently in the NEPA process and is being analyzed by the Bureau of Ocean Energy Management. Liberty is located approximately 20 miles east of Prudhoe Bay and inland of the Beaufort Sea's barrier islands. The Liberty Project will have overlapping impacts with the GMT2 Project in three areas: social impacts to the community of Nuiqsut due to participation in multiple simultaneous NEPA processes, overlapping impacts to overall subsistence uses, and greenhouse gas emissions contributing to global climate change.

Alaska Stand Alone Pipeline

The Alaska Stand Alone Pipeline project is a proposed natural gas pipeline that would follow the Trans-Alaska Pipeline System from the gas conditioning facility in Prudhoe Bay south to a connection with the existing ENSTAR natural gas pipeline system in the Matanuska-Susitna Borough. The physical impacts of the conceptual Alaska Stand Alone Pipeline Project are unlikely to overlap with GMT2 (with the exception of greenhouse gas emissions contributing to global climate change), but the social impacts associated with the community of Nuiqsut's participation in a parallel NEPA process will overlap and be additive to the impacts of the GMT2 NEPA process.

Leasing Program for the Coastal Plain of the Arctic National Wildlife Refuge

Title II of the Tax Cuts and Jobs Act of 2017 (Tax Act), directs the Secretary of the Interior, acting through the Bureau of Land Management, to establish and administer a competitive oil and gas program for the leasing, development, production and transportation of oil and gas in and from the Coastal Plain of the Arctic National Wildlife Refuge (Tax Act section 20001(b)(2)(A)). The Tax Act amended the Alaska National Interest Lands Conservation Act section 303(2), which established the Arctic National Wildlife Refuge, by adding an additional purpose to "provide for an oil and gas program on the Coastal Plain." Oil and gas leasing in the Coastal Plain of the Arctic National Wildlife Refuge is reasonably foreseeable; however, its impacts will not overlap geographically with the projected impacts of the GMT2 Project. The leasing plan has therefore not been considered in the evaluation of cumulative impacts.

4.6.3 Cumulative Impacts to the Terrestrial Environment

The evaluations in this section describe the direct and indirect effects of gravel fill and gravel mining on cumulative effects evaluations from past, present and reasonably foreseeable future projects for physiography, soil, and permafrost (Section 4.2.1). The impact criteria would be the same as described in Section 4.2.1. As noted above in Section 4.6.2 impacts to paleontological resources are not expected to occur and as a result are not discussed further.

Additive cumulative effects have occurred from some 40 years of construction activity in the area (including the Native Village of Nuiqsut); maintenance and abandonment of military sites along the coast; development, use, and abandonment of Legacy Wells in the NPR-A; and oil and gas development at Kuparuk, Alpine, and Umiat (including gravel footprint from extraction and construction and winter exploration activity). Future impacts could include pipelines and infrastructure to support oil development off the coast of Alaska as well as reasonably foreseeable future projects in the NPR-A. Cumulatively (including the Native Village of Nuiqsut, Military Development, Legacy Wells, Kuparuk, Alpine, Umiat, Umiat Road and Pipeline.), the footprint is approximately 10,200 acres.

The cumulative impacts from the proposed project to the physiography, soil, and permafrost of the area would be directly related to the construction materials needed for production of oil from the GMT2 site. Gravel would be mined from the existing Arctic Slope Regional Corporation Mine site, which would result in an incremental cumulative impact as the mine site is expanded to meet the gravel demand for the GMT2 Project. Demand for gravel for future developments may utilize the undeveloped Clover potential gravel source; however, no project that is currently under construction or reasonably foreseeable will utilize gravel from the Clover source.

The GMT2 site, in combination with existing gravel footprints and footprints of developments in permitting total approximately 23,000 acres, which represents 0.5 percent of the geographic extent of this analysis. The potential for future impact to the existing physiography, soil, permafrost regimes and to petroleum resources are recognized and cannot be quantified at this time; therefore, analysis of potential future impacts are not included for the approximately 23,000 acres described above. Likewise, the potential remediation/reclamation of former Military Sites and Legacy Wells would have a countervailing impact due to uncertainty of federal funding availability and the relative priority and timing of site cleanup, when compared to similar sites across the North Slope and Alaska.

The duration of the impacts ranges is short term (1 to several years) if the vegetation is disturbed and up to several decades if the soils are destroyed. Incremental impacts of the proposed project would be small (approximately 2 to 3 percent) when compared to past, present, and future development. While soils and permafrost impacts are additive, the total and incremental amount of disturbed area is small compared to the total resource within the North Slope region and is not considered to be cumulatively significant (BLM 2004, Section 4G.5.3). The short-term impacts are expected to diminish after a few years, with the long-term impact estimated to be about 3 percent of the original footprint regardless of the alternative (BLM 2012, Section 4.8.7.3). The long-term impact resulting from the fugitive dust that roads and pads may contribute to the increased rate of permafrost degradation, which may adversely affect the stability of the gravel fills overtime. Effects would be localized, long term, and potentially major. More gravel and reconstruction may be necessary over the life of project. The decrease in albedo may cause higher temperatures and increase thaw rates.

If global climate change persists, the cumulative effects 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. Since there is great depth of the permafrost on the North Slope it would take several decades of warming at the predicted rate before it would transition into discontinuous permafrost. However, if the permafrost continues to warm, its ability to support structures would diminish, which could affect development on the North Slope. Thicker gravel may be needed to support structures, and abandoned work pads and roads could become unusable as they are cut up by deep polygonal troughs over thawing ice wedges, or by other thermokarst degradation (BLM 2012, Section 4.8.7.3).

Overall cumulative impacts to the physiography, soil, permafrost, and geology resources would be minor, site specific, and long term. Projects near proposed new access would have an additive effect. Cumulative impacts to petroleum resources would be major due to depletion, although primarily limited to the GMT Unit. Alternative D would not have any disturbance to physiography, soil, permafrost, and geology.

Reasonably foreseeable future development would increase the direct footprint of gravel fill and gravel mining for all projects (oil and gas and non-oil and gas); these impacts would likely be concentrated along the coast between the Canning River and westward into the NPR-A. The north-south Dalton Highway and Trans-Alaska Pipeline System also supports oil and gas development on the North Slope by providing direct access to the rest of Alaska and other markets. A natural gas pipeline system would be located in the vicinity of both the Dalton Highway and Trans-Alaska Pipeline System. Overall impacts to the landscape would be minor, site specific, and long lasting, depending on the relationship of a reasonably foreseeable future development for projects near existing or proposed new access.

The proposed action is consistent with the provisions of the federal oil and gas leases in the project area, and the land use plan approved in BLM (2013). Overall, the direct and indirect impacts to physiography, and geology, other than petroleum and gravel resources, are predicted to be of moderate intensity and long term in duration, but of local extent. Because the resources are common as defined in the impact criteria, the overall direct and indirect impacts are characterized as minor for all action alternatives. The cumulative effect of Alternative D would incur no incremental impacts to gravel or other geologic resources. Petroleum resource impacts would be major across the action alternatives.

4.6.4 Cumulative Impacts to Water Resources

Cumulative impacts to water resources and water quality from oil and gas exploration, development, and production in the NPR-A and across the North Slope would result from: (1) thermokarst from damaged vegetation and streambanks; (2) water withdrawals from lakes; (3) disruption of natural flows by roads, pads, and river crossing structures; (4) gravel mining; and (5) spills. Cumulative impacts to water resources in the project area are discussed more fully in BLM (2004a, Section 4G.5.6 and Section 4G.5.7) and BLM (2012, Section 4.8.7.4).

4.6.4.1 Past and Present Impacts and Their Accumulation

Approximately 2,500 acres of direct land surface disturbance from non-oil and gas activities have impacted water bodies and drainage patterns (BLM 2012, 4.7.8.4). Scientific excavations; temporary tent camps; overland moves by transport vehicles; aircraft landings, and use of gravel strips; boats; use of off-highway vehicles such as four-wheel vehicles and snowmachines; hazardous material or debris removal; legacy well plugging; and small fuel spills; all have the potential to impact water resources and quality. These impacts are usually localized and result in short-term impacts for up to a few years. Large amounts of debris were left on the North Slope from exploration and military activities from 1940 to 1970 that impacted water quality, but cleanup efforts since the 1970s have removed some of the remaining debris.

Through 2011, oil and gas activities have caused approximately 18,400 acres of direct impacts to lands on the North Slope, and indirect impacts to water resources may have occurred on another 18,400 acres. These impacts to water resources are likely to persist for several decades or more. Water withdrawals are required for all oil field operations. Permit regulations have maintained water quality and quantity in lakes as natural recharge processes have been sufficient to recharge the lakes each year.

Through 2011, over 9,500 acres of gravel pads and roads were constructed in association with oil-field development on the North Slope. Inadequate design and placement of structures, culverts, or bridges have caused impoundments, streambank erosion, scour, and sedimentation at stream crossings. This has altered natural sediment transport and deposition, creating scour holes or channel bars. Several spills have occurred on the North Slope, but their impacts have been minor and have likely not accumulated. Effects of discharges from offshore facilities and subsurface injection of drilling wastes are largely unknown, but likely have had little cumulative effect on water quality on the North Slope.

4.6.4.2 Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The BLM (2004a; 2012) concluded non-oil and gas activities such as construction of roads and pads at villages could impact water bodies and drainage patterns, but would be minor due to the slow growth (2 percent annually) of the communities. Water to support the cleanup of abandoned military sites and Legacy Wells would likely come from the same lakes used originally. None of these water supply lakes are associated with the construction and operations of the GMT2 Project or with other reasonably foreseeable demand for water in the Nuiqsut area.

A large amount of debris was left on the North Slope from Legacy Well exploration and military activities from 1940 to 1970 that impacted water quality, but on-going cleanup efforts since the 1970s have removed some of the remaining debris. BLM has assessed the condition of the U.S. Geological Survey Legacy Wells and embarked on a program to plug and abandon those wells that pose risks.

Between 2002 and 2013, the BLM had plugged 18 of 19 wells identified to pose a potential risk to the environment. A detailed assessment of the Legacy Wells was made in 2013 and identified 50 additional wells needing remediation. This assessment can be found in the BLM National Petroleum Reserve in Alaska: 2013 Legacy Wells Summary Report (BLM 2013b). These and other remediation and reclamation projects in the Harrison Bay and Lower Colville River Watersheds would have a cumulative, long-term, countervailing, and local impact to water quality.

Oil and Gas Exploration and Development Activities

The BLM (2012) analyzed potential cumulative impacts on water resources and water quality from oil and gas development in the Beaufort Sea offshore leases, construction of a commercial gas pipeline, and unconventional oil and gas development east of the NPR-A. Large discoveries of oil in the Chukchi or Beaufort Seas offshore could make additional developments in the northern NPR-A more economically feasible, resulting synergistically in even more impacts in the NPR-A. In general, all action alternatives, present and reasonably foreseeable future projects have the potential for long-term cumulative impacts to local water resources resulting from the placement of new infrastructure. During most winters, ice roads are constructed between staging areas in the Kuparuk River Unit to locations within the NPR-A as far as the Utqiagvik (formerly Barrow) area. Water needed for construction of CD5 was available and has been permitted. Generally, oil and gas development in the project area will have impacts on local water resources from sedimentation, water withdrawal, and altered drainage patterns. As described in BLM (2014), impacts to water resources from GMT1 will include localized impacts such as increased inundation levels and impacts from the Tinmiaqsigvik (Ublutuoch River) bridge. Improper siting of gravel mine sites could result in changes to the configuration of stream channels, stream flow hydraulics or lake dynamics, erosion and sedimentation. Gravel removal for roads and pads has resulted in over 6,400 acres of surface impacts through 2011, with 4,550 acres rehabilitated by conversion into functional habitat for plants and animals and possible fish habitat (BLM 2012, Section 4.8.7.4, page 91). The Clover site and other gravel sources may be required as development moves west and greater distances from the Arctic Slope Regional Corporation Mine site near Nuiqsut. Gravel mining for oil and gas development is projected to account for a total of 10,950 acres by the year 2100 (Table 4.6-2).

The BLM (2012) determined that some lakes were being pumped annually along primary transportation routes until development commenced. If lakes do not fully recharge or have water quality changes, future withdrawals may be conditional upon permit stipulations. It is possible that if water is drawn from a majority of lakes in a concentrated area, this could affect the surface flow regime of an area (BLM 2012, Section 4.8.7.4, page 94).

Seismic and overland travel (including non-oil and gas activities) could result in thermokarst erosion with associated increases in turbidity of adjacent water bodies. The BLM (2004a) determined that construction of gravel roads and pads, road crossing structures and removal of gravel from riverine pools could affect water flow and result in subsequent melting of permafrost (thermokarst) and induce changes to stream morphology (BLM 2004a, Section 4G.5.6).

Dust deposition along roads can increase turbidity of adjacent water bodies. Snowdrifts along gravel and building structures can increase wintertime soil surface temperatures and result in increased thaw depths, contributing to thermokarsting (BLM 2012, Section 4.8.7.4, page 91). These impacts would be considered additive, but local, long term, and minor in effect.

Inadequate design and placement of structures, culverts, or bridges and unbreached or slotted ice bridges could cause impoundments, streambank erosion, and scour and sedimentation at stream crossings, thereby altering natural sediment transport and deposition, and creating scour holes or channel bars. Up to 1,106 miles of roadways are projected for maximum development within the NPR-A (BLM 2012). A total of 55,895 acres of direct impacts are projected to occur through 2100 (Table 4.6-2). To date, very little abandonment of large-scale projects (except for single exploration or development wells) has occurred anywhere on the North Slope. However, abandonment of gravel pads and roads, as well as pipelines, would most likely only have a temporary impact on local aquatic habitats. Removal of problematic stream crossing structures would contribute to positive cumulative impacts on water resources by allowing for a return to the previous hydrological regime.

Spills from GMT2 and other oil and gas developments on marine or estuarine waters or along streams draining into such water bodies could impact those waters (Section 4.5). The extent of such contamination would be related to the size, nature, and timing of the spill. Because spill frequency and volume are expected to be low, the cumulative impact from oil spills is not considered to be an additive cumulative impact. If a large (500- to 900-barrels) spill were to occur during the ice-covered season, the impacts would be minor. If it were to happen during the open-water or broken-ice seasons, hydrocarbons dispersed in the shallow estuarine water column could exceed acute-toxic criteria during the initial spill period, but would be short term and localized (BLM 2004a, Section 4G.5.7). Spills have occurred on the North Slope, but their impacts have been minor and have not accumulated.

Contribution of the Alternatives to Cumulative Impacts

Cumulative impacts to water resources tend to be proportional to the amount of area impacted by infrastructure, with modifications due to specific activities and locations. Cumulative impacts to water resources from gravel roads and pads and gravel mines would generally be proportional to the number of acres developed in a nature that disrupts the hydrologic regime.

On a watershed level, cumulative water resource impacts are related to alterations in the drainage pattern, and to a lesser degree stream flow. GMT2 would have similar, though potentially fewer impacts, than GMT1, which would be additive (BLM 2014, Section 4.6.5). Alternatives A and B have a greater potential for cumulative impacts to drainage patterns due to the long linear gravel access road installation.

The BLM (2004a) analyzed the potential cumulative impacts of the project to water resources and water quality (BLM 2004a, Section 4G.5.6–4G.5.7). It predicted that no cumulative impact to North Slope water supplies from withdrawal of water for construction and operation would occur because the annual yield (runoff and refill of lakes) is many times greater than the amount withdrawn.

Erosion, sedimentation, and stream flow are impacts to water quality that may be sustained to a lesser extent, as a result of road construction, stream crossings, and culverts. Sustained periods of these impacts are not expected to have significant cumulative impacts on a watershed level under any of the action alternatives. These impacts would be additive to other reasonably foreseeable future projects impacts that may be developed.

The primary change in project components of Alternative C with potential to alter the degree of cumulative hydrological impacts is the reduction in the total length of new roads, and the construction of an airstrip. Despite the elimination of the GMT1–GMT2 Access Road which parallels the pipeline, the new gravel footprint is larger than Alternatives A and B due to the addition of the airstrip and occupied structure pad, and the increase in pad size to support a remote, self-sufficient camp and drilling operation.

The gravel footprint of the 5,000-foot airstrip under Alternative C is expected to have minor impacts to the localized drainage pattern.

The 5,000-foot airstrip and associated GMT2 pad and occupied structure pad under Alternative C would not cross any major drainages or streams. To minimize surface water ponding adjacent to the gravel embankments, the gravel surface may need to be contoured to direct surface water runoff (from precipitation and snow melt) to the down-gradient edges of the pad. The width of the pads and airstrip are too large to traverse with culverts. If ponds develop, runoff may need to be routed along the edges of the airstrip and pads. Over the compacted gravel surface there will be less infiltration of precipitation which may reduce the recharge of shallow groundwater in the immediate area. However, this impact will be localized and of low intensity.

Water withdrawal from lakes to support construction of ice roads and activities would be temporary under Alternatives A and B, and is not expected to result in cumulative impact to water resources. Naturally occurring seasonal water recharge occurs at a rate sufficient to offset withdrawal volumes if best management practices and state permit requirements are adhered to as directed. Cumulative impacts to water withdrawal sources and recharge functions are not expected.

Alternative C would require significantly more water withdrawal from local lakes to support summer and winter drilling during the non-winter months when ice road access to Alpine Processing Facility would not be possible. Under Alternative C there are more ice road miles during the construction phase, and also a need for annual ice roads during the operation phase (production). Therefore, impacts of ice roads under Alternative C would be greater and of longer duration compared to the other action alternatives. If reasonably foreseeable future roadless projects were developed, similar impacts would be additive. The impacts to rivers and drainage basins under Alternative C would be less than those for the other action alternatives.

In comparison to the other action alternatives during the operation period, Alternative C could result in higher spill risk due to increased activity with aircraft operations and year-round living accommodations. Overall, it is expected that the combination of lakes in the vicinity of Nuiqsut will continue to meet demand for existing and reasonably foreseeable future demand for water to construct ice roads and pads, exploration drilling and for GMT2, as well as for potable water supply. Further, it is expected that existing mitigation requirements (e.g., BLM best management practices and stipulations and State and North Slope Borough permitting conditions) will avoid or minimize impacts to fish and fish habitat due to water withdrawal. Alternative D (no action) would result in no change from the current baseline conditions.

4.6.4.3 Conclusion

Impacts to water resources and water quality from GMT2 would be additive to past, present, and reasonably foreseeable future action impacts on the North Slope. The majority of the impacts would result from oil and gas development activities, with construction of roads, permanent pads, stream-crossing structures, and water use from lakes during the winter months being the major contributors. These impacts tend to be proportional to the amount of area impacted by infrastructure, with modifications due to specific activities and locations. All of these activities involve construction of infrastructure that would affect water quality through dust, impoundments, changes in natural drainage patterns, snow drifting, and oil, seawater or produced water spills. These impacts would be long-term and would accumulate. 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. Alternative D (no action) would result in no change from the current baseline conditions.

BLM (2012, Section 4.8.7) concluded that climate change may increase particulate matter (fugitive dust, byproducts of combustion, and evaporation of hydrocarbons) to the extent shallow lakes and ponds dry up or become 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.

4.6.5 Cumulative Impacts to Air Quality

A cumulative air quality assessment should account for air emissions from nearby existing sources and reasonably foreseeable developments that are not yet built, and therefore are not included in the background ambient air quality data. A cumulative impacts analysis was performed to assess the impact on air quality and air quality related values at the sensitive Class II areas from the proposed GMT2 Project as well as existing and reasonably foreseeable development sources. The sources evaluated in the cumulative impacts analysis for the prior GMT1 study (BLM 2013) and this GMT2 supplemental EIS are presented in Table 4.6-3.

Table 4.6-3. Reasonably foreseeable development sources included in GMT1 and GMT2 cumulative impacts analysis

Reasonably Foreseeable Development Source	Evaluated in GMT1?	Evaluated in GMT2?
ConocoPhillips GMT1	No	Yes
ConocoPhillips GMT2	Yes	No
Shell Discoverer Camden Bay	Yes	No
Eni Nikaitchuq Development	Yes	Yes
TDX Deadhorse Power Plant	Yes	Yes
Pioneer Oooguruk Development	Yes	Yes
Brooks Range Petroleum North Shore	Yes	No
ConocoPhillips Alpine CD5	Yes	Yes
ExxonMobil Point Thomson Facility	Yes	Yes
Brooks Range Petroleum Mustang	Yes	Yes
BPXA Liberty	Yes	Yes
Nanushuk Pad (proposed)	No	Yes
Nanushuk Drill Site 2 (proposed)	No	Yes
Nanushuk Drill Site 3 (proposed)	No	Yes
Nanushuk Operations Center (proposed)	No	Yes

The cumulative impacts analysis was performed using a tiering (scaling) approach based on the GMT1 far-field modeling data and results and the GMT2 supplemental EIS emissions. The difference in the magnitude of emissions presented for each pollutant from GMT2 and reasonably foreseeable development sources, between the GMT1 study and now, was used along with the results from the GMT1 far-field modeling to estimate GMT2 and cumulative far-field impacts by scaling the GMT1 results by the ratio of the cumulative emissions in the GMT2 and GMT1 studies. Results from the tiering were then compared with the regulatory standards and air quality-related value thresholds relevant to this project.

The total emission rates for each pollutant were compared and a ratio (R) was calculated using the following equation: Ratio (R) = (total emissions from all sources in GMT2 study) divided by (total emissions from all sources in GMT1 modeling). Because NO_x and SO_2 emissions also contribute to PM formation, the tiering ratio for daily PM_{10} was determined using the sum ("Q") of daily PM_{10}, hourly NO_X and hourly SO_2 emissions. A similar approach was used for the $PM_{2.5}$ scaling ratio. Additional information on the cumulative scaling analysis performed may be found in the GMT2 far-field air quality impacts analysis (Ramboll Environ and Kleinfelder 2017).

Table 4.6-4 presents the ratios calculated and used for the tiering analysis for each pollutant and the emission rates used to calculate the ratio. The Q value shown here equals the sum of hourly NO_x, hourly SO_2, and daily PM_{10}, all in units of grams per second.

Table 4.6-4. Tiering analysis calculated ratios

Emission Source	NO_x Hourly Emission Rate (g/sec)	NO_x Annual Emission Rate (g/sec)	SO_2 Hourly Emission Rate (g/sec)	SO_2 Annual Emission Rate (g/sec)	PM_{10} Daily Tiering Value (g/sec)	$PM_{2.5}$ Daily Tiering Value (g/sec)	$PM_{2.5}$ Annual Tiering Value (g/sec)	Q Value (g/sec)
GMT1	243.41	243.41	14.55	14.55	14.77	13.96	13.96	272.73
GMT2	219.49	217.76	24.96	21.46	37.30	33.41	11.26	281.75
Ratio (R)	0.90	0.89	1.72	1.48	2.53	2.39	0.81	1.03

The maximum predicted impacts from the cumulative far-field modeling performed for GMT1 and existing and reasonably foreseeable development sources identified in that study (AECOM 2014) were scaled using the ratio (R) values presented in Table 4.6-4 to predict maximum impacts from the proposed GMT2 Project plus existing and reasonably foreseeable development sources. For example, 1-hour NO_2 maximum predicted impacts from the GMT1 far-field modeling (72 µg/m3, from Table 3-1 in AECOM 2014) was multiplied by the NO_2 hourly emission rate ratio of 0.90 to obtain a maximum predicted impact of 65 µg/m3 for 1-hour NO_2 for the GMT2 far-field modeling.

Results of the tiering analysis are presented in Table 4.6-5 and Table 4.6-6 for the Arctic National Wildlife Refuge and Gates of the Arctic National Park and Preserve, respectively, and demonstrate that cumulative impacts from GMT2 and existing reasonably foreseeable development sources will not adversely impact air quality at the two sensitive Class II areas. There are no exceedances of the Class II prevention of significant deterioration increments or National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards for either sensitive Class II area.

Table 4.6-5. Cumulative air quality impacts at Alaska National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Class II Increment (µg/m^3)	Over Increment?	Ambient Background (µg/m^3)	Total Concentration (µg/m^3)	NAAQS/ AAAQS (µg/m^3)	Over NAAQS/ AAAQS?
NO_2	1-hour	65	--	--	41.9	106.9	188	No
NO_2	Annual	0.21	25	No	3.8	4.0	100	No
SO_2	1-hour	2.9	--	--	5.9	8.8	196	No
SO_2	3-hour	1.7	512	No	6.2	7.9	1,300	No
SO_2	24-hour	0.62	91	No	4.8	5.4	365	No
SO_2	Annual	0.024	20	No	0.003	0.027	80	No
PM_{10}	24-hour	2.38	30	No	45.2	47.6	150	No
$PM_{2.5}$	24-hour	2.30	9	No	7.3	9.6	35	No
$PM_{2.5}$	Annual	0.123	4	No	2.1	2.2	12	No

Table 4.6-6. Cumulative air quality impacts at Gates of the Arctic

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	Over Increment?	Ambient Background ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS/ AAAQS ($\mu g/m^3$)	Over NAAQS/ AAAQS?
NO_2	1-hour	0.38	--	--	41.9	42.3	188	No
NO_2	Annual	0.0021	25	No	3.8	3.8	100	No
SO_2	1-hour	0.12	--	--	5.9	6.0	196	No
SO_2	3-hour	0.10	512	No	6.2	6.3	1,300	No
SO_2	24-hour	0.051	91	No	4.8	4.9	365	No
SO_2	Annual	0.0015	20	No	0.003	0.005	80	No
PM_{10}	24-hour	0.38	30	No	45.2	45.6	150	No
$PM_{2.5}$	24-hour	0.38	9	No	7.3	7.7	35	No
$PM_{2.5}$	Annual	0.020	4	No	2.1	2.1	12	No

The Q tiering ratio was used to scale the visibility impacts from the GMT1 far-field cumulative analysis to get an approximate measure of the GMT2 cumulative visibility impacts. The scaled 98th percentile Δdv for each year is presented in Table 4.6-7. Cumulative visibility impacts are small.

Table 4.6-7. Cumulative visibility impacts

Class II Area	98th Percentile Δdv 2007	98th Percentile Δdv 2008	98th Percentile Δdv 2009
Arctic National Wildlife Refuge	4.35	3.85	4.66
Gates of the Arctic National Park and Preserve	0.77	0.70	1.05

The hourly NO_x and SO_2 emission tiering ratios were used to scale the GMT1 far-field cumulative deposition impacts. The results of the scaling for cumulative nitrogen and sulfur deposition impacts are presented in Table 4.6-8. The estimated impacts for nitrogen deposition from the GMT2 Project and reasonably foreseeable development sources combined are well below the range of critical loads for deposition shown in Table 3.2-10. The estimated cumulative impacts for nitrogen deposition including the existing (measured) nitrogen deposition of 0.94 kg/ha-yr at Gates of the Arctic National Park and Preserve shown in Table 3.2-10 are also below the range of critical loads.

Table 4.6-8. Cumulative deposition impacts

Class II Area	Pollutant	Averaging Period	Maximum Impact Due to Project Reasonably Foreseeable Development Sources (kg/ha-yr)	Critical Load Range (kg/ha-yr)	Below/ Within/ Above Range?
Arctic National Wildlife Refuge	Nitrogen	Annual	0.025	1–3	Below
Gates of the Arctic National Park and Preserve	Nitrogen	Annual	0.004	1–3	Below
Arctic National Wildlife Refuge	Sulfur	Annual	0.006	-	-
Gates of the Arctic National Park and Preserve	Sulfur	Annual	0.001	-	-

4.6.5.1 Summary of Cumulative Air Quality Impacts

Potential cumulative air quality impacts from GMT2 and nearby existing sources plus reasonably foreseeable development sources that are not yet built, and therefore, not included in the background ambient air quality data were evaluated. The cumulative impact analysis tiered off of the GMT1 cumulative analysis using the ratio of emissions between GMT2 study cumulative emissions to GMT1 study cumulative emissions. Changes in cumulative emissions between GMT2 and GMT1 are due to differences in project emissions, updates to existing source emissions, and changes in anticipated reasonably foreseeable development emissions. The potential cumulative impact of GMT2 plus existing and reasonably foreseeable development source emissions are estimated to be less than the National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards and other available evaluation thresholds.

4.6.6 Cumulative Impacts of Noise

Cumulative impacts of noise on the acoustical environment, wildlife, and people in the project area are attributable to operation of motorized vehicles, boats, and aircraft; use of mechanical equipment; use of firearms; and mine blasting. These noise sources and associated impacts result from activities associated with oil and gas exploration and development, as well as from a range of activities not associated with oil and gas development.

4.6.6.1 Past and Present Impacts and Their Accumulation

Unlike many of the resources and impact issues considered in this supplemental EIS, data characterizing past and present noise levels in the GMT2 Project area and across the North Slope are relatively lacking. The 2016 PAM study (Stinchcomb and Brinkman, *unpublished data*; see Section 3.2.3.3 and Appendix C) focused on aircraft noise, included only four sites in the project area, and was of short duration. Three sites in the project area were among the four sites overall where noise sources other than aircraft contributed to recorded noise levels. This is to be expected, given the study site locations in proximity to existing development activities. But this result also indicates that in most of the study area beyond the GMT2 Project area, aircraft noise was the dominant form of noise. Aircraft noise was especially common at three of the sites in the project area (the fourth site was monitored only for 5 days), with median and maximum numbers of daily aircraft noise events among the highest found in the entire study with the exception of Umiat.

4.6.6.2 Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Future construction and operation of transportation infrastructure and planned expansion of the Arctic Slope Regional Corporation gravel mine are foreseeable future actions that will generate noise and contribute to the overall accumulation of noise impacts in and around the GMT2 Project area. These activities are not associated directly with oil and gas exploration and development, although they may be affected by them.

Oil and Gas Exploration and Development Activities

Foreseeable future oil and gas exploration and development activities on the North Slope will contribute to the accumulation of noise impacts in the region. Operation of motorized vehicles and aircraft for transportation of personnel and material; operation of motorized equipment for aspects of exploration, development, and production; and oil-and-gas-related mine operations will contribute to greater geographic extent, frequency of occurrence, and overall accumulation of noise impacts.

Contribution of the Alternatives to Cumulative Impacts

For the action alternatives, impacts from noise on the acoustical environment are addressed in Section 4.2.3.3. Noise impacts resulting from these alternatives generally would be proportional to their relative gravel requirements (noise attributable to gravel mining), gravel footprints (noise attributable to infrastructure construction), numbers of vehicle trips and miles, and numbers of aircraft flights. On a project-level basis, overall noise impacts are considered to be moderate for all action alternatives, with reasonably foreseeable impacts of Alternatives A and B less than the foreseeable impacts of Alternative C due to the greater level of aircraft activity under Alternative C. The various types and levels of noise resulting from GMT2 would contribute to the greater geographic extent, frequency of occurrence, and overall accumulation of noise impacts in the project area and in the North Slope region as a whole.

4.6.6.3 Conclusion

Impacts to the acoustical environment and noise-sensitive wildlife and people from GMT2 would be additive to noise impacts of past, present, and other foreseeable future actions. As with project-level impacts, overall cumulative impacts of noise generally are expected to be proportional to the geographic extent and frequency of occurrence of noise generated by motorized vehicles, aircraft, and equipment, but also are contingent on context. Cumulative impacts on the acoustical environment due to noise from past, current, and foreseeable future actions are regional in extent, of high intensity, and of temporary or interim duration. But even if temporary or interim in terms of the acoustical environment, noise impacts on wildlife and human receptors are important or unique in context where they occur and impact residential communities such as Nuiqsut and concentrated or dispersed subsistence-use areas (see Section 4.6.8.8 and related sections).

4.6.7 Cumulative Impacts to Biological Resources

4.6.7.1 Vegetation and Wetlands

Approximately 99 percent of the terrestrial vegetation within the project area is classified as wetlands (see Section 3.3.1) and impacts to vegetation and wetlands would result from construction, operations, and abandonment/rehabilitation of sites. The cumulative impacts to vegetation and wetlands include the direct loss of land cover due to placing gravel fill on the tundra and by mining gravel, and indirect loss or alteration of land cover as a result of modification of surface drainage patterns, gravel spray and dust (extending outward up to 300 feet from the facility footprint). Cumulative impacts to vegetation and wetlands are discussed more fully in BLM (2004a, 2012).

Past and Present Impacts and Their Accumulation

BLM (2012) summarized past and present direct and indirect impacts of non-oil and gas and oil and gas-related activities on wetlands and vegetation. Approximately 2,500 acres of direct impacts and 4,630 acres of indirect impacts to vegetation and wetlands from non-oil and gas activities (primarily communities) persist on the North Slope today (BLM 2012). Oil and gas activities have caused approximately 18,400 acres of direct impacts to vegetation, including wetlands, that persist today, and about the same acreage of indirect impacts (BLM 2012). These include the recently built Nuiqsut Spur Road, which connects the village of Nuiqsut to the all-weather road system of the Alpine development and its satellites. Whether impacts are associated with non-oil and gas residential, commercial or military development, or oil and gas activities, these impacts to vegetation are additive to future impacts and would be likely to persist for several decades or more (BLM 2012). However, the rate at which vegetation and wetlands are disturbed by development has slowed substantially in recent years due to advances in technology and a slowing of oil field development on the North Slope (BLM 2012).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The primary impact to vegetation and wetlands associated with non-oil and gas reasonably foreseeable future projects are the permanent loss of vegetation and wetlands through the placement of gravel to support infrastructure and transportation systems such as roads, and impacts from gravel mining. The proposed Colville River Access Road and the community of Nuiqsut are within the GMT2 Project area and the Harrison Bay/Lower Colville River Watershed, and thus any construction in these locations would have additive impacts to vegetation and wetlands.

Oil and Gas Exploration and Development Activities

Seismic and Exploration Drilling Activities: Impacts from seismic and exploration drilling activities in the past have typically been from damage to the vegetative mat or the underlying soils from tracked vehicles or sleds on skids cutting into hummocks, or from dozer operators making tight turns or dropping the blade too deeply into the snow. Use of newer technologies, such as vehicles that apply less pressure to the ground or best management practices like restricting travel to periods when there is adequate snow and frost cover to protect vegetation, have reduced the level of impacts to vegetation and soil. Impacts from future seismic and exploration drilling activities are not likely to accumulate and become additive to past effects (BLM 2012). Vegetation recovery studies have shown that most impacts to vegetation from seismic and exploration drilling activities should be minor and short term (National Research Council 2003).

North Slope exploration drilling is not typically authorized for gravel road or pad development, so no future impacts associated with gravel infrastructure are expected from exploration drilling activities.

Oil and Gas Development and Production: The primary impact to vegetation and wetlands associated with the proposed project and other reasonably foreseeable future projects is the permanent loss of vegetation and wetlands through the placement of gravel to support infrastructure (pads) and transportation systems (roads). The total future direct and indirect impacts to wetlands and floodplains on the North Slope would be the sum of impacts from the gravel footprint, excavation of material sites, and construction of elevated and buried pipelines. The loss of vegetation and wetlands resulting from the development of GMT2 and reasonably foreseeable future projects would also affect the wildlife and fisheries resources that rely on this habitat.

Future development and production could occur on the North Slope in the NPR-A, the Beaufort and Chukchi Seas, and onshore between the NPR-A and the Arctic National Wildlife Refuge. New development, especially for economically marginal oil fields, would most likely occur near existing fields so that infrastructure systems could be shared (BLM 2012). Specific reasonably foreseeable future projects include development in the Greater Mooses Tooth, Bear Tooth, Colville River, Pikka and Tofkat Units. These potential projects, along with established activities, recent developments, and recently permitted activities noted in Table 4.6-2, Past, Present and Reasonably Foreseeable Future Developments, are all within the Harrison Bay and Lower Colville River Watersheds and would have additive impacts to vegetation and wetlands in that area. One offshore prospect in Smith Bay would likely require an onshore pipeline and possibly a road that would also impact this area.

Although the increase in the area disturbed by oil and gas development has slowed dramatically in recent years, BLM (2012) estimated that an additional 6,300 acres could be covered by gravel or impacted by gravel mines east of the NPR-A between 2012 and 2100. Approximately 38,000 acres of vegetation may be indirectly affected by dust, changes in hydrology, and thermokarst (BLM 2012).

Oil and gas development and operation would cause the following long-term impacts: burial of vegetation under gravel pads, roads, and airstrips; excavation of materials at mine sites; construction of vertical support members for elevated oil pipelines; and excavation of trenches for buried gas and utility lines. Construction of gravel pads, roads, and airstrips could also result in indirect effects by altering the moisture regime of vegetation near the structures due to dust and snow accumulation and modification of natural drainage patterns. Impacts to floodplains could occur from river channel crossings by pipelines and roads, which could destroy vegetation where bridge pilings or vertical support members are required for the crossing. These factors could combine to warm the soil, deepen thaw, and cause thermokarst adjacent to roads and other gravel structures.

Abandonment: Increased oil and gas development and production on the North Slope would also result in an increased need for removal of infrastructure and rehabilitation of vegetation upon completion of operations. Removal of aboveground facilities, pipelines, and power poles would have a minor impact on vegetation. Roads and pads would remain unaffected if they are maintained, but if maintenance is discontinued, thaw subsidence in ice-rich areas would result in settling of the gravel structures into thermokarst troughs. Removal of roads and pads would accelerate thaw subsidence, but would also accelerate the reclamation process. Removal of gravel fill has recently been accomplished in wetlands and preliminary studies suggest that a wetland mosaic of vegetation can be restored (BLM 2012).

If global climate change persists, the cumulative effects to wetlands and floodplains from oil and gas and non-oil and gas development on the North Slope could be greater than predicted. Continued climate change would eventually lead to shifts in the composition and distribution of Arctic tundra vegetation and wetlands. Permafrost would thaw to increased depths, causing 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 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 vegetation (BLM 2012).

Contribution of the Alternatives to Cumulative Impacts

Section 4.3.1 discusses the direct impacts due to the footprint of Alternatives A, B, and C. BLM (2004a) described the potential cumulative impacts to wetlands and vegetation to be minor. The incremental contribution to cumulative impacts from GMT2 would also be minor, unless a large oil spill was to occur. Impacts to North Slope vegetation communities from oil field abandonment activities would result in a small, temporary contribution to cumulative impacts followed by a recovery over the long term. The affected area would be a small fraction of the total North Slope acreage, so the benefit would be relatively small. It is not expected that synergistic impacts (whether beneficial or adverse) to vegetation would occur as a result of developing additional acres. The potential cumulative impacts to vegetation and wetlands of the proposed project are within the range of those analyzed by BLM in 2004.

The vegetation and wetlands impacts of the action alternatives are within the range (i.e., minor and localized) of cumulative impacts of oil and gas activities analyzed earlier (BLM 2012). Non-oil and gas development together with oil and gas activities would occupy less than 1,400 acres within the largely undeveloped 4.3-million-acre area comprising the Harrison Bay and Lower Colville River Watersheds. Future impacts to vegetation both inside and outside of the NPR-A would be additive to the impacts to vegetation that have accumulated in the past and persist today. In the context of the entire North Slope, however, these cumulative impacts would be relatively minor. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

Overall, the direct, indirect, and cumulative impacts to vegetation and wetlands associated with the proposed GMT2 and completion of other reasonably foreseeable future projects are expected to be within the potential cumulative impacts to wetlands and vegetation described in the Alpine Satellite Development Plan EIS (BLM 2004a) and to be of moderate intensity and long-term duration. Alternative D (no action) would result in no change from the current baseline conditions.

4.6.7.2 Fish and Fish Habitat

Past and Present Impacts and Their Accumulation

Activities Not Associated With Oil and Gas

Impacts on fish to date from most North Slope non-oil and gas activities, such as developing villages, recreation, hunting, research, waste removal and remediation projects, and winter overland supply operations have been minor and localized. Impacts on fish from military Distant Early Warning-Line stations that initially accumulated along the coast have been recovering since abandonment (BLM 2012, Section 4.8.7.7).

Oil and Gas Exploration

Impacts to fish from seismic activities and exploration over the last several decades should have largely been local, acute, and short-lived. Explosive-based seismic surveys and exploration that included construction of gravel infrastructure have been replaced by Vibroseis-based surveys and winter exploration that utilizes temporary ice infrastructure, which have fewer potential repercussions on the environment. Aquatic habitats and local fish communities that were temporarily impacted in the past have likely recovered (BLM 2012, Section 4.8.7.7).

Oil and Gas Development and Production

Some aspects of North Slope oil and gas development and production have caused impacts on fish that have accumulated, while impacts on fish from other aspects have not persisted. Impacts from gravel pads and roads as well as causeways have accumulated by impeding fish movements and significantly altering fish habitat by changing physical and chemical conditions. Year-round freshwater use for domestic facilities, seawater use for waterflooding, and oil spills have all effected fish in ephemeral ways that have not likely accumulated (BLM 2012, Section 4.8.7.7).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas

Non-oil and gas activities that will take place in the NPR-A and adjacent lands related to village development; recreation, hunting, and research and associated small camp, watercraft, and floatplane use; waste removal and remediation projects; and winter overland supply operations will probably increase in the future. However, in most cases, minor impacts on fish would be localized and brief and would not accumulate (BLM 2012, Section 4.8.7.7).

Construction of new gravel roads provides improved access to subsistence harvest of fish from waters that were previously remote. Improved access carries a risk that small populations of slow growing fish may be overharvested. Although this is possible, it is unlikely that substantially increased harvest levels would go unnoticed or unchecked. Accordingly, there is still a risk of overharvesting local populations of fish.

Oil and Gas Exploration

It is expected that future seismic surveys and exploration drilling operations will continue using current technologies. Based on evidence that these current techniques effectively mitigate impacts on fish, the localized impacts that could occur would not be expected to accumulate. Airgun-based seismic activities and exploratory drilling in the Chukchi Sea and Beaufort Sea could impact coastal marine fish as well as anadromous fish from the NPR-A, primarily due to disturbance. Nearshore operations would potentially impact more fish than offshore operations since many fish species tend to concentrate along the coast during much of the open-water season. Overall, impacts on fish from seismic activities and exploration in the NPR-A, lands to the east, and in the Chukchi and Beaufort Seas would not likely accumulate (BLM 2012, Section 4.8.7.7).

Oil and Gas Development and Production

The elements of onshore North Slope oil and gas development and production most likely to contribute to future impacts on fish that could accumulate include permanent infrastructure (e.g., roads, pads, pipelines, and causeways) and gravel mining necessary to build the infrastructure. The gravel infrastructure (roads, pads, airstrips) and associated gravel mining associated with oil and gas development and production have caused impacts on fish that have accumulated by impeding fish movements and significantly altering the physical and chemical conditions of fish habitat. Oil and gas development and production to the east of the NPR-A would require additional facilities and infrastructure that would be additive to impacts from NPR-A development. Collectively, these cumulative impacts from onshore oil and gas development and production could reduce the size and structure of fish populations, diminish individual fish condition, and shift local fish community composition and species distribution (BLM 2012, Section 4.8.7.7).

Impacts on fish from North Slope oil spills on land thus far have not accumulated because the spills have been small and cleanup and rehabilitation efforts have generally been successful. Regardless, given the magnitude of development scenarios, this situation could change, with the probability of spills entering aquatic habitats increasing. Also, as pipelines age and degrade, spills would probably be more frequent and impacts on fish could be additive. Impacts on fish from even small individual spills in streams and lakes could accumulate over time (BLM 2012, Section 4.8.7.7).

Oil and Gas Facility Abandonment

Except for the abandonment of isolated individual exploration or development wells, to date, very little abandonment has occurred anywhere on the North Slope. However, abandonment of gravel pads and roads, as well as pipelines, would most likely only have a temporary impact on local aquatic habitats provided that the abandonment includes removal and restoration of any problematic stream crossing structures. The process of removal, restoration, and abandonment would contribute to positive cumulative impacts on fish by allowing fish to reach habitats that were previously made inaccessible by development.

Contribution of the Alternatives to Cumulative Impacts

In general, the greater the amount of infrastructure, the higher the expected incidents of impacts to fish and fish habitats. As such, the highest anticipated impacts would occur under Alternatives A and B, followed by Alternatives C. Overall impacts under Alternatives A and B are anticipated to be similar, as they only vary slightly in routing and infrastructure extent. The reduction of roads in Alternative C would avoid many of the potential disruptions to fish and fish habitats under the other action alternatives, although annual ice roads would be required for the life of the project. Potential impacts from oil pipeline spills would be similar under Alternatives A, B, and C. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The direct, indirect, and cumulative impacts to fish and fish habitat associated with the proposed GMT2 Project and other regional oil and gas activities (Map 4.6-1) would be additive and in some scenarios, could be synergistic. Because of the highly migratory life history of many Arctic fish species, if enough local impacts on fish occurred in the various oil and gas areas near GMT2, these impacts could accumulate and result in a decline in productivity for fish populations at a regional scale.

4.6.7.3 Birds

As noted in Section 4.3.3, all action alternatives associated with the proposed GMT2 Project have the potential, via direct and indirect impacts, to affect birds, bird behavior, and their nesting, brood-rearing, foraging, and molting habitats through habitat loss, alteration, and disturbance. Mechanisms may include physical changes resulting in loss of habitat, displacement from habitats altered by vehicle noise, dust deposition, and thermokarst, attraction to habitats altered by thermokarst and early green-up adjacent to gravel infrastructure, or disturbance from increased aircraft noise or visual stimuli. Cumulative impacts to birds are discussed more fully in BLM (2004, 2012).

Past and Present Impacts and Their Accumulation

The BLM (2004, 2012) found that the additive impacts of past, present, and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope.

Activities Not Associated With Oil and Gas Exploration and Development

Impacts to birds from most North Slope non-oil and gas activities such as subsistence activities (including hunting, fishing, berry picking, etc.), recreational use, activities associated with scientific surveys and research camps, village expansion, clean-up of old oil and gas exploration sites, and activities associated with government actions (e.g., clean-up of abandoned well sites) have been minor and localized (BLM 2012). Approximately 2,500 acres of habitat have been directly impacted by non-oil and gas development on the North Slope and those impacts are additive to future impacts and would be likely to persist for several decades or more in the absence of an active reclamation program (BLM 2012).

Oil and Gas Exploration and Development Activities

Overall, direct mortality impacts due to collisions with vehicles, aircraft, buildings, pipelines, powerlines and communications towers were estimated to occur only at very low levels in the North Slope oilfields during present and future developments. The National Research Council (2003) concluded that reduced productivity was the most substantial cumulative impact to bird populations due to oil and gas development activities, and that determination was based on decreased productivity due to increased levels of predators attracted to the development area. The National Research Council (2003) review focused on the Prudhoe Bay Oilfield, with most studies conducted through the mid 1990s when the landfill and dumpsters were accessible by gulls, ravens, bears and foxes. Since the late 1990s, the landfill has been fenced to exclude bears, and animal proof dumpsters have been installed throughout North Slope oilfields (BLM 2004).

More recently, a 4-year avian study on the Arctic Coastal Plain further corroborated this concept with evidence of increased predation risk for passerine nests within 5 kilometers of oil field infrastructure (Liebezeit et al. 2009). When the relationship was tested by individual avian species individually, not all species (notably semipalmated and pectoral sandpipers) exhibited the same findings (Liebezeit et al. 2009). The inconsistent results among species may have been due to variability in survey year, conditions, or sites. The following recommendation was provided for gaining a better understanding of this notable potential cumulative impact to avian species, "We recommend targeted management actions to minimize anthropogenic effects and suggest new research needed on this issue as expanding development is planned for the Arctic Coastal Plain of Alaska. In particular, we recommend research on demography of key predators and their importance with respect to nest survival, and experimental studies that better address challenges posed by high natural variability" (Liebezeit et al. 2009).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The primary impact to birds associated with non-oil and gas reasonably foreseeable future projects is the permanent loss of habitat through the placement of gravel to support infrastructure and transportation systems such as roads, and impacts from gravel mining. Increased harvests resulting from increased access to remote areas via new roads, especially from subsistence hunting, are characterized as a notable cumulative impacts factor in the Alpine Satellite Development Plan area. Subsistence harvest within the Alpine Satellite Development Plan area would affect approximately 2,800 birds and eggs, compared to an estimated 950 nesting waterbirds and ptarmigan affected by habitat loss, alteration, and disturbance caused by reasonably foreseeable future development within the plan area (BLM 2004). The BLM (2012) analyzed potential cumulative impacts across the North Slope to non-special status bird species occurring in the NPR-A, and impacts on birds from non-oil and gas activities that are part of BLM operations or authorizations were not expected to accumulate.

Oil and Gas Exploration and Development Activities

Seismic and Exploration Drilling Activities. Impacts to birds from seismic and exploration drilling activities in the past have typically been related to damage to the vegetation. Use of newer technologies have reduced the level of impacts to vegetation and soil, and thus, to bird populations using these resources. Vegetation recovery studies have shown that most impacts to vegetation, and thus, to birds, from seismic and exploration drilling activities should be minor and short term (Section 4.3.1, "Vegetation and Wetlands" (National Research Council 2003). North Slope exploration drilling is not typically authorized for gravel road or pad development, so no future impacts associated with gravel infrastructure are expected from exploration drilling activities. Impacts from future seismic and exploration drilling activities are not likely to accumulate and become additive to past effects (BLM 2012).

Oil and Gas Development and Production. The primary impacts to birds associated with the proposed project and other reasonably foreseeable future projects is the permanent loss of habitat through the placement of gravel to support infrastructure (pads) and transportation systems (roads) and the disturbance of birds due to noise from drilling and associated activities. The loss of habitat resulting from the development of GMT2 and reasonably foreseeable future projects would affect the bird resources that rely on these habitats.

Future development and oil production could occur on the North Slope in the NPR-A, the Beaufort and Chukchi Seas, and onshore between the NPR-A and the Arctic National Wildlife Refuge. New development, especially for economically marginal oil fields, would most likely occur near existing fields so that infrastructure systems could be shared (BLM 2012). Specific reasonably foreseeable future projects include development in the Greater Mooses Tooth, Bear Tooth, Colville River, Kuparuk River, Ooguruk, Pikka and Tofkat Units. These potential projects, along with established activities, recent developments, and recently permitted activities noted in Table 4.6-2, Past, Present and Reasonably Foreseeable Future Developments, are all within the Harrison Bay and Lower Colville River Watersheds and would have additive impacts to birds in that area.

Although direct habitat loss from cumulative oil and gas development on the North Slope would affect only a small proportion of the total area, indirect habitat loss, or functional loss, could result from long-term displacement of birds from the vicinity of oil and gas activities and could involve a much larger area. Future offshore or nearshore development of leases in the Beaufort Sea could expose birds to additional habitat loss and disturbance related to oil and gas development through onshore facilities to support offshore/nearshore leases.

Spills of crude oil and other substances associated with reasonably foreseeable future projects could affect birds on the North Slope. Cumulative effects would depend on the type, number, size, location, and timing of spills, and the type and effectiveness of the oil spill response and the species exposed to the spill.

If global climate change persists, the cumulative effects to birds from oil and gas and non-oil and gas development on the North Slope could be greater than predicted due to larger than currently expected changes to bird habitat. Continued climate change would eventually lead to shifts in the composition and distribution of Arctic tundra vegetation and wetlands, which would affect birds in both positively and negatively. Permafrost would thaw to increased depths, causing 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 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 birds (BLM 2012).

The BLM (2012) analyzed potential cumulative impacts across the North Slope to non-special status bird species occurring in the NPR-A and found that cumulative impacts on bird productivity and abundance are likely to be long term and could result in adverse impacts on productivity of some species of birds. BLM expects that the impacts of facilities and activities for future projects on bird populations, though additive, would be substantially less than those of past projects because of the smaller total area needed for future projects due to advances in technology.

Contribution of the Alternatives to Cumulative Impacts

With respect to birds, all of the action alternatives would have impacts of low intensity, long-term duration, important in context, and of local extent. All future impacts will be additive to the impacts to birds and bird habitat that have accumulated in the past and persist today, but in the context of the entire North Slope west of the Canning River, these cumulative impacts are expected to be relatively small. The 2012 Integrated Activity Plan/EIS found that if current rates of development continue into the future, about 3,750 additional acres of bird habitat would be lost through the construction of pads, roads, and airstrips through the year 2100, and 750 acres by gravel mines. About 27,000 additional acres would be indirectly affected by dust, changes in hydrology, and thermokarst through 2100.

Section 4.3.2 discusses, in depth, the impacts to birds from Alternatives A, B, and C. Direct impacts to bird habitats from gravel placement would be greater for Alternative C than Alternatives A and B. The impacts associated with habitat loss and alternation for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Impacts associated with disturbance to birds from vehicle traffic would be greatest under Alternative A or B, due to the distance vehicles would have to travel. Alternative C would have no gravel access road traffic. The impacts associated with disturbance from vehicle traffic for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Potential impacts to birds from aircraft under Alternative C is greater than Alternatives A or B due to the requirement to use aircraft to access the GMT2 drill pad when ice roads are not feasible (roughly 9 months of the year). The air traffic at the GMT2 facility under Alternative C would be additional to the existing activity in the Alpine Central Processing Facility and Nuiqsut airspaces, and would continue for the long term while additional flights required under Alternatives A and B would drop considerably after construction is completed. The impacts (disturbance and displacement) associated with aircraft traffic for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Alternatives A and B would have annual ice roads constructed in Years 1–3 to allow for construction of gravel infrastructure. Post-construction of gravel infrastructure there would be no ice roads needed for these two alternatives. Alternative C requires annual ice roads to be constructed for the life of the project. Few birds are present in the area during ice road season; however, re-use of ice annual road routes and ice pad locations could damage tundra, resulting in potential long-term impact to potential high value bird habitats.

Potential impacts to birds from mortality and predation due to Alternatives A and B would be higher than for Alternative C, because the absence of a gravel road would negate the probability of mortality due to vehicle traffic and fewer culverts in gravel structures would create fewer potential sites for predators exploit. The impacts associated with mortality from traffic and predators for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Potential impacts from oil pipeline spills would be similar under Alternatives A, B, and C. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The combination of impacts to birds from the proposed project coupled with impacts from reasonably foreseeable future projects in would be additive, long term, and localized, or perhaps regional, depending on the type of access to the reasonably foreseeable future (roaded or not roaded). However, in the context of the North Slope west of the Canning River, these cumulative impacts would be relatively small (BLM 2012) and would be dependent upon reasonably foreseeable future project locations relative to bird populations and their preferred habitat.

Further development in the cumulative impacts evaluation area may also impact birds through a cumulative reduction in habitat and an increase in disturbance. These impacts are not expected to cause pervasive cumulative impacts, because the impacts of the currently proposed and reasonably foreseeable future projects on bird populations, though additive, would be less than those of past projects due to smaller project areas (by comparison) and the large extent of existing habitat in the area of evaluation. The contribution from the proposed project is expected to be negligible with respect to the cumulative impacts evaluation area, and would be decreased from that approved in the 2004 Alpine Satellite Development Plan Record of Decision due to the reduced footprint of the proposed project.

Direct impacts to birds associated with the proposed project are expected to be localized and minor in nature with no adverse impacts expected at the population level. The direct, indirect, and cumulative loss of bird habitat generally would be of low intensity, long-term in duration, localized, and important in context. Overall, it is anticipated that less than 1 percent of the total high value bird habitat in the project study area would be impacted, directly or indirectly, by any single action alternative.

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 (BLM 2012).

Oil spills would not significantly add to cumulative impacts, except for an unlikely to very unlikely large spill to aquatic habitats.

The combination of impacts from the proposed project, coupled with impacts from other reasonably foreseeable future projects would be additive, long term, and localized. The overall cumulative impact to birds for the Harrison Bay and Lower Colville River Watersheds, and other reasonably foreseeable future projects is considered to be minor.

Alternative D would not have any incremental cumulative impacts to birds.

4.6.7.4 Terrestrial Mammals

Caribou

Both the Teshekpuk Caribou Herd and the Central Arctic Herd use the GMT2 Project area for winter/summer forage during one or more seasons each year, and at very low densities for calving in June. The project area is part of a high use corridor for fall migration by the Teshekpuk Caribou Herd, and overall it tends to be used more year-round by the Teshekpuk Caribou Herd than the Central Arctic Herd. Although the footprint of facilities is a good indicator of potential impact to caribou, the activity occurring at the production pad, road, and airfields produces different impacts to caribou.

Cumulative impacts on caribou as a result of habitat loss and disturbance to animals are discussed in general terms under impacts on terrestrial habitats. Caribou may be affected by temporary ice roads and pads, and by disturbance caused by development construction and operations, especially during migration and calving periods. Cumulative impacts to terrestrial mammals are discussed more fully in BLM (2004a, 2012).

Past and Present Impacts and Their Accumulation

Approximately 2,500 acres of habitat have been directly impacted by non-oil and gas development on the North Slope, and those impacts continue to persist. Oil and gas activity between the Colville and Canning Rivers, where hundreds of miles of gravel roads cross a large portion of the Central Arctic Herd calving range in a 500-square-mile area, has caused an additional habitat loss or alteration of over 17,000 acres that persist today. Since most of these impacts are associated with ongoing residential or non-oil and gas commercial development, and oil and gas activities, these impacts to habitat are additive to future impacts and would be likely to persist for several decades or more in the absence of an active reclamation program (BLM 2012).

Oil and gas development has altered the distribution of female Central Arctic Herd caribou during the calving season and interfered with caribou movements between inland feeding areas and coastal insect relief areas. Female caribou may experience lower parturition rates when in close proximity to oil field development. It has also been suggested that declines in Central Arctic Herd caribou productivity in the early 1990s may have been the result of additive impacts of oil field development and high insect activity, although populations of Teshekpuk Caribou Herd and Central Arctic Herd caribou have increased between the mid-1970s and 2008. Thus, disturbance of caribou due to oil field development may adversely affect caribou populations, but these impacts are not readily apparent based on population trends. The Western Arctic Herd, whose range does not overlap the current oil fields and whose insect-relief habitat is not on the coastal plain, increased in numbers until about 2003. Since then, population estimates show a decline (Alaska Department of Fish and Game 2016).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development. As described in BLM (2004a), cumulative impacts on caribou from road traffic would be expected to involve short-term displacement, especially during calving when maternal caribou avoid areas within 2.5 miles (4 kilometers) of roads. Displacement from roads outside the calving season would not be expected to have a measurable effect on herd abundance or large-scale patterns of distribution (BLM 2004a).

Non-oil and gas activities on the North Slope would continue to disturb mammals and cause the loss of minor amounts of their habitat. Distant Early Warning-Line stations and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Furthermore, villages are likely to increase in size causing the loss of additional habitat. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to increase to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century (BLM 2012).

Oil and Gas Exploration and Development Activities. Based on past seismic activity on the North Slope, the BLM (2012) assumed continuation of the recent experience of three to four seismic crews active in NPR-A each winter. Since that assumption was made, however, there have been only one to two crews per winter. Exploration sites with gravel pads, disturbed areas around these pads, exploration airstrips, and gravel exploration roads have been replaced in recent years by ice roads, ice airstrips, and ice drilling pads to reduce the costs and environmental effects of exploration. Both disturbance and habitat loss impacts from ice roads and pads are short term and are not expected to accumulate. Only a small amount of habitat is likely to be affected long term by exploration activities (i.e., seismic) (BLM 2012).

BLM (2012) estimated that oil and gas development in the Chukchi and Beaufort Seas, construction of a road between Umiat and the Dalton Highway, and construction of a commercial gas pipeline and unconventional oil and gas development east of the NPR-A, could cause direct, terrestrial impacts on up to 6,300 acres of terrestrial habitat and indirect impacts on 38,000 acres (Section 4.6.5.1). At this point in time, the Umiat Road project has been withdrawn from permitting consideration and is no longer considered a reasonably foreseeable future. Additionally, the Chukchi Sea is considerably outside the GMT2 cumulative impacts analysis area and exploration of offshore leases in the Chukchi Sea has been halted, at least temporarily. More recently, a new potential development in the very-nearshore Smith Bay, could result in a pipeline and possible road going through or around core Teshekpuk Caribou Herd habitat in the Teshekpuk Lake area.

Although direct habitat loss from cumulative oil and gas development on the North Slope would affect only a small proportion of the total area, indirect habitat loss, or functional loss, could result from long-term displacement of wildlife from the vicinity of oil and gas activities and could involve a much larger area. Future gas and both conventional and unconventional oil exploration and development between the Colville and Canning Rivers, in addition to a commercial gas pipeline, would increase the amount of activity within the Central Arctic Herd caribou range. Future offshore or nearshore development of leases in the Beaufort Sea could expose Teshekpuk Caribou Herd and Central Arctic Herd caribou to additional activities related to oil and gas development (through onshore facilities to support offshore/nearshore leases). Future leases in the NPR-A could expose a large number of the Teshekpuk Caribou Herd caribou to exploration and development activities on their summer and winter grounds, and during migration. Caribou from the Western Arctic Herd would also be exposed to development activities in their summer range.

Construction of a gas pipeline would have short-term effects on wintering caribou if caribou are present during construction. This could affect both the Central Arctic Herd and Teshekpuk Caribou Herd. If buried, the pipeline would have no further disturbance effects except for brief periods of maintenance. It is anticipated that these effects would be minor and would not accumulate. A much greater impact would be effects from the gas development that such a pipeline would make possible (BLM 2012) within the NPR-A, and to the east.

Spills associated with reasonably foreseeable future projects could affect caribou on the North Slope. Cumulative effects would depend on the type, number, size, location, and timing of spills, and the type and effectiveness of the oil spill response. Potential oil spills from both offshore and onshore oil activities would be likely to have a small effect on caribou because comparatively low numbers of animals would be expected to be disturbed or contaminated, or to ingest contaminated food sources.

Abandoned gravel pads and roads could provide some benefits as insect-relief sites for caribou. The ultimate fate of the gravel pads and roads would not be known until closer to the end of a field’s production life. Permitting agencies could require that gravel be removed and the tundra revegetated. If other uses are determined to be preferable, regulatory agencies could allow permittees to leave gravel pads in place, either revegetated or not.

Contribution of the Alternatives to Cumulative Impacts

Impacts associated with vehicle traffic would be greatest under GMT2 Alternative A or B, due to the increased distance vehicles would have to travel. Alternative C would have no gravel access road traffic, but the absence of impacts from roads would likely be offset by the increase in impacts from air traffic at CD1/Alpine Processing Facility and GMT2 site. The use of aircraft at airports that are 16 to 21 miles apart (GMT2, Nuiqsut and CD1) under Alternative C is expected to have the greatest overall impact to caribou.

In addition to direct and indirect impacts to caribou from the GMT2 Project, the addition of the GMT1–GMT2 Access Road under Alternative A or B could add increased hunting pressure to caribou herds due to increased road access west of existing development. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

Overall, industry and agency actions on the North Slope are expected to have minor impacts to caribou herd productivity. The area between the Colville and Canning Rivers represents much of the range of the Central Arctic Herd. In some winters, this area is also important habitat for part of the Teshekpuk Caribou Herd. Cumulative impacts on caribou habitat are within the range of cumulative impacts from oil and gas activities considered by BLM (2004a, 2012), which estimated there would be direct or indirect impacts on 44,000 acres of caribou habitat by 2100 (BLM 2012). The contribution from all action alternatives of the GMT2 Project is expected to be minor, and synergistic effects at the herd level would not be anticipated. Alternative D (no action) would result in no change from the current baseline conditions.

Impacts to all mammalian populations from the combined impacts of vegetation change (from both human activities and climate change) and climate change induced weather patterns could prove to be synergistic rather than additive.

Grizzly Bear, Fox, and Other Terrestrial Mammals

Impacts under the proposed project's action alternatives are expected to be higher during the construction phase. Construction of the project action alternatives would result in long-term, direct and indirect habitat loss due to gravel extraction and the placement of gravel for roads, pads, and, under Alternative C, an airstrip. Once construction is completed, the drilling and operation phase would affect terrestrial mammals and their habitats in the medium term through altered survival or productivity, habitat alteration, disturbance, potential for vehicle collision, and mortality for human safety. The cumulative impacts to grizzly bears, foxes, and other terrestrial mammals would be additive when considering the proposed project and all other reasonably foreseeable future projects. Cumulative impacts to terrestrial mammals are discussed more fully in BLM (2004a, 2012).

Past and Present Impacts and Their Accumulation

As reported by BLM, approximately 2,500 acres of habitat have been directly impacted by non-oil and gas development on the North Slope and those impacts continue to persist. Oil and gas activities have caused an additional habitat loss or alteration of over 17,000 acres that persist today. Since most of these impacts are associated with ongoing residential and non-oil and gas commercial development, or oil and gas activities, these impacts to habitat are additive to future impacts and would be likely to persist for several decades or more in the absence of an active reclamation program (BLM 2012).

Grizzly bears, foxes, and other terrestrial mammals have been little affected—some may even have benefited—from development on the North Slope. Subsistence and recreational hunting pressure has likely increased from historic levels due to increases in human populations and better access to the North Slope. Still, based on subsistence harvest surveys, subsistence harvest of mammals has been relatively stable since the early 1990s. Based on population trends of game mammals on the North Slope, neither hunting nor other human activities appear to be adversely affecting mammal populations (BLM 2012).

Future Impacts and Their Accumulation

BLM (2012) analyzed potential cumulative impacts across the North Slope to mammals occurring in the NPR-A. Some impacts that could prove to be synergistic rather than additive are the combined impacts of vegetation change (from both human activities and climate change), climate change induced weather patterns on the productivity of all mammalian populations, and predation. Mammalian populations have inherent levels of resilience, through behavioral flexibility and movement, to change in different factors affecting survival and productivity. Development of oil and gas in the NPR-A, alone or in combination with similar development elsewhere on the North Slope or offshore, could result in a decrease in this level of resilience. For some species, the magnitude of decrease may be adequate to result in negative population level responses.

Activities Not Associated With Oil and Gas Exploration and Development. Non-oil and gas activities on the North Slope would continue to disturb mammals and cause the loss of minor amounts of mammal habitat. Distant Early Warning-Line and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Furthermore, villages are likely to increase in size causing the loss of additional habitat. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century (BLM 2012).

Oil and Gas Exploration and Development Activities. The BLM (2004a) found that oil development on the North Slope would likely result in increased abundance of Arctic foxes near development areas, which may present a rabies health hazard to humans in the oilfield areas. The attraction of grizzly bears to human refuse may lead to the loss of bears as the result of interactions with humans, which could lead to an eventual decline in bear abundance near development areas. The cumulative impacts on muskoxen, moose, wolves, wolverines, and small mammals from oil and gas development on the North Slope would be local and short term, within 1 to 2 miles of exploration or development facilities, and with no adverse impacts on populations (BLM 2004a, Section 4G.6.4.1).

Spills associated with reasonably foreseeable future projects could affect terrestrial mammals on the North Slope. Cumulative effects would depend on the type, number, size, location, and timing of spills, the type and effectiveness of the oil spill response, and the species exposed to the spill. Potential oil spills from both offshore and onshore oil activities would be likely to have a small effect on terrestrial mammals because comparatively low numbers of animals would be expected to be disturbed or contaminated, or to ingest contaminated food sources.

Abandoned gravel pads and roads could provide some benefits as burrowing habitat for species such as foxes and ground squirrels. The ultimate fate of the gravel pads and roads would not be known until closer to the end of the production field life. Permitting agencies could require that gravel be removed and the tundra revegetated. If other uses are determined by the permitting agencies to be preferable, the agencies could allow the permittee to leave the gravel pads in place, either revegetated or not revegetated.

Contribution of the Alternatives to Cumulative Impacts

Impacts to grizzly bears, foxes, and other terrestrial mammals for the action alternatives are presented in Section 4.2.1. Alternatives A, B, C would have similar, minor, impacts to terrestrial mammals, with impacts due to habitat loss and alteration expected to be of low intensity, long-term duration, and limited extent (Table 4.3-15). The affected resources are rated common because grizzly bear, foxes, and other terrestrial mammals are considered usual or ordinary in the region, not depleted in the locality, and not protected by legislation.

Some mammal populations (e.g., fox and grizzly bear) have been little affected by development on the North Slope. The greatest threat to grizzly bears may be increased hunter access under Alternative A or B, as well as a potential increase in mortality in the defense of life and property at the GMT2 site. Fox populations may increase, but mitigation measures should minimize any potential expansion of fox populations in the GMT2 Project area. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The cumulative impacts to grizzly bears, foxes, and other terrestrial mammals would be additive when considering other reasonably foreseeable future projects. Alternative D (no action) would result in no change from the current baseline conditions. If climate change over the next several decades were to result in widespread changes in vegetation composition and insect abundance, disturbance effects of oil and gas activities to terrestrial mammals could be exacerbated and could extend beyond the life of the oil and gas fields. If these cumulative effects were to result in reductions in 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), climate change induced weather patterns on productivity and predation.

The implementation of new mitigation measures in conjunction with lease stipulations and best management practices required for the protection of terrestrial mammal resources under all alternatives could reduce the cumulative effect to terrestrial mammals from oil and gas, and non-oil and gas activities.

4.6.7.5 Marine Mammals

Marine mammals are not expected to occur within the GMT2 Project area, or north of there along the coastline of Harrison Bay. The waters along the coast are either out of their geographic range or too shallow for most species to use during limited migrations through the area. Of the 10 marine mammal species initially considered, it was determined that 6 are not expected to occur in the project area (Section 3.3.4), and are not further evaluated. The four exceptions are polar bear, covered under Section 4.3.5, and spotted seal, bearded seal, and the beluga whale which are covered under Section 4.3.4.1. Cumulative impacts to marine mammals are discussed more fully in BLM (2004a, 2012) and are expected to be negligible.

4.6.7.6 Threatened and Endangered Species

Cumulative impacts to threatened and endangered species are described in BLM (2004, 2012). The types of potential impacts to threatened and endangered species under the GMT2 Project are similar to that of other birds and mammals, and include habitat loss and alteration, disturbance and displacement, mortality, obstruction of movement, and predation. Sections 4.3.3, “Birds,” and 4.3.4.2, “Marine Mammals,” provide discussion of potential impacts to birds and marine mammals in general.

The threatened and endangered species that have been reported to occur, or have occurred, in or near the GMT2 Project area are Steller’s eider, spectacled eider, and polar bear. Potential impacts to these species from project elements and activities vary among the different action alternatives during construction, drilling, and operations (i.e., production). Discussion of potential impacts, and comparison of alternatives is presented below.

Steller’s Eider and Spectacled Eider

Steller’s Eider

Section 3.3.3 discusses the distribution, population, and habitat associations of Steller’s eider. Nest searches in the Colville River Delta, Kuparuk River Unit, and northeast NPR-A over approximately 25 years have found no nests or indications of breeding by Steller’s eiders (Johnson et al. 2013). In a similar time period, only a few sightings of individuals have been recorded (Johnson et al. 2013; Seiser and Johnson 2014). Therefore, there is a low probability for their future presence in the future at the project study area (Johnson et al. 2013). There is no designated critical habitat for this species on the North Slope. The overall cumulative impact to Steller’s eiders for the Harrison Bay and Lower Colville River Watersheds for the proposed project and other reasonably foreseeable future projects is considered to be negligible. There would be no impacts under the no-action alternative. Cumulative impacts to threatened and endangered (or special status species) are discussed more fully in BLM (2004, 2012).

Spectacled Eider

Section 3.3.3 discusses the distribution, population, and habitat associations of the spectacled eider. There is no designated critical habitat for the spectacled eider on the North Slope. Multi- year surveys show the spectacled eider is present in the project study area, with the species occurring in high concentrations on the Colville River Delta and north of the Native Village of Nuiqsut. Habitats utilized by the spectacled eider adjoin the conceptual location of the road, production pad, and pipeline system of the proposed GMT2 Project. The spectacled eider could be impacted by the proposed project under all action alternatives as a result of habitat loss and alteration, disturbance and displacement, obstruction of movement, various sources of mortality (e.g., vehicle collisions, nest predation), or spills. There would be no impacts under the no-action alternative. Cumulative impacts to threatened and endangered (or special status species) are discussed more fully in BLM (2004, 2012).

Past and Present Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development. Approximately 2,500 acres of habitat on the North Slope have been directly impacted by non-oil and gas development, and those impacts continue to persist. Oil and gas activities have caused an additional habitat loss or alteration of over 17,000 acres that persist today. Although only a small portion of this area would have been used by threatened and endangered species, much of it has occurred along the coastline and near Utqiagvik (formerly Barrow), areas where spectacled and Steller's eiders are often found. These impacts are additive to future impacts and would likely persist for several decades or more in the absence of an active reclamation program.

Oil and Gas Exploration and Development Activities. Direct and indirect impacts from disturbance of many different types are difficult to measure, but are likely accumulating as the number of developments and the amount of developed area increase. New oil and gas developments have reduced their footprint size and the corresponding direct impacts have been reduced. However, these new developments often rely on aircraft support for transportation of personnel and equipment potentially increasing disturbance to feeding, nesting, staging and molting birds. The impacts of predators on threatened and endangered species populations may be waning as industry reduces the amount of predator-attracting garbage in the fields. Habitat loss and disturbance can add incrementally to the impacts of development on threatened and endangered species (BLM 2012).

Whether past impacts to threatened and endangered species populations from habitat loss or disturbance are associated with non-oil and gas residential and commercial development, or oil and gas activities, these impacts are additive to any potential future impacts (BLM 2012).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development. Non-oil and gas activities are expected to continue in the future resulting in the loss of small amounts of habitat and disturbance to threatened and endangered species. In some cases, loss of habitat from these activities would be temporary, lasting only a season or a few years.

However, habitat loss and disturbance associated with military facilities, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Villages are likely to increase in size, causing the loss of additional habitat and increase disturbance, and will likely increase the predation rate of spectacled and Steller's eiders and nests in the vicinity of the human expansion. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century. It is currently illegal to use lead shot while hunting waterfowl, although lead shot is allowed for hunting upland species. Illegal use of lead shot for hunting waterfowl, or legal use of lead shot for hunting upland species near waterfowl habitats, could contribute to the impacts of lead poisoning on eider populations. Programs are currently are underway by the USFWS and the North Slope Borough to inform hunters of harvest closures on these species in an effort to decrease this source of mortality. However, lead shot appears to persist in the environment and any additional lead shot would be additive to past amounts, incrementally increasing the chance of exposure to eiders and further reducing survival.

Oil and Gas Exploration and Development Activities. The BLM (2012) analyzed potential cumulative impacts across the North Slope to spectacled and Steller's eiders occurring in the NPR-A. Development activities that could contribute to cumulative impacts to spectacled and Steller's eiders and their habitat on the North Slope include onshore oil and gas development by federal, state, and Native entities; federal and state offshore oil and gas development (including the construction of onshore infrastructure); oil and gas transportation, including commercial gas pipelines; and road construction. All of these activities involve construction of infrastructure that would directly destroy habitat within the immediate footprint of the project and indirectly affect potential habitats for eiders through disturbance, predation, dust, flooding, changes in natural drainage patterns, thermokarst, snow drifting, and oil and chemical spills. The loss of habitat resulting from the development of the proposed project and reasonably foreseeable future projects would affect the threatened and endangered bird resources that rely on these habitats. Development in the northern portion of the NPR-A could have a synergistic effect on spectacled eiders using the Colville River Delta by the need for increased infrastructure or air or ground traffic in the delta to transport oil and gas, or corresponding supplies and equipment, to or from the NPR-A.

The primary impacts to threatened and endangered birds associated with the proposed project and other reasonably foreseeable future projects is that future development and oil production could occur on the North Slope in the NPR-A, the Beaufort and Chukchi Seas, and onshore between the NPR-A and the Arctic National Wildlife Refuge. New development, especially for economically marginal oil fields, would most likely occur near existing fields so that infrastructure systems could be shared (BLM 2012). Specific reasonably foreseeable future projects include development in the Greater Mooses Tooth, Bear Tooth, Colville River, Kuparuk River, Ooguruk, Pikka and Tofkat Units. These potential projects, along with established activities, recent developments, and recently permitted activities noted in Table 4.6-2, Past, Present and Reasonably Foreseeable Future Developments are all within the Harrison Bay and Lower Colville River Watersheds and would have additive impacts to threatened and endangered birds in that area.

Although direct habitat loss from cumulative oil and gas development on the North Slope would affect only a small proportion of the total area, indirect habitat loss, or functional loss, could result from long-term displacement of threatened and endangered birds from the vicinity of oil and gas activities and could involve a much larger area. Future offshore or nearshore development of leases in the Beaufort Sea could expose birds to additional habitat loss and disturbance related to oil and gas development through onshore facilities to support offshore/nearshore leases.

Spills of crude oil and other substances associated with reasonably foreseeable future projects could affect threatened and endangered birds on the North Slope. Cumulative effects would depend on the type, number, size, location, and timing of spills, and the type and effectiveness of the oil spill response and the species exposed to the spill.

If global climate change persists, the cumulative effects to threatened and endangered birds from oil and gas and non-oil and gas development on the North Slope could be greater than predicted due to larger than currently expected changes to bird habitat. Continued climate change would eventually lead to shifts in the composition and distribution of Arctic tundra vegetation and wetlands, which would affect birds in both positively and negatively. Permafrost would thaw to increased depths, causing 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 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 threatened and endangered birds (BLM 2012).

Contribution of the Alternatives to Cumulative Impacts

The BLM (2004) found that the incremental contribution of the Alpine Field to the cumulative impacts on spectacled and Steller’s eiders on the Arctic Coastal Plain was likely to be limited to occasional disturbance from aircraft overflights resulting in temporary, nonlethal impacts. Disturbance of some individual eiders as a result of both onshore and offshore oil and gas operations would likely be unavoidable over the long term. The impacts from typical activities associated with cumulative exploration and development of oil and gas prospects on the North Slope and adjacent marine areas may include small declines in local nesting or loss of small numbers of spectacled eiders (and potentially

Steller's eiders). These impacts would occur through disturbance of survival and productivity, predation pressure enhanced by human activities, and collisions with structures and vehicles. Increased human access via new roads and highways may result in locally severe increases in subsistence hunting pressures. Alternatively, subsistence hunting may decrease if hunters choose to avoid developed areas. The cumulative activities discussed above may cause localized impacts within the Colville River Delta but are unlikely to cause significant cumulative population impacts (BLM 2004).

Section 4.3.3 discusses, in depth, the impacts to birds from Alternatives A, B, and C. Direct impacts to habitats used by threatened and endangered bird species from gravel placement would be greater for Alternative C than Alternatives A and B. Under all alternatives, no significant impact to the spectacled eider population is expected due to the low population density in the vicinity of the proposed facilities. The impacts associated with habitat loss and alternation for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Alternatives A and B would have annual ice roads constructed in Years 1–3 to allow for construction of gravel infrastructure. Post-construction of gravel infrastructure there would be no ice roads needed for these two alternatives. Alternative C requires annual ice roads to be constructed for the life of the project. No threatened and endangered birds are present in the area during ice road season; however, re-use of ice annual road routes and ice pad locations could damage tundra, resulting in potential long-term impact to potential high value threatened and endangered bird habitats.

Impacts associated with disturbance to threatened and endangered birds from vehicle traffic would be greatest under Alternative A or B, due to the distance vehicles would have to travel. Alternative C would have no gravel access road traffic. The impacts associated with disturbance from vehicle traffic for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Potential impacts to threatened and endangered birds from aircraft under Alternative C is greater than Alternatives A or B due to the requirement to use aircraft to access the GMT2 drill pad when ice roads are not feasible (roughly nine months of the year). The air traffic at the GMT2 facility under Alternative C would be additional to the existing activity in the Alpine Central Processing Facility and Nuiqsut airspaces, and would continue for long term while additional flights required under Alternatives A and B would drop considerably after construction is completed. The impacts (disturbance and displacement) associated with aircraft traffic for Alternatives A and B are expected to be of low intensity, long-term duration, important in context, and of local extent. While impacts (disturbance and displacement) associated with aircraft traffic for Alternative C are expected to be of low intensity, long-term duration, important in context, and of regional extent.

Potential impacts to threatened and endangered birds from mortality and predation due to Alternatives A and B would be higher than for Alternative C, because the absence of a gravel road would negate the probability of mortality due to vehicle traffic and fewer culverts in gravel structures would create fewer potential sites for predators exploit. Under Alternatives A and B the construction of a road system could improve access for subsistence hunting of birds. The impacts associated with mortality from traffic and predators for all alternatives are expected to be of low intensity, long-term duration, important in context, and of local extent.

Potential impacts from oil pipeline spills would be similar under Alternatives A, B, and C. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The combination of impacts to threatened and endangered birds from proposed project coupled with impacts from reasonably foreseeable future projects in would be additive, long term, and localized or perhaps regional depending on the type of access to the reasonably foreseeable future (roaded or not roaded). However, in the context of the North Slope west of the Canning River, these cumulative impacts would be relatively small (BLM 2012) and would be dependent upon reasonably foreseeable future project locations relative to eider populations and their preferred habitat.

Further development in the cumulative impacts evaluation area may also impact spectacled and Steller's eiders through a cumulative reduction in habitat and an increase in disturbance. These impacts are not expected to cause pervasive cumulative impacts, as the impacts of the currently proposed and reasonably foreseeable future projects on spectacled and Steller's eider population, though additive, would be less than those of past projects due to smaller project areas (by comparison) and the large extent of existing habitat in the area of evaluation. The contribution from the proposed project is expected to be negligible with respect to the cumulative impacts evaluation area, and would be decreased from that approved in the 2004 Alpine Satellite Development Plan Record of Decision due to the reduced footprint of the proposed project.

Direct impacts to threatened and endangered birds associated with the proposed project are expected to be localized and minor in nature with no adverse impacts expected at the population level. The direct, indirect, and cumulative loss of bird habitat generally would be of low intensity, long term in duration, localized, and important in context. Overall, it is anticipated that less than 1 percent of the total high value bird habitat in the project study area would be impacted, directly or indirectly, by any single action alternative.

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 threatened and endangered 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 (BLM 2012).

Oil spills would not significantly add to cumulative impacts, except for an unlikely to very unlikely large spill to aquatic habitats.

The combination of impacts from the proposed project, coupled with impacts from other reasonably foreseeable future projects would be additive, long-term, and localized. The overall cumulative impact to threatened and endangered birds for the Harrison Bay and Lower Colville River Watersheds, and other reasonably foreseeable future projects is considered to be minor.

Alternative D would not have any incremental cumulative impacts to threatened and endangered birds.

Polar Bear

Section 3.3.5 discusses the distribution of polar bear, a wide-ranging animal that can be found along the coast of the entire North Slope. Maternal polar bear dens are documented along the mouth of the Colville River Delta, but have not been documented inside the project study area (BLM 2012, Map 3.3.8-6). There is designated critical habitat for this threatened species on the North Slope. The three habitat units of that critical habitat include sea ice habitat extending east from the international dateline to Canada, barrier islands along Alaska's coast within the range of the polar bear, and terrestrial denning habitat extending 5 miles inland from the coast from Utqiagvik (formerly Barrow) to the Kavik River and 20 miles inland from the Kavik River to Canada. No part of the GMT2 Access Road/pad infrastructure is in any of these three units. Impacts to polar bears from the proposed project could result through habitat loss, disturbance, incidental harassment, intentional hazing, or mortality. Polar bears are likely to be impacted in similar ways to terrestrial mammals. Cumulative impacts to marine mammals and threatened and endangered (or special status species) are discussed more fully in BLM (2004, 2012).

Past and Present Impacts and Their Accumulation

Prior to the 20th century, both the Chukchi/Bering and Southern Beaufort Sea polar bear populations probably existed near carrying capacity (Allen and Angliss 2010). Once harvest by non-Natives became common in the 1960s, the size of the Southern Beaufort Sea population declined substantially (Amstrup et al. 1986; Amstrup 1995). Since passage of the Marine Mammal Protection Act in 1972, both the southern Beaufort and Chukchi/Bering Sea populations seem to have increased (Allen and Angliss 2010). However, polar bears have since been listed as threatened rangewide because of climate change-related threats to the species' sea ice habitat (BLM 2012).

Changes in sea ice conditions can have cascading effects that increase the magnitude of impacts from other sources of impact. For example, thinning ice and a greater extent of marginal ice stability in the fall may already be leading to reduced sea ice denning, and a corresponding increase in denning on land, in Southern Beaufort Sea bears (Fischbach et al. 2007). This in turn increases the probability of disturbance to denning bears from human activities. The chances of bear-human encounters in coastal villages and industrial areas also increases with a greater proportion of the Southern Beaufort Sea or Chukchi/Bering Sea populations coming on land during the fall open-water period, or as the amount of time individual bears spend on land increases (BLM 2012).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development. BLM (2012) described potential cumulative impacts to polar bears from non-oil and gas activities that would result from harvest (subsistence, handicrafts, and recreation), other sources of direct mortality, research, pollution and contaminants, and coastal development. These activities and impacts are described below and are summarized from BLM (2012, Section 4.8.7.11).

The primary concern for polar bears on the North Slope is loss of sea ice. The potential for an oil spill remains a potential threat to polar bears at the local population level, and this threat may increase with increased shipping traffic in the Arctic. While most other threats are either being managed or are not currently thought to be significant threats to polar bear populations, each could become significant in combination with future effects of climate change and the resultant loss of sea ice.

Hunting by non-Natives has been prohibited since 1973 although Alaska Natives living in coastal communities can hunt polar bears for subsistence and the making of handicrafts. The Southern Beaufort Sea population is currently considered depleted (Allen and Angliss 2010), and harvest quotas are set by the Inuvialuit-Iñupiaq Council. The harvest level for the Chukchi/Bering Sea population is not limited at this time; while the Alaska Native harvest from this population is reported to have declined recently, the portion of harvest that occurs in Russia is not well quantified (Allen and Angliss 2010).

Polar bears are occasionally killed during defense of life and property (Brower et al. 2002). Other relatively rare sources of mortality include predation by other polar bears, injury during fights or attacks among polar bears for reproductive advantage (Swenson et al. 1997), and injury received during play bouts (Taylor et al. 1985). Polar bears may also occasionally sustain serious injury while hunting, which can lead to death (Stirling et al. 2008).

There are several on-going research programs studying polar bears that may cause short-term adverse impacts to individual polar bears observed in surveys or targeted in capture efforts and may also incidentally disturb other bears nearby.

Persistent organic pollutants and the heavy metal mercury are known to have accumulated in individuals of the Southern Beaufort Sea and Chukchi/Bering Sea populations of polar bears, although adverse impacts have not been demonstrated for individual bears nor are the contaminants thought to have population-level impacts. However, contaminant body burdens, in combination with other factors such as loss of sea ice habitat and decreased prey availability, could ultimately contribute to adverse impacts in the health or productivity of individual polar bears.

The BLM estimates that approximately 1,800 acres have been occupied by community development in six Alaska North Slope villages through 2008, with much of the development associated with these villages occurring along the coast. Fourteen Distant Early Warning-Line sites were constructed along the coast of the North Slope in the 1950s, ranging in size from 150 to 2,835 acres. Beginning in the 1990s some of these sites have been remediated and restored, while others were converted to National Weather Service stations. Coastal development since 1900 has likely increased disturbance impacts to bears and increased human-bear encounters, but there is no evidence that this has significantly affected polar bear populations. If land-based denning by polar bears increases with declines in sea ice, future coastal development may make potential polar bear denning habitat prone to disturbance or unavailable.

Oil and Gas Exploration and Development Activities. Cumulative impacts to polar bears from activities across the North Slope were fully considered in BLM (2012). Oil and gas development in the Chukchi and Beaufort Seas has the greatest potential to lead to additive impacts for polar bears. Even small spills that could not be completely remediated could accumulate over time and could include direct fouling of polar bears, their prey, or their habitat. These spills could foul ice and shorelines, so the continued risk of direct exposure remains, as does the risk of long-term contamination of both marine and terrestrial habitats (BLM 2012). Proposed activities with the most potential to affect polar bears in the NPR-A include oil and gas exploration and development, aircraft and watercraft traffic, and winter overland travel. These activities could affect polar bears by causing direct mortality from defense of human life, accidental oil spills, altering polar bear behavior, physiology, or movements; or disturbing or destroying snow dens, which could cause impacts to cubs at critical life stages, resulting in mortality (BLM 2012).

Based on past seismic activity on the North Slope, the BLM (2012) assumed continuation of the recent experience of three to four seismic crews active in NPR-A each winter. Since that assumption was made, however, there have been only one to two crews per winter. Exploration sites with gravel pads, disturbed areas around these pads, exploration airstrips, and gravel exploration roads have been replaced in recent years by ice roads, ice airstrips, and ice drilling pads to reduce the costs and environmental effects of exploration. Both disturbance and denning habitat loss impacts from ice roads and pads are short term and are not expected to accumulate. Only a small amount of potential denning habitat is likely to be affected long-term by exploration activities (i.e., seismic) (BLM 2012).

Future development and oil production could occur on the North Slope in the NPR-A, the Beaufort and Chukchi Seas, and onshore between the NPR-A and the Arctic National Wildlife Refuge. New development, especially for economically marginal oil fields, would most likely occur near existing fields so that infrastructure systems could be shared (BLM 2012). Specific reasonably foreseeable future projects include development in the Greater Mooses Tooth, Bear Tooth, Colville River, Kuparuk River, Ooguruk, Pikka and Tofkat Units. These potential projects, along with established activities, recent developments, and recently permitted activities noted in Table 4.6-2, Past, Present and Reasonably Foreseeable Future Developments, are all within the Harrison Bay and Lower Colville River Watersheds. Some of these reasonably foreseeable future projects fall within the critical habitat area for terrestrial denning habitat, which extends 5 miles inland from the coast from Utqiagvik (formerly Barrow) to the Kavik River potentially affecting denning habitat and decreases denning success.

Although direct habitat loss from cumulative oil and gas development on the North Slope would affect only a small proportion of the total area, indirect habitat loss, or functional loss, could result from long-term displacement of polar bears from the vicinity of oil and gas activities and could involve a much larger area. Future offshore or nearshore development of leases in the Beaufort Sea could expose polar bears to additional habitat loss and disturbance related to oil and gas development through onshore facilities to support offshore/nearshore leases.

If global climate change persists, the cumulative effects to polar bears from oil and gas and non-oil and gas development on the North Slope could be greater than predicted due to larger than currently expected changes to their habitat. Such impacts could accumulate with changes in thinning of ice and greater extent of marginal ice stability in fall 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 polar bears (BLM 2012).

The proposed project represents an additive cumulative effect with respect to polar bears.

Contribution of the Alternatives to Cumulative Impacts

Under the action alternatives, polar bears may be drawn or attracted to human activity associated with the proposed project resulting in incidental or intentional harassment. Under Alternatives A, and B which add permanent gravel roads, there is an increased risk of collision with vehicles. These alternatives also increase the local transportation network, thus allowing easier access for subsistence hunters. Alternative C would have no gravel access road traffic, but the absence of impacts from roads would likely be offset by the increase in impacts from air traffic at CD1/Alpine Processing Facility and GMT2 site. The potential mortality impacts to polar bears resulting from all the action alternatives are expected to be minor. Alternative D would have no negative impacts to polar bears.

Conclusion

Oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat. In particular, some polar bear denning habitat has likely been altered or made unavailable as a result of construction and human activity. The amount and effect is unknown, but likely minimal, since the majority of historic dens were offshore and most land dens were to the east of major development (Amstrup and Gardner 1994). The main land-based polar bear travel corridor (within 1 mile of the coast) and nearshore area have been fragmented to some extent; but the effect has likely been minimal. This minimal effect can be attributed to the small amount of development that has occurred related to total area, and the ability of polar bears to cross man-made routes, including roads and causeways.

Whereas industry activities have had some impacts on individual polar bears, there is no evidence these impacts have resulted in changes to polar bear populations (BLM 2012, Section 4.8.7.11). While other threats are managed or are not currently thought to be significant threats to polar bear populations, each could become significant in combination with future effects of climate change and the resultant loss of sea ice. Changes in the extent and timing of sea ice are expected to have a significant impact on polar bears through alteration of their distribution, nutritional status, reproductive success, and ultimately their abundance.

When evaluating the currently proposed project in conjunction climate change and other reasonably foreseeable future 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.

Bowhead Whale and Ringed Seal

Two species of marine mammals listed under the Endangered Species Act are present in the Beaufort Sea: the bowhead whale (endangered) and the ringed seal (threatened). All but the CD5 pad, a short section of pipeline system from GMT1, and a short section of pipeline system from CD5 to CD1 are further than 5 miles from the coast. This infrastructure would not likely impact these species.

Cumulative impacts to bowhead whales, and ringed seals are most likely to occur as a result of subsistence hunting, vessel transportation, air transportation, commercial fishing, spills or other discharges to the marine environment, dredging, coastal development, and climate change (BLM 2012, Section 4.8.7.11). Cumulative impacts to marine mammals and threatened and endangered (or special status species) are discussed more fully in BLM (2004, 2012).

Past and Present Impacts and Their Accumulation

For Bering-Chukchi-Beaufort Seas bowhead whales, the most dramatic population level impacts were associated with commercial whaling that occurred from 1849 to 1915 (Bockstoce and Botkin 1983). In fact, all circumpolar bowhead populations are still recovering to varying degrees from commercial whaling today (Zeh et al. 1993; BLM 2012, Section 4.8.7.11).

More recently, climate change and increasing human activities (particularly with regard to oil and gas activities) may be having large impacts on these species. For bowheads, some information is available on how individual animals respond to oil and gas activities but the observations are short term and provide little usable data for longer-term impacts on individuals or the population. Bowheads seem to be highly sensitive to low levels of anthropogenic sounds and deflect away from those sounds or change their behavior. Ringed seals seem to be quite tolerant of anthropogenic activities. Little is known about other species (BLM 2012).

Although some information exists on how individual animals respond to anthropogenic sounds, it is not known how those impacts accumulate. Most bowhead whales annually return to Beaufort Sea to feed, and much information exists on how individual animals respond to anthropogenic sounds (Richardson et al. 1995). One such response is that migrating bowhead whales have avoided areas of specific human activities ranging from 1 to 2 kilometers to over 20 kilometers (Richardson 1999, 2008). Bering/Chukchi/Beaufort Sea bowheads do not seem to have habituated to industrial activities. If impacts were countervailing or do not accumulate over years, cumulative impacts or past and present activities may have been minimal to date (BLM 2012).

Hunting and commercial fishing are the two primary factors that have affected bowhead whales in the past and continue today, while ringed seals are thought to have been relatively unaffected by anthropogenic sources. While commercial fishing, vessel strikes, and subsistence take have removed individuals from the bowhead population and possibly affected population growth rates, the impact is minimal and has not altered a strong population growth trend (George et al. 2004; BLM 2012).

Noise and disturbance associated with offshore seismic and drilling activities, and boat and barge traffic, have affected bowhead whales, causing deflection and behavioral changes (Richardson et al. 1995). A large body of literature exists about the sensitivity of bowhead whales to industrial sounds and activities (see National Research Council 2003); however, it is not known how impacts from these stressors accumulate. Bowhead populations have been increasing for at least 3 decades despite oil and gas activities. It is possible, though, that the population could have increased more rapidly in the absence of industrial activities. It appears that ringed seals are relatively insensitive to some disturbance impacts from oil and gas activities such as vessel traffic, offshore seismic and drilling activities but studies have not been completed to assess with confidence whether long-term persistent changes in behavior exist that could lead to reduced fitness and population changes. Other impacts from oil and gas activities such as vessel discharge, introduction of new biota, oil spills, and changes in prey distribution or abundance have a high probability of negatively impacting seals (BLM 2012).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development. Non-oil and gas activities could also contribute to cumulative impacts on bowhead whales and ringed seals. Principle impacts include: shipping, commercial fishing, subsistence hunting, tourism, and climate change. Although a few individuals would likely be injured or killed, non- oil and gas activities are not expected to have much impact on the bowhead whale or seal population, and bowhead whale populations have increased steadily under current management (George et al. 2004; Zeh and Punt 2005). However, if major commercial shipping routes become established in the Arctic, ship strikes of bowheads and other shipping-related impacts may occur at higher rates (e.g., oil spills, debris, bilge water) (Reeves et al. 2012; BLM 2012).

A presumably small number of bowhead whales could be injured or killed as a result of entanglement in fishing gear or collisions with ships (Reeves et al. 2012). Fishing would compete for seal prey items and over time may produce population level impacts due to decreased body conditions of seals from nutritional stress. It is expected that subsistence harvesters would continue to harvest bowhead whales and that traditional seal harvest will continue (BLM 2012).

Past and present activities associated with hard rock mining, operation and rehabilitation of Distant Early Warning-Line and similar military sites, tourism, and scientific research can cause impacts to bowhead whales and ringed seals and result in disturbance, deflections, and masking of whale and seal sounds. These disturbances can be expected to continue or possibly increase in the future (BLM 2012).

It is likely that reduced sea ice and climate changes could result in increased commercial shipping traffic and increased commercial fishing. These activities could result in an increase in vessel collisions for bowheads resulting in additional injury and mortality (BLM 2012).

Increased fishing effort in areas currently used by bowheads and ice seals would likely result in an increased rate of encounters with fishing gear, greater entanglement rates, and subsequent injury, loss of fitness, and mortality. Ringed seals would experience an increased competition for food resources, which could affect overall body condition and recruitment into the population (BLM 2012).

Oil and Gas Exploration and Development Activities. The potential impacts of future oil and gas development on the North Slope to special status marine mammals was analyzed in BLM (2012). If a large oil spill were to occur as a result of (1) development and production associated with any past, present, or reasonably foreseeable future development project on the North Slope or in the Beaufort or Chukchi seas, or (2) grounding of a large commercial vessel, some bowhead whales and ringed seals would likely be impacted. However, most whales directly exposed to spilled oil would likely experience temporary, nonlethal impacts from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil- contaminated prey, baleen fouling, reduction in food resources, or temporary displacement from some feeding areas. A few individuals could be killed if they were to experience prolonged exposure to freshly-spilled oil. Reproductive impacts are also possible. Impacts to seal species would depend on a number of factors such as the amount and duration of exposure, and proportion of oiled prey consumed. Reduction in food resources would be more detrimental to seal species due to their life history characteristics when compared to long-lived bowhead whales with large stored energy supplies. Oil spill cleanup activities (e.g., vessel and aircraft traffic) could displace some bowhead whales, should those activities coincide with the fall migration.

If there were increased offshore exploration and development activities, the potential for cumulative impacts to marine mammals by noise or other activities would increase. Whale species most likely to experience cumulative impacts include gray whales. Increases in ice-free periods and ice retreat may be accompanied by a northward shift in commercial fisheries and shipping traffic, potentially increasing rates of disturbance, entrapment, entanglement, and vessel strikes. Offshore oil and gas exploration and development, should it occur in areas occupied by whales, would result in disturbance impacts and may impact foraging success, possibly to the extent that fitness is reduced. Contribution of impacts from onshore NPR-A activity to the overall cumulative impacts to special status marine mammals will likely be relatively small (BLM 2012). While specific effects of climate change and ocean acidification on bowhead whales and ringed seals are uncertain, ice seals, in particular, may experience loss of habitat and changes in prey distribution and availability. Impacts of the currently proposed project are within the range of impacts analyzed in BLM (2012).

Of the reasonably foreseeable future projects, development of offshore prospects and onshore support infrastructure would have the greatest potential impact to these species based on the location of these projects. The impacts would be additive to those of GMT2 and future onshore development in the NPR-A. A full evaluation of how potential offshore development and associated onshore support infrastructure could impact these three species is outside of the scope of this document.

Contribution of the Alternatives to Cumulative Impacts

Under all of the action alternatives for the proposed GMT2 Project, the impact to bowhead whales and ringed seals is considered negligible based on the project location relative to these species. Alternative D would have no incremental impact due to the lack of development.

Conclusion

In the Arctic, industrial sounds and other disturbances have displaced whales from preferred habitats; these impacts can be difficult to quantify and to determine if they accumulate. In addition to noise and disturbance from existing oil development, seals and bowhead whales could be affected by future offshore development in the Beaufort and Chukchi Seas.

The probability of a spill reaching marine waters under the proposed project is very low. In the event of a spill reaching marine waters, the spill would need to reach waters of greater depth well offshore from the coastline to coincide with the seasonal preference of these three species for an impact to occur. An oil spill could affect marine mammals in offshore or coastal areas, with the impacts depending on the location and amount of oil spilled and time of year. The impacts of future habitat alteration associated with gravel island construction, platforms, or other structures related to oil development would likely be minor.

The presence of small amounts of hazardous materials, including hydrocarbons and previously used insecticides, would likely have minor impacts on marine mammals.

The BLM (2004) found that the overall cumulative impacts of the proposed development and other past, present, and reasonably foreseeable future activities would be minor. Impacts were expected to be the potential loss of up to several hundred seals and walruses, and probably less than 10 gray whales. Cumulative noise and disturbance in the Beaufort Sea and on the North Slope are expected to briefly and locally disturb or displace a few seals and gray whales (BLM 2004).

4.6.8 Cumulative Impacts to Social Systems

4.6.8.1 Cultural Resources

Cumulative impacts to cultural resources could occur in the project area as a result of additive direct impacts such as those that occur from ground-disturbing activities such as gravel excavation, road construction, installation of vertical support members for pipelines and powerlines, and other ground disturbance in proximity to project components. Other activities and events that could cause direct impacts to cultural resources include damage caused by equipment during the construction, drilling, and operation phases of the project, and unanticipated incidents such as blowouts, spills, or fires and subsequent cleanup activities. There may also be adverse impacts to undiscovered cultural resources due to erosion and gullying resulting from development projects. Cumulative indirect effects typically occur from bringing more people into the region increasing the potential for disruption, destruction, or unauthorized collecting or looting of cultural resources.

Cumulative impacts to cultural resources could also occur from direct and indirect impacts in the project area including removal, trampling, or dislocation of cultural resources and culturally sensitive areas by personnel and visitors, complete or partial destruction of a site from erosion, melting permafrost, vibrations, or other landscape changes caused by GMT2 Project components; and the loss of traditional meaning or importance of a resource or loss of cultural association with a resource.

Past and present actions and events that have potentially affected cultural resources in the project area include historic and continued exploration and extraction of oil reserves, development of military sites for communications, scientific research and surveys, and recreation and tourism activities. Because of the potential existence of unidentified cultural resources, it is difficult to quantify the extent to which past and present activities have impacted cultural resources. While some cultural resources in these areas have undoubtedly been damaged, destroyed, or buried under gravel, most of these impacts have occurred outside the NPR-A (BLM 2012). However, the potential for cumulative impacts increases with increased construction, drilling, and operations ground-disturbing activities, and also bringing more people into the region.

As noted by the BLM (2012), from a cumulative perspective, more cultural sites have been disturbed and cultural material removed from the region as the result of scientific studies than have been destroyed or removed through unauthorized collection resulting from oil and gas exploration and development or other construction-related activities. While the scientific value and significance of the material that was obtained through scientific work is known, the value and significance of material lost through unauthorized collection or destruction will never be known. This is the greatest potential cumulative impact to cultural resources (BLM 2014).

New development, research, or recreation activity in conjunction with the proposed GMT2 Project increases the likelihood of future identification, disruption, or destruction of cultural resources. Therefore, the action alternatives, in combination with other oil and gas exploration or extraction, or any other proposed development in the GMT2 vicinity, have the potential to create cumulative effects on cultural resources. These include: destruction or possible disturbance of unidentified cultural resources via increased gravel mining, or other ground-disturbing activities; added noise or visual effects; and fragmentation of culturally important areas through reduction in access and changes in local resource availability. To reduce these impacts, measures can be taken to protect those resources that have been identified. While unidentified sites are susceptible to adverse effects in direct correlation to the extent of ground disturbance, number of construction activities, and people in the region, the GMT2 has a low likelihood of impacting unidentified resources because of the relatively low number of cultural resources documented in nearby areas.

Cumulative effects to known cultural resources are similar across the GMT2 alternatives, except for Alternative D which would have no incremental adverse cumulative effect to cultural resources in the region. Cumulative impacts to cultural resources would be low because (1) there are no historic properties, Alaska Heritage Resources Survey sites or Traditional Land Use Inventory sites within the GMT2 direct area of potential effect; (2) only three sites (Traditional Land Use Inventory HAR078, Traditional Land Use Inventory HAR079, and Traditional Land Use Inventory HAR103) are within the limits of the indirect area of potential effect; (3) of those sites within the indirect area of potential effect, temporary access, frozen conditions, and poor surface visibility will likely help protect these resources; and (4) impacts to the viewsheds and soundscapes of the two sites outside the 2.5-mile indirect impact boundary and within the 5-mile sound and viewshed boundary will be temporary.

Impacts to the travel routes identified as circulation and land use features of the area identified in Nuiqsut Paisanich as the Nuiqsut Cultural Landscape would result in a detectable alteration, but these effects would be mitigated to some degree by proposed access points being provided by ConocoPhillips as part of the proposed action. Because of the generally unpredictable location and context of cultural resources, the magnitude of cumulative impact the resources is difficult to estimate. However, it is expected that if current procedures for survey and inventory before exploration and development activities continue, the impact to the resource would be minimal. Due to the variety of circumstances surrounding the location and character of cultural resources, the significance of potential future cumulative impacts to historic properties, Alaska Heritage Resources Survey sites, and Traditional Land Use Inventory sites is difficult to assess; however, if the protections that are currently in place carry forward, then the cumulative impacts in the region would be expected to be minor.

Summary and Comparison of Alternatives

Impacts to cultural resources are similar across the action alternatives. There are no historic properties, Alaska Heritage Resources Survey sites, or Traditional Land Use Inventory sites known from the direct area of potential effect of Alternatives A, B, or C. Three Traditional Land Use Inventory sites are located within the 2.5-mile buffer, but are unlikely to experience any substantial or prolonged disturbance. Two more Traditional Land Use Inventory sites are located at the far northwestern margin of the 5-mile buffer for all alternatives, and these would experience a small degree of minor, local, temporary noise and visual impacts. Routes utilized by Nuiqsut residents to travel north and west of the community to Teshekpuk Lake, Smith Bay, Admiralty Bay and Utqiagvik (formerly Barrow), have been identified as features of the area identified as the Nuiqsut Cultural Landscape. Effects to these common elements of the cultural landscape from Alternatives A and B gravel road, ice road, and pipeline construction and maintenance, or Alternative C pipeline and ice-road construction and maintenance, could be mitigated in the same manner across alternatives by constructing and operating this infrastructure in a manner that allows local residents to cross the road/pipeline and continue to utilize these routes. No adverse effects or impacts to cultural resources are anticipated under Alternative D.

Overall, the current analysis resulted in a determination of “No Historic Properties Affected” (36 CFR 800.4[d][1]) under Section 106 of the National Historic Preservation Act; and a NEPA finding of minor impacts to cultural resources. No known Alaska Heritage Resources Survey sites, Traditional Land Use Inventory sites, or historic properties are within the direct effects area of potential effect, and impacts to the three sites in the indirect area of potential effect are expected to be negligible. The low visual and low, temporary noise impacts to the two sites at the far northwestern boundary of the buffer area would not affect cultural or physical integrity of the sites, or alter their character, nature, or feeling in terms of NRHP criteria or NEPA considerations. Effects to the travel routes north and west of Nuiqsut proposed as features of the area identified as the Nuiqsut Cultural Landscape could be mitigated by constructing and operating the GMT2 Access Road and pipeline in a manner than enables Nuiqsut residents to continue to travel along these routes.

4.6.8.2 Sociocultural Systems

Overall impacts associated with the GMT2 Project and past, present, and reasonably foreseeable development to the sociocultural characteristics of North Slope communities other than Nuiqsut would occur. Those impacts are expected to be primarily economic and beneficial, because GMT2 would result in a substantially larger amount of money in the state-administered NPR-A Impact Fund. Development of GMT2 under Alternatives A and B would most likely increase the feasibility of the current State of Alaska proposal to construct a permanent road from Nuiqsut to Utqiagvik, and development of such a road would likely make other development prospects more feasible. (The proposed road is not considered a reasonably foreseeable future at the time of writing). It is not expected that impacts resulting from GMT2 would be greater than those caused by technology, previous development, or climate change. Cumulative impacts to sociocultural systems are discussed in BLM (2004, Section 4G.7.1) and BLM (2012, Section 4.8.7.14). The analysis of the direct and indirect consequences of the GMT2 Project on sociocultural systems within the community of Nuiqsut found that all alternatives would likely have substantial, albeit varying, impacts. Nuiqsut would be likely to experience significant impacts to sociocultural systems because of the GMT2 Project and other past, present, and reasonably foreseeable exploration and development projects in the area.

The cumulative impacts of past, current, and reasonably foreseeable future actions on subsistence are discussed below in Section 4.6.10.8, “Subsistence.” Subsistence activities are critical to maintaining social ties within Inupiaq communities; substantial disruption to traditional hunting, harvesting, processing, distributing, and consuming Native food will also have impacts on social organization in the community.

Past and Present Impacts and Their Accumulation

Although North Slope Iñupiat have experienced the impacts of development on their social organization since their initial contact with non-Inupiaq explorers in the early 19th century, the cumulative impacts analysis is limited to events that have occurred since 1970. The cumulative impacts of oil and gas development on sociocultural patterns over the last 40 years are hard to establish with precision. There is evidence that North Slope systems have experienced both positive and negative ongoing, additive, and synergistic cumulative impacts from oil and gas activities. Today, the North Slope Borough receives approximately 98 percent of its tax revenues from oil and gas development, thus development has a substantial economic effect: no North Slope Borough community is considered an economically threatened community.

Stresses on North Slope sociocultural systems include residents’ inability to access traditional use areas, threats to subsistence resources, concerns about public health, decreased spiritual connection with the land, tensions associated with participating in multiple permitting processes for development and associated public meetings, and inter- and intra-community conflict. Long-term stresses result in greater impacts to sociocultural systems. Ongoing sociocultural impacts that are directly related to nearby oil development are expected to be substantially more intense in Nuiqsut than in other North Slope Borough communities. In other North Slope Borough communities, it is anticipated that the economic benefits that will accrue from GMT2 in combination with other past, present, and reasonably foreseeable future actions will outweigh any negative impacts these communities will experience. Depending on an individual or family’s particular value system and economic situation, the negative sociocultural impacts associated with development are likely to continue to match or outweigh the benefits of development in Nuiqsut.

Future Impacts and Their Accumulation

Activities Not Associated with Oil and Gas Exploration and Development

Non-oil and gas activities on the North Slope since the 1970s with associated substantial sociocultural impacts include, but are not limited to, the passage of Alaska Native Claims Settlement Act, the formation of the North Slope Borough, the passage of Alaska National Interest Lands Conservation Act, and the transferal of the management of the NPR-A from the Navy to the BLM. Many of the prominent Borough-wide sociocultural issues are discussed in North Slope Borough Economic Profile and Census Reports and North Slope Borough Comprehensive Plans, which are periodically produced for each community and the Borough as a whole. The Economic Profile and Census Reports focus on changing dependency ratios (a concern because the dynamics of the North Slope population has increasing percentage of school age children and elders but fewer working age residents), housing (overcrowding and outmigration are issues in all communities), income, training and education, use of the Inupiaq language, health, and subsistence (North Slope Borough and CRA North Slope Borough, prepared by Circumpolar Research Associates Shepro [2016]).

For the comprehensive plans, each community identifies its top strengths, weaknesses, opportunities, and threats, which effectively illustrate many of the primary sociocultural issues. Responses from Nuiqsut's Draft 2015 (North Slope Borough Planning 2015) comprehensive plan are:

Strengths:

- Unity of residents to work together to thrive as a community
- Leadership abilities and dedication by residents to participate in governance and protection of the health of residents and the environment
- Year-round, seasonal availability of subsistence resources of fish, whale, moose, caribou, seals, and berries
- Community commitment to the protection of subsistence hunting and lifestyle now and for generations to come
- Elder knowledge and the sharing of that knowledge with youth
- The enduring family tree—each person knowing who they are in relation to other extended family members and valuing that connection
- Community gatherings
- Natural gas-generated electricity/inexpensive energy
- Education system
- Job opportunities in the oil and gas industry for motivated people whose subsistence duties do not conflict with industry work schedules
- Water and sewer services
- Whaling as a community effort

Weaknesses:

- Restricted access to traditional hunting grounds by nearby industry
- Concern that air pollution from oil industry potentially contributes to asthma and respiratory infections in villagers, particularly young children
- Individual's low motivation for jobs and career training, particularly for jobs in the oil and gas industry/inability of industry to cope with employee's subsistence duties and schedules
- Need gravel for village public and private residents' use, particularly for repair of damage due to road subsidence and driveway wear
- Need new housing to relieve severe overcrowding
- Need a day care center to facilitate parents working/current proposed center is small/no outdoor play yard/who will run it?

- Desire to eradicate drugs and alcohol use and abuse
- High cost of living, particularly costly food and gas
- Communication between elders and youth needs improvement
- High drop-out rate by high school students/still needs improvement
- Lack of understanding of how Borough funds are allocated between the villages and Utqiagvik (formerly Barrow) coupled with a desire to have a more equitable distribution of resources
- Need local decision making on how Borough resources are allocated, rather than “top down” decisions
- Helicopter activity within the subsistence area “spooks” the caribou and alters their migration patterns away from the village
- Need to extend water/sewer service to all residences
- Septic tanks freeze due to lack of, or failure of, heat tracers
- Need a washateria
- Borough needs to hold contractors accountable for quality design, materials, and construction work (poor quality heating, sewers, and housing systems are examples)
- The village needs health assessments of its residents as a baseline as well as regular monitoring
- Need apartment buildings
- Need housing for all income levels, including working families whose income is above Department of Housing and Urban Development low-income criteria
- Need activities for kids
- Need year-round monitoring of spur road activities, particularly with regard to oil spills and damage to the adjacent environment by worker traffic
- Need parking at Prudhoe for residents’ vehicles coming in on the ice road
- Need to bring back DARE officers to the school
- Need a school bus driver
- Taguiugmiullu Nunamiullu Housing Authority housing construction jobs go to out of town people and not to local residents
- A need to provide indoor recreation for youth and adults

Opportunities:

- Dredge the silted Puutu Channel to provide improved boat access to the Colville River and to produce gravel for village use
- Build new Arctic climate energy-efficient homes in the south side of town
- Operate job training and offer a broader spectrum of educational opportunities
- Operate a day care center
- Provide improved access to the Colville/Kuukpik River
- Provide cultural and recreational activities for youth and adults
- Improve interaction between elders and youth in the school
- Stand up against state and federal permitting agencies to prevent sport/trophy hunters within the village subsistence area
- Stand up to state and federal permitting agencies to require mitigation for commercial and industrial development to assure the least possible impact to the community’s way of life
- Establish a cost-effective dust control system
- Provide a road to the Cross Island area to bring whale meat and muktuk to the village instead of flying it in and to bring whaling supplies to the island
- Provide roads, power, water, sewer, and other utilities to shareholder lots to build new homes
- Native Village of Nuiqsut to get federal funds and knowledge to build new housing, similar to the housing in the Native Village of Utqiagvik (formerly Barrow)
- Provide boat and trailer access to the river

- Provide a shared system of boat trailers and trucks to haul boats to the river (for households who do not have those vehicles)
- Improve runway with paving and other elements to assure emergency medical evacuations, if needed
- Avoid multiple landing strips and air traffic by industry, which disturb subsistence resources and hunters, by having Nuiqsut airport serve as a regional airport
- Provide public parking at Prudhoe
- Provide a natural gas filling station

Threats:

- Expensive gas/diesel fuel and resulting expensive food and airfare
- Alcohol, drugs, and smoking use and abuse
- Climate change and its effects—stream bank erosion, subsidence, change in timing of subsistence wildlife, hazardous ice travel
- Air pollution due to industry discharges (including from flaring gas) into the prevailing winds towards the village
- Reduced access to subsistence resources due to area oil and gas activities
- Oil and gas development too close to the village with the potential for an oil spill on water and land as well as greater air pollution
- Helicopter activity spooking the caribou and changing their migration routes out of reach of residents
- Off-shore oil and gas exploration could disrupt, disturb, or damage Cross Island whaling resources
- Taguiugmiullu Nunamiullu Housing Authority housing construction jobs go to out of town people and not to local residents
- Contractors do not train and hire local residents and this becomes an endless cycle
- The Borough “freeze” on the sale of gravel for private lots and driveways cause Fire and Health emergency personnel to be unable to access people in need
- Since Alpine development, Borough Capital Improvement Program funds do not come to Nuiqsut any more
- On the east side of the river oil companies will be building roads and residents will have to go through numerous “check points” to pass these roads to access subsistence resources
- Oil company roads are too high for snow machines to pass and access to subsistence resources is blocked
- Sport hunters scare away caribou, particularly the vanguard herd
- State and federal agencies limiting subsistence harvest (quotas and bans) resulting in uncertainty about the ability to hunt in the future
- Loss of State revenues result in worsening of enforcement of permits for environmental protection
- Airport “hub”/expansion to accommodate large planes for industry may change the character of the village

Oil and Gas Exploration and Development Actions

The Greater Mooses Tooth Unit is located within the jurisdictions of several entities that have varying authorities on oil and gas development activities on lands within the unit. Entities include the BLM for federally managed land within the NPR-A (including both BLM-managed surface and subsurface, and land that has been selected by the Kuukpik Corporation but not yet conveyed), the North Slope Borough, the Kuukpik Corporation as a surface land owner, and Arctic Slope Regional Corporation as the owner of the subsurface rights under Kuukpik Corporation land. The GMT2 and other reasonably foreseeable future activities on the North Slope do not change the scope of authorities of these institutions, but may change where said authorities are applied if land and subsurface ownership are transferred to the two Native corporations. Cumulative impacts to sociocultural systems in Nuiqsut include tension between, on the one hand, all Nuiqsut entities and, on the other, all North Slope regional entities. For example, nearly every single village Tribe, corporation, and city on the North Slope has joined with the Voice of the Arctic

Iñupiat, a non-profit organization for local advocacy and engagement on state, federal and international forums addressing Arctic issues, but none of the three Nuiqsut entities has joined the organization. Another example of the sociocultural tension that results from oil and gas activities was the recent lack of support by Kuukpik Corporation for exploratory drilling at Putu 1, which is strongly supported by Arctic Slope Regional Corporation.

With oil development in close proximity to Nuiqsut increasing in the future, cumulative sociocultural impacts directly related to it (including many described as direct and indirect impacts of GMT2 in Section 4.4.2 and listed above by the community as weaknesses and threats) are likely to increase. Any impacts to subsistence have strongly associated impacts to social bonds and community cohesion and resilience.

Oil and gas-related reasonably foreseeable future activities that could affect social organizations on the North Slope include offshore oil and gas development activities, including the Liberty Project, the draft EIS for which identifies major potential impacts to Nuiqsut subsistence whaling at Cross Island. The already substantial tensions related to the permitting processes for Liberty will be exacerbated by the currently proposed federal plans to sell leases and quickly approve permit applications for all offshore drilling in the Arctic.

Various and significant concerns about expanded offshore oil development will be additive with the numerous concerns over GMT2 and the cumulative effects of the reasonably foreseeable future oil development projects on land near Nuiqsut (see Section 4.6.10.8, “Subsistence,” below, for a complete list of current and reasonably foreseeable future oil exploration and development within 40 miles of Nuiqsut). The potential for additional development to the west of the community (Cassin, Qugruk, Willow), south of the community (Stony Hill, Horseshoe), and east of the community (Putu, Nanushuk), when considered with Alpine and the Alpine Satellites to the north/northwest and near-solid expanse of development from Kuparuk to Point Thompson on the east, has many Nuiqsut residents feeling overwhelmed. It should be noted that many felt overwhelmed by the amount of development in close proximity to Nuiqsut years before many of these new reasonably foreseeable futures were considered.

The incremental construction of development-related infrastructure throughout the community of Nuiqsut’s traditional hunting and harvesting areas will likely result in the erosion of identify or cultural connection with those lands. This impact has already occurred with traditional use areas or camps within existing development areas that are no longer accessible to local residents.

The possibility of a major oil spill in the marine environment and its impacts on bowhead whales, other marine mammals, and fish are residents’ greatest concern associated with offshore oil and gas activity. Offshore development in the Beaufort Sea may require onshore processing facilities and would require onshore pipelines.

These and other stresses accumulate because they interact and are repeated with each new lease sale, EIS, development proposal, and facility expansion. Income from royalties, taxes, and jobs, generated by oil and gas activity and available to residents of the North Slope, would be anticipated to offset many sociocultural concerns. Dominance by industrial infrastructure over the majority of the Nuiqsut cultural landscape would not be effectively offset by these economic benefits.

Contribution of the Alternatives to Cumulative Impacts

With the Nuiqsut Spur Road and upcoming completion of the GMT1 road and Colville River Access Road, residents of Nuiqsut will have facilitated to subsistence areas and will be able to commute to work in the Alpine Field. Under Alternatives A and B, these benefits would expand to the GMT2 site for employment and area for hunting. Concerns that development of the GMT Unit will deflect caribou and adversely impact Nuiqsut’s ability to harvest caribou remain.

The cumulative impacts of the past, present, and reasonably foreseeable future activities on economic organization are tied closely to cumulative impacts on subsistence. The community of Nuiqsut participates in a mixed subsistence-market economy. The increasing presence of development activities in and around the community may disrupt the economic organization of the community through changes in subsistence activities and participation in the cash economy. If subsistence activities or resources are disrupted to the extent that overall harvests of subsistence resources decline, then residents may begin to rely more heavily on wage employment and participate less in traditional subsistence activities. Research by Native Alaskan individuals and institutions has found that high levels of participation in subsistence and the accompanying celebration of the native way of life are the most promising efforts to decrease depression and suicide rates (Peter et al. 2016).

As discussed in Sections 4.4.2, “Sociocultural Systems” and 4.4.5, “Subsistence,” disruption to Nuiqsut will be substantial under all action alternatives but would be particularly negative under Alternative C. Alternative C would preclude residents from commuting to work at GMT2 and would not provide facilitated access to the area for hunting.

Alternative C would likely result in a greater annual influx of outside workers to construct the additional ice roads that would be necessary.

In terms of overall impacts, Alternatives A and B would have the least substantial impacts because they require smaller increases in regional air traffic and would have the largest footprint with a particularly active drill site, camp, and airstrip.

Conclusion

The GMT2 Project, in addition to past, present, and reasonably foreseeable future activities on the North Slope, 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.

As discussed in BLM (2012, Section 4.8.7.13–4.8.7.14), several effects of climate change are particularly significant in the western Arctic. These effects are exacerbating erosion rates and migration schedules for subsistence resources. A decreasing ability of residents to harvest resources at the appropriate times would be likely to create significant social anxiety for the Iñupiat.

The BLM (2012) found that the overall extent of expected cumulative impacts on sociocultural systems would vary depending on the alternative selected, but that no scenario was expected to result in overall impacts that would be more substantial than those caused by technology, other aspects of modernization, and climate change. The current supplemental EIS sociocultural systems analysis is focused on Nuiqsut and the potential impacts of GMT2. It finds that all the action alternatives are likely to result in a mixture of sociocultural benefits and adverse impacts. None of the numerous adverse impacts is considered significant in and of itself. Taken as a whole, the degree and intensity of the wide range of impacts are much more substantial. In the context of rapidly increasing development in close proximity to the community, those already substantial sociocultural impacts will likely be synergistic with similar impacts resulting from other projects. There would substantially higher degrees of negative sociocultural impacts associated with Alternative C.

Appropriate mitigation and performance-based lease stipulations and best management practices should reduce the cumulative effect to sociocultural systems in Nuiqsut from oil and gas activities, and non-oil and gas activities.

4.6.8.3 Economy

The BLM (2004) describes cumulative impacts to the economy as potential gains in direct employment, which would include additive jobs in petroleum exploration, development, and production, and oil spill cleanup activities (BLM 2004, Section 4G.7.2.1). Cumulative impacts are projected to generate additive employment and personal income increases for local, North Slope Borough, and state residents.

Table 4.6-3 contains information concerning past, present and possible future oil and gas development in the cumulative analysis area. Overall cumulative economic impacts resulting from increased development on the North Slope would have benefits at state, regional, and local levels. Cumulative impacts to the economy are discussed more fully in BLM (2004, Section 4G.7.2; BLM 2012, Section 4.8.7.20).

Past and Present Impacts and their Accumulation

The North Slope Borough has transformed to a mixed cash-subsistence economy. Particularly in the last 40 years, residents have both benefited and grown accustomed to the result of modern capital development on the North Slope. In addition to the petroleum industry, the North Slope Borough has become a dominant economic organization on the North Slope. The North Slope Borough taxes the oil and gas facilities and uses the revenues to provide education and a wide array of other public services within its boundaries. Property taxes on oil and gas infrastructure provided over 82 percent of the total revenues received by the North Slope Borough in 2009 (BLM 2012, Section 4.8.7.20).

Kuukpik Corporation collects revenues from their ownerships in the Alpine Field and enters into surface access agreements for use of Kuukpik land. Kuukpik Corporation owns surface lands within the project area, and Arctic Slope Regional Corporation owns the subsurface minerals. Development in the Alpine Field would directly benefit these entities and royalties to Arctic Slope Regional Corporation from production of these fields would generate revenues for the corporation and its shareholders. Seventy percent of these petroleum royalties would be shared with the other Alaska Native regional corporations in accordance with section 7(i) of Alaska Native Claims Settlement Act.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Continued recreational, research, and other activities are expected to largely follow historic economic patterns. Growth and development associated with villages and military sites are also expected to continue (BLM 2012, Section 4.8.7.20).

Oil and Gas Exploration and Development Activities

Events that would affect the economy of the North Slope Borough and the State of Alaska result from existing and future onshore and offshore oil and gas leasing and development assisted by the potential construction of the Alaska Stand Alone Pipeline. Oil and gas exploration and development would occur on existing leases on State- and Native-owned lands east of the NPR-A, federal and Native-owned leases in the NPR-A, and federal and state leases in the Beaufort and Chukchi Seas. Future oil and gas lease sales with subsequent exploration and development may occur in the NPR-A, Chukchi Sea, Beaufort Sea, and lands east and west of the NPR-A. Construction of a natural gas pipeline is required to take North Slope gas to market, and would be important to the local and state economy. Economic impacts to the State, borough, and local economies are within the range analyzed in BLM (2012, Section 4.8.7.20).

Kuukpik and Arctic Slope Regional Corporation will likely benefit from other reasonably foreseeable future oil and gas activities in the area as mentioned, and Arctic Slope Regional Corporation benefits economically from the oilfield services it provides. Additionally, proximity of NPR-A communities, particularly Nuiqsut, to development in and near the NPR-A can provide opportunities to those communities. These opportunities could extend to community businesses that might provide goods and services, as well as residents who might obtain work as a result of the development and production activities.

Revenues from exploration and development of oil and gas resources in the NPR-A and elsewhere on the North Slope have added economic stability to local communities. The cumulative economic impacts also apply at the local community level. Although smaller scale, the economic ramifications could result in an increase in employment, income and revenue that is long term, but localized. Since communities in the NPR-A receive revenue from oil and gas through land ownerships used by industry, distribution of special funds unique to the NPR-A, and appropriations for a variety of services from the State government the economic impact could be substantial. There are a number of jobs in Nuiqsut that are technically North Slope Borough but paid for with NPR-A Impact funds from the State's share of revenues collected from federal development. Continuing or expanding those opportunities are dependent on NPR-A royalty revenues.

Contribution of the Alternatives to Cumulative Impacts

Production of oil from the GMT2 would, for a substantial period into the future, be a source of revenue to the North Slope Borough, which in turn, becomes part of the source of allocations to local communities. Production of oil resources from the GMT Unit under the cumulative case would be one of the sources of oil and tax revenues that would go to the North Slope Borough. For the purposes of this analysis, it is assumed that Alternatives A, B, and C would generate similar tax revenues. Alternative D would provide no additional revenue to the North Slope Borough since there would be no production from this project. Impacts to the State economy are based on the assumption that there are commercial quantities of recoverable oil and gas in the GMT Unit that would be extracted at the GMT1 and GMT2 sites. GMT2 and GMT1 would go on line at different times; phased construction and production would extend the overall economic effect of the revenue stream to the State from the GMT Unit over time. The cumulative effect of production and a pipeline system to CD5 would have a beneficial effect on other undiscovered oil and gas resources in the GMT Unit by having road access into the GMT Unit under Alternatives A and B.

The impacts to the economy under the action alternative would be similar; however, there may be slight differences in employment, income, and revenues due to differences in capital spending. It is estimated that the total capital cost of Alternatives B, C, and D1 would be higher (12, 14, and 80 percent, respectively) than the cost of Alternative A. Alternative C may also lead to increased economic benefits for the Native Village of Nuiqsut due to additional income from use of the airport and hotel.

Conclusion

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 North Slope Borough, and a substantial impact to the state if it must help fund the relocation.

4.6.8.4 Land Use

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. Cumulative impacts to land use in the project area are discussed more fully in BLM (2004a, Section 4G.7.6; 2014, Section 4.6.10.4).

Past and Present Impacts and Their Accumulation

Table 4.6-2 contains information concerning past, present and possible future oil and gas development. Lack of access in the NPR-A limits uses of these lands. The plan area considered in the Alpine Satellite Development Plan EIS (BLM 2004a), which includes GMT2, accounts for 890,000 acres of the 4.3-million-acre plan area (or 21 percent). Of this, the Alpine Field Development accounts for approximately 100 acres, and the Native Village of Nuiqsut accounts for 5,900 acres of development. The Nuiqsut Spur Road was constructed on Kuukpik Corporation lands and allows year-round access to the Alpine development area for increased subsistence use of the area, and increased employment opportunities for the Nuiqsut community. The remaining land is undeveloped, outside of subsistence-related camps and cabins and the Helmerick's property in the northeast part of the Colville River Delta. North Slope Alaska Natives, particularly those in Nuiqsut, use the Alpine Satellite Development Plan Plan Area for subsistence hunting and gathering. Oil exploration and scientific research activities also occur in various locations.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Future activities have the potential to impact land use including several non-oil and gas-related activities. Anticipated non-oil and gas activities include archaeological and paleontological excavations, scientific studies, recreational use, overland moves by transport vehicles, reclamation of former military or legacy well sites, expansion of existing communities, or the construction of new roadways. All of these activities would impact existing land use to some extent. Changes from additional future activities could be either positive or negative depending on location, ownership, and current uses.

Oil and Gas Exploration and Development Activities

The GMT Unit is located within the jurisdictions of several entities, which have varying authorities and perspectives on oil and gas development activities on lands within the unit. These include the BLM for federally managed land in the NPR-A (including land that has been selected by Kuukpik Corporation but not yet conveyed), the North Slope Borough, Kuukpik Corporation as a surface land owner, and Arctic Slope Regional Corporation as the owner of the subsurface rights under Kuukpik Corporation land and as a surface land owner. The GMT1, proposed GMT2 Project, and other reasonably foreseeable future development activities on the North Slope do not change the scope of authorities of these institutions, but may change where said authorities are applied if land and subsurface federal ownerships are transferred to the two Native corporations. The combination of GMT1, the proposed GMT2 Project, and the proposed Bear Tooth Unit Development would not change existing land use of federally managed land in the NPR-A, reflecting a Department of Interior decision to issue oil and gas leases with an implied expectation by the lease holder that environmentally responsible development of discovered commercially recoverable oil and gas resources would be approved. The CD5–GMT1 Road involves an area selected by the Kuukpik Corporation. Land owned by the Kuukpik Corporation is designated for a mixed use, which includes oil and gas production facility operations associated with Alpine. Until these lands are conveyed, BLM manages all selected land in the same manner as federally managed land in the NPR-A. Overall, the cumulative impact to land use by construction of GMT1, Bear Tooth Unit Development, and the GMT2 under any of the action alternatives is not expected to change the land uses now in place (BLM 2014, Section 4.6.10.4). Generally, the cumulative impacts of these developments would be similar and would not change existing land use.

The 2004 Alpine Satellite Development Plan EIS stated that additive cumulative impacts on land use, habitats, and subsistence on the North Slope would be expected to occur from current and future development and operation of energy, transportation, and utility facilities. The BLM 2014 stated that the combination of GMT1 and the conceptual GMT2 Project would not change existing land use of federally managed land in the NPR-A. The continued development of previously undisturbed areas on the North Slope will change the character of land use and cause increases in noise and disturbance. Both documents (BLM 2004, 2014) found that most of the cumulative impacts from future development were expected to be localized to the development facilities.

Other reasonably foreseeable future projects considered in this document (i.e., Colville River Unit Drilling Expansion, Willow Exploration, Kuparuk River Unit Future Development, Ooguruk Unit Development, Pikka Unit Development, Seismic Exploration, Community of Nuiqsut facilities, and the continued use of the Arctic Slope Regional Corporation Mine site) would have an additive impact with respect to land use to the extent that development associated with reasonably foreseeable future projects may extend into areas which have not been set aside for oil and gas development.

Contribution of the Alternatives to Cumulative Impacts

Alternatives A and B were cited and designed to comply with all relevant lease stipulations, as well as most of the BLM (2013a) best management practices governing surface uses. Alternative C may not have an adverse cumulative impact to the overall land ownership on the North Slope since land ownership is fixed by federal law. However, the location of unfilled land entitlements for the State and to Native corporations may move to other valid existing selections by the Kuukpik Corporation and Arctic Slope Regional Corporation within NPR-A. Selected land associated with GMT2 may not transfer from federal to private ownership because it is reasonable to conclude that most of these selections were based on prospective oil and gas development. The extent that existing valid selections by the Kuukpik Corporation and Arctic Slope Regional Corporation would or would not continue to patent is beyond the scope of this document.

Conclusion

Other related cumulative impacts to land use are discussed under Section 4.6.8.9, “Subsistence” and Section 4.6.8.5, “Recreation.”

4.6.8.5 Recreation

Cumulative impacts to recreation from oil and gas exploration, development, and production in the NPR-A and across the North Slope would result from construction and operation of facilities and roadways resulting in decreased solitude and primitiveness and possible increased access to recreational opportunities. Cumulative impacts to recreation are discussed more fully in BLM (2004a, Section 4G.7.7; 2012, Section 4.8.7.16).

Public recreational facilities in the GMT2 Project area are nonexistent and recreational opportunities in this area are a function of the natural setting. Primitive unconfined recreational opportunities (e.g., backpacking, sightseeing, and hunting) are possible, but access is limited due to the remote nature of the area. Public recreation in the area is of low intensity and primarily limited to non-local visitors who float the Colville River between Umiat and Nuiqsut.

Past and Present Impacts and Their Accumulation

The BLM (2012, 2014) considered the effects of past and present non-oil and gas and oil and gas- related activities and their accumulation on recreation resources (BLM 2012, Section 4.8.7.16; BLM 2014, Section 4.6.10.5) as described below.

Non-oil and gas activities would have minimal temporary or short-term impacts to recreation resources within the NPR-A. Temporary structures such as tents, vehicles such as Rolligons, and noise from generators, aircraft, human presence, and associated activities could have some minimal seasonal impacts on the setting, experiences, and desired beneficial outcome from use of public land. All of these identified non-oil and gas activities are transitory and seasonal, thus limiting the likelihood of recreationists encountering them in any given location.

The previous and current growth of communities around and within the GMT2 Project area may have a negligible impact on recreation resources through competition for resources on public lands. The past use of lands for military development and the adjacent active and inactive Air Force radar sites, do not take away from recreation opportunities.

Some past oil and gas exploration activity resulted in gravel pads and runways that remain today and can be beneficial for recreationists. Past oil and gas activities, including legacy wells, have left drums and other debris that would impact a recreationist for the duration that the items are visible.

Overall, the impacts to recreation resources and use from past and present activities are considered negligible. Past activities have left some mark on the land that can detract from the recreation experience however, evidence of past use is scattered and localized.

Future Impacts and Their Accumulation

Future impacts to recreation and recreational resources are anticipated from both non-oil and gas and oil and gas activities. Impacts could be both positive and negative.

Activities Not Associated With Oil and Gas Exploration and Development

After reclamation has taken place on past military development sites and legacy well locations, there may be remaining gravel runways and pads that could be used to access sites and to camp, which could benefit recreationists and other activities such as research. Nevertheless, this could lead to competition among user groups for this resource (BLM 2012, Section 4.8.7.16). Development of the Colville River Access Road could provide easier access for recreationalists in the GMT2 Project area if the road is open to the public. Future impacts could be both positive and negative.

Oil and Gas Exploration and Development Activities

The BLM considered impacts to recreation across the North Slope that may result from future oil and gas and related activities. Reasonably foreseeable future projects would have an additive cumulative impact on recreation resources in the NPR-A (BLM 2012, Section 4.8.7.16; BLM 2014, Section 4.6.10.5) it is assumed that impacts in the GMT2 Project area would be similar.

Of the proposed and reasonably foreseeable future projects, depending on the alternative selected, the CD5–GMT1 Road has potential to impact recreational opportunities in the cumulative impacts evaluation area, but any impact would be negligible (BLM 2014, Section 4.4.4.3). The construction of the CD5–GMT1 Road would allow additional access to the project area, but could only be used by the local population for subsistence activities. Thus, the potential impact to recreation overall is considered to be negligible.

Contribution of the Alternatives to Cumulative Impacts

Impacts to recreation during drilling and operations are considered to be minimal due to the lack of access and limited extent. Under Alternatives A and B, the construction of a new gravel road may increase recreational access to a larger area than is currently accessible via roadway. However, because road use would be limited to industrial traffic and travel by local residents, impacts to recreation are likely to be minimal. Alternative C would not provide additional opportunity for public access because a road would not be constructed and travel in and out of the associated airstrip would be limited to industry. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The BLM (2004a) predicted that short-term impacts, such as green trails and disturbance from noise and other activities, would not accumulate. 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 (BLM 2004a, Section 4G.7.7). Alternative D (no action) would result in no change from the current baseline conditions.

As the climate warms in future years, the timing and location of recreation activities could change. For instance if wildlife distribution changes then both wildlife viewers and hunters would correspondently change the location that they recreate. 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. The impacts to recreation associated with the proposed project are within the range of impacts considered by BLM (2012, Section 4.8.7.16).

4.6.8.6 Wilderness

The region of context for considering cumulative effects is the area of land from the Willow prospect area going east to Deadhorse containing the villages of Nuiqsut, Umiat, GMT1 and GMT2 Project areas. Continued development of oil and gas, and public utilities and infrastructure, over the next 50 to 100 years could cause the entire project area to lose its wilderness characteristics as a result of dissecting the area into parcels smaller than 5,000 acres, or by reducing naturalness within the area significantly. Flat topography allows long sight distances where above ground structures and elevated roads or pads could be seen easily, thus reducing naturalness throughout the region. Best management practices could help to reduce visibility of disturbance and structures, potentially enlarging the size of interspersed lands maintaining wilderness characteristics.

4.6.8.7 Visual Resources

Cumulative impacts to visual resources from oil and gas exploration, development, and production in the NPR-A and across the North Slope would result from increased development resulting in changes to the character elements of form, line, color, and texture of the natural landscape. Cumulative impacts to visual resources in the project area are discussed more fully in BLM (2004a, Section 4G.7.8; BLM 2012, Section 4.8.7.19).

BLM (2012, Map 2-5) identifies the visual resources in the GMT2 Project area as being managed as a Class IV resource. The overall cumulative impact to visual resources in the area by production facilities, elevated pipeline system, gravel road, and airports would be high (obvious disturbances to visual resources).

Past and Present Impacts and Their Accumulation

Past and present non-oil and gas-related activities, including archeological collection efforts, field camps, survey work, scientific research, recreation activities, film permits, and overland moves, are seasonal and generally limited with respect to size or scale, and therefore the casual observer has been minimally impacted. Landscape modifications from previous and current growth of communities around and within the NPR-A, the past use of lands for military development, and inactive Air Force Radar Sites have impacted visual resources or scenic quality, by creating a contrast to the landscape character elements of form, line, color, and texture of a primarily horizontal natural landscape. The colors of structures and equipment associated with non-oil and gas activities contrast with the white color of the snow-covered landscape and the various hues of greens and browns.

Cabins and camp structures associated with subsistence activities can be found throughout the North Slope. These structures are usually isolated single-story small plywood cabins that produce some contrast with the surrounding landforms, but on a very local scale, along lakes, rivers, and creeks (BLM 2012, Section 4.8.7.19). The Nuiqsut Spur Road has changed the characteristic of the landscape and increased the local transportation network, allowing traffic to move between Nuiqsut and the Alpine Field.

Airstrips are located within the NPR-A, villages, oil and gas fields, and at Deadhorse. While the profile of an airstrip is low, landform changes are introduced by brown colors in predominantly green vegetation and more regular lines than the surrounding irregular vegetation (BLM 2012, Section 4.8.7.19).

Winter overland moves, such as overland transportation of fuel and supplies to villages, and previous seismic activity can leave long lasting impacts to vegetation. The contrast has been minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 nine years, the evidence of use would be minimal (BLM 2012, Section 4.8.7.19).

Oil and gas activity prior to the 1998 lease sale left remnants (drums and other debris) of use on the landscape. As funding becomes available, the BLM has been plugging old wells, cleaning sites, and removing debris. However, debris not located at old well sites are scattered in the NPR-A. As the BLM encounters these items, GPS points are taken so that debris eventually may be able to be removed. The debris is a contrast to the landscape character elements of line, form, color, and texture of the landscape. Oil and gas activity since the 1999 lease sale has included requirements that leaseholders reclaim an area once they have completed their activity on the land. Some wells have been capped for future re-entry. However, they only occupy a minimal space on the landscape, approximately an imprint of 6 by 6 feet (BLM 2012, Section 4.8.7.19).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Activities not associated with oil and gas exploration are anticipated to continue as they have in the past and associated impacts are expected to be similar to current impacts described above.

Of the non-oil and gas reasonably foreseeable future projects, the Colville River Access Road has the greatest potential cumulative impacts. The proposed Colville River Access Road would permanently change the characteristic of the landscape, introduce public access into a currently non-easily accessible area and increase the overall noise level.

Oil and Gas Exploration and Development Activities

BLM (2012) concludes the cumulative effect of oil and gas development on the visual resources of the North Slope generally would be limited to the foreground-middle ground zone of the viewer BLM (2012, page 135). The GMT1 development, Arctic Slope Regional Corporation Mine site expansion, and the Bear Tooth Unit development, and reasonably foreseeable future projects are likely to have the greatest potential cumulative impacts. The GMT and Bear Tooth Unit developments would add facilities and structures (roads, airstrips, drill rigs) that would have a moderate impact to visual resources resulting in noticeable disturbances. The Arctic Slope Regional Corporation Mine site expansion would add a permanent impact to visual resources, but it would only slightly increase the impact of the current mine site on visual resources and would be minor. The proposed Pikka development would add facilities and structures that would have a moderate impact with noticeable disturbance to the visual resources northeast of Nuiqsut.

Contribution of the Alternatives to Cumulative Impacts

The BLM (2004a) considered cumulative impacts to visual resources from the proposed Alpine development. Short-term impacts such as green trails would not accumulate, and would naturally recover. Impacts from long-term or permanent facilities such as roads, pipelines, gravel pads, and pits would accumulate and would result in the loss of scenic quality. Long-term impacts from future development with a possible life span of over 30 years would affect the visual resources for the North Slope. These impacts would be expected to be greatest within a 0.5-mile radius of each developed site. Pipelines could be elevated above ground level. Except during construction and repair of pipelines, there would be no associated on-the-ground activity. Therefore, long-term impacts to visual resources from pipelines would be expected to be minimal beyond approximately 0.5 mile (BLM 2004a, Section 4G.7.8).

Oil and gas activities, including the alternatives associated with the GMT2 Project, would result in changes to the existing undeveloped nature of the project area. During the construction phase, the primary negative impact to visual resources from the alternatives for GMT2 would result from the presence of drill rigs in the project area. During drilling and operations, pad facilities and communication towers would introduce a strong contrast to the natural landscape. The addition of gravel roads, pads, and airports as well as above-grade pipelines and bridges would also alter the existing visual landscape.

With all of the GMT2 action alternatives, there would be a cumulative adverse impact on visual resources within approximately 5 miles of proposed permanent facilities. Alternative C would eliminate the visual impact of a gravel road to the GMT2 pad in Alternative A and B, but would include an elevated pipeline. This would be counterbalanced by the establishment of a new airport and instrumentation. The impacts of new facilities would change the existing visual resources associated with the GMT2 Project. For new facilities, there would be noticeable impacts to visual resources that would be long-term in duration and likely to be visible up to 2.5 miles from the facilities. New facilities constructed adjacent to existing facilities or added to existing vertical support members would not change the existing visual character associated with existing oil and gas facilities. All three of the action alternatives are consistent with VRM Class IV land management objectives and would impact the visual resources moderately. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The overall cumulative impact to visual resources from production facilities, an elevated pipeline system, gravel roads, and airports would be high and result in an obvious disturbance. The GMT2 Project area is one characterized as low relief with very low vegetation cover, suggesting the 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 (BLM 2014, Section 4.6.10.6). Alternative D (no action) would result in no change from the current baseline conditions.

As development expands across the North Slope, primarily into areas where no infrastructure currently exists, so would the extent of impacts 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. The proposed project and reasonably foreseeable future projects, in conjunction with the GMT1 Project and the range of alternatives for the proposed GMT2, would have an additive cumulative negative impact, which would permanently alter the existing visual resources.

Although best management practices, lease stipulations, and mitigation measures would help blend structures and permanent facilities into their surroundings, the overall cumulative impact to visual resources in the immediate area of production facilities, elevated pipeline, gravel roads, and airports would be high and result in obvious changes to visual resources. The cumulative impacts from the currently proposed project are within the range analyzed in BLM (2012).

The implementation of lease stipulations and best management practices, required for the protection of visual resources under all alternatives, should reduce the cumulative effect to visual resources from oil and gas, and non-oil and gas activities.

4.6.8.8 Local Transportation

Cumulative impacts to local transportation from oil and gas exploration, development, and production in the NPR-A and across the North Slope would vary depending on whether new developments link into existing road systems or rely on roadless construction and are supported by air transportation. The cumulative impacts of new local transportation facilities in the Nuiqsut area would be intense and long term and would have both localized and regional benefits. Cumulative impacts to local transportation in the project area are discussed more fully in BLM (2004a, Section 4G.7.9).

Past and Present Impacts and Their Accumulation

The GMT2 Project area has undergone significant changes with respect to local transportation since the 1970s. The community of Nuiqsut was reestablished in 1973, and soon after, Trans-Alaska Pipeline System was built and production at Prudhoe Bay began. The reestablishment of the community, construction of the Nuiqsut Spur Road, and oil development in Prudhoe Bay and the GMT2 Project area have included the development and construction of roads, airports and other supporting infrastructure in the previously undeveloped area.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The addition of the Colville River Road Access would complete a road connection providing year-around vehicle access to fish and wildlife resources along the Colville River and its delta, as well as to estuarine and marine resources along the coast. The cumulative impacts of new local transportation facilities in Nuiqsut area would be intense and long term, and would have both localized and regional benefits.

Oil and Gas Exploration and Development Activities

The 2004 Alpine Satellite Development Plan Final EIS found that the proposed Alpine Field development, along with continued oil and gas development throughout the North Slope, would result in substantial increases in both road and air traffic levels, particularly on the central oil and gas transportation infrastructure in the Prudhoe Bay area. However, most of the transportation infrastructure on the North Slope is restricted to industry and local resident use, and operated well below capacity. Despite the substantial increase in activity levels, the existing infrastructure, combined with the proposed roads and airstrips serving remote facilities, was expected to be sufficient to accommodate these increased demands for air and overland transportation. Therefore, the BLM (2004a) did not anticipate any adverse cumulative impacts on transportation resources on the North Slope (BLM 2004a, Section 4G.7.9.1). The transportation impacts considered there are consistent with those for the currently proposed project.

The GMT1 project is increasing the transportation network from CD5 to GMT1 through the construction of the CD5-GMT1 gravel road. The 2014 BLM found that the cumulative impacts of new transportation facilities would be intense and long term and would have both localized and regional benefits.

The cumulative impacts from Alternatives A and B would be similar to the GMT1 project impacts. The proposed road will provide year-around access to the GMT2 facility, although access on this road system will be limited to the local community. Other reasonably foreseeable future projects, such as the Pikka

Unit and Bear Tooth Unit Developments, could have a synergistic cumulative effect to the extent that new offshore and onshore developments connect to project infrastructure expanding the local transportation network and providing access to subsistence resources.

Contribution of the Alternatives to Cumulative Impacts

All of the action alternatives would increase access to the general area around GMT2. The overall increase in permanent road access, under Alternatives A and B may be beneficial to future discoveries of commercially recoverable oil and gas resources in the GMT Unit depending on the location of the oil and gas resource. Having a gravel road system is likely beneficial to residents of Nuiqsut seeking access to traditional subsistence areas now limited to travel by off-road vehicle/snowmachine. Conversely, improved year around access may adversely impact the ability to harvest subsistence resources in the immediate area of the road and other facilities.

Alternative C would increase air transportation in the Nuiqsut area, but would not likely provide any beneficial improvements for local residents. Alternatives A and B will link GMT2 to GMT1 and the proposed gravel road infrastructure of the Alpine Unit. Minor impacts to local transportation are expected, as most construction would take place on industry-constructed ice roads with no public impacts. These alternatives would have a minor impact over an interim duration (during construction only) on a regional basis. Alternative C would not include a road connection to GMT2 and would require construction of a new airport at the GMT2 pad. Alternative C would result in a large increase in aircraft traffic, which would occur for the entire duration of the proposed project. As such, Alternative C would have a moderate impact for a long duration on a regional basis. Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

The cumulative effect of GMT2 would be focused on the construction of an industrial gravel road system in an area currently roadless. For the GMT2 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. Cumulative impacts could be either positive or negative based on the selected alternative.

The cumulative impacts of these new transportation facilities, as they provide opportunities for other reasonably foreseeable future projects to occur in the project area, would be intense and long term, and would have both localized and regional benefits. Alternative D (no action) would result in no change from the current baseline conditions.

Potential impacts to transportation are mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and best management practices of BLM (2013a) will reduce the impacts and total area of disturbance; these include E-1, E-5, and F-1.

4.6.8.9 Subsistence

Cumulative impacts would be direct and indirect impacts to subsistence use areas due to the construction of infrastructure leading to physically restricted access, and reduced access due to avoidance because of infrastructure, air and ground traffic, security concerns, and resource availability. Cumulative impacts would likely include localized deflection or more broadly altered migration routes of caribou. Cumulative impacts to subsistence have been discussed in BLM (2004, § 4G.7.3; 2012, § 4.8.7.13; and 2014 § 4.6.10.8).

These previous analyses concluded that the cumulative impacts of current and reasonably foreseeable actions would likely be substantial and would restrict access. The 2014 analysis of the direct and indirect impacts of GMT1 concluded that the effects of that project in and of itself would likely be significant. The GMT1 road, pad, and pipelines were constructed (Year 1 of construction) in winter 2016–2017.

Past and Present Impacts and Their Accumulation

The community of Nuiqsut was reestablished in 1973. Soon after, the Trans-Alaska Pipeline System was built and production began at Prudhoe Bay, approximately 63 miles east of Nuiqsut. Since that time, oil and gas development has expanded both east and west, resulting in infrastructure and activities in traditional subsistence use areas that have effectively displaced subsistence camping, hunting, and fishing activities. The community of Nuiqsut's traditional use area previously extended to the Prudhoe Bay area and several residents have native allotments along the coast between Nuiqsut and Prudhoe.

Other activities, including primarily social change (globalization), modern transportation methods, the economy of the NSB and Nuiqsut, effects of climate change and, to a lesser degree, scientific research activities, have substantially affected Nuiqsut's subsistence uses.

Future Impacts and Their Accumulation

Activities Not Associated with Oil and Gas Exploration and Development

Future activities not associated with oil and gas exploration, production, and development, could have cumulative impacts on subsistence uses. One reasonably foreseeable project is the Colville River Access Road, which would facilitate residents' access to the main channel of the Colville River. A potential impact of this road is that it could create a hunting corridor. Such changes have been documented in other rural communities where roads have been introduced, as described in BLM (2012, Section 4.8.7.13). In the case of the Colville River Access Road, facilitated access to hunting areas is an express purpose of the road.

The impacts of increased street vehicle accessibility and use throughout the Kuukpikmiut's traditional range by non-residents during the winter and shoulder months who are trying to travel between Deadhorse and communities to the west (primarily Utqiagvik but also Atqasuk) is a growing concern for Nuiqsut. The use of four-wheelers and other wheeled vehicles for subsistence can damage habitat and impact subsistence access to popular hunting areas: if trails become so damaged that they are rendered impassable, hunters may be prevented from traveling to an area or they may cause further damage by making new trails. These impacts to the tundra and subsistence access are not anticipated to exceed changes to the Arctic Coastal Plain that are anticipated to occur due to changing weather patterns.

Oil and Gas Exploration and Development Activities

Existing and currently proposed oil exploration and development projects within 40 miles of Nuiqsut include:

- The Kuparuk River Unit to the east:
    - Three central processing facilities, seawater treatment plant, 47 11-acre pads with over 1,150 wells, approximately 520 acres of surface development. Constructed 1979–1981, production is ongoing and more is planned.
    - Tabasco, accessed from drill site 2T, since 1998, 25 miles from Nuiqsut.
    - Tarn/Drill sites 2L and 2N 1998, 17 miles from Nuiqsut.
    - Meltwater/Drill Site 2P since 2001, 15 wells, 17 miles from Nuiqsut.
    - Palm/Drill Site 3S since 2002, 23 miles from Nuiqsut.

- Shark Tooth/Drill Site 2S, new gravel pad with up to 24 wells, new power lines and pipeline and 14 new wells drilled on existing pad, construction began 2014, currently in production, 20 miles from Nuiqsut.
- West Sak/NE West Sak/Drill Site 1H expanded by 9 acres for 18 additional wells, drilling in third quarter of 2017, 35 miles from Nuiqsut.

- The Oooguruk Unit:
    - Oooguruk, 6-acre gravel island with 40 wells, constructed 2007–2008, ongoing development drilling, 26 miles from Nuiqsut.
    - Nuna, 2 onshore production pads, one constructed, associated roads and pipelines, 22 miles from Nuiqsut.
- The Placer Unit, 3 exploration wells drilled 2016, unspecified future development plans, 17 miles from Nuiqsut.
- The Southern Miluveach Unit/Mustang, exploratory well (development on hold), would include up to 11 production wells, 20 re-injection wells, and operations camp, 17 miles from Nuiqsut.
- The Nikaitchuq Unit/Eni Nikaitchuq, 2 drills pads, 52 planned wells. One pad onshore at Oliktok Point, one pad on an 11-acre artificial gravel island (Spy Island). Construction began 2008, 23 wells drilled to date, in production with further drilling planned 2017. 36 miles from Nuiqsut.
- The Pikka Unit:
    - Nanushuk, 3 drill pads with 78 wells, 1 operations pad and central processing facility, 25 miles of gravel road, 288 acres of gravel fill, 12 miles from Nuiqsut.
    - Qugruk, 3 exploratory wells drilled 2013, 18 miles from Nuiqsut.
- Colville Delta Unit:
    - Alpine CD1, CD2, central processing facility, airstrip, 3 miles gravel road, total surface development 97 acres, since 2000. Two drill pads with approximately 140 wells, connected to Kuparuk via 34-mile pipeline, 8 miles from Nuiqsut.
    - Qannik, expansion of CD2 Drill Pad, 18 wells added 2007, 8 miles from Nuiqsut.
    - Expansion of CD2 Drill Pad Winter scheduled for winter 2018, 42 wells will be added, 8 miles from Nuiqsut
    - Fjord/CD3, drill pad with airstrip, since 2006, 14 miles from Nuiqsut.
    - Nanuq/CD4, drill pad with road since 2006, 5 miles from Nuiqsut.
    - Fjord West/CD2, CD3, CD5 (reservoir accessed from 3 pads).
    - CD5 road, bridge, and pad constructed 2013-14, approximately 7 miles from Nuiqsut.
- Greater Mooses Tooth Unit:
    - GMT1, previously CD6, 12-acre pad, 33 wells will be drilled 2019-2022, 7.6 mile road from CD5, 12 miles from Nuiqsut.
    - Rendezvous exploratory wells, discovery wells for GMT2 drilled in 2000, 16 miles from Nuiqsut.
    - Tingmiaq/Willow, 2 exploratory wells drilled 2016, 3 exploratory wells planned for 2018 and possible appraisal wells in 2019. Unspecified development plans, estimated 300 million barrels of oil, 27 miles from Nuiqsut.

- Bear Tooth Unit:
    - Cassein, 2 exploratory wells drilled in 2013, currently being evaluated for development potential.
- Putu, exploratory well, drilling planned for 2018, approximately 3 miles east of Nuiqsut.
- Stony Hill (no unit), exploratory well planned for 2018, 7.5 miles SSW of Nuiqsut.
- Horseshoe (no unit), exploratory well drilled in 2017, unspecified plans for development, 12 miles from Nuiqsut.
- Arctic Slope Regional Corporation Gravel Mine, active with planned 300+ acre expansion beginning 2018, 4.5 miles from Nuiqsut.
- Seismic exploration surveys will occur in multiple locations within 40 miles of Nuiqsut, including winter 2017–2018 with northern boundary of the survey block approximately 10 miles south of Nuiqsut.

These activities, in combination with development of GMT2, may increase problems between subsistence users and oil and gas activities. These developments would cause synergistic cumulative disturbances to subsistence use areas and would likely contribute to localized deflection of caribou and other large land mammals from the area. The combination of these activities would result in the community of Nuiqsut being effectively surrounded by development. This will most likely pose difficulties for those hunters who prefer to avoid oil and gas infrastructure altogether. As noted above, the shifting of Nuiqsut subsistence use areas away from oil and gas infrastructure has been documented (Pedersen 1979; Research Foundation of the State University of New York 1984; Impact Assessment, Inc. 1990; Pedersen et al. 2000; SRB&A 2014; Nukapigak and Kuukpik Corporation 2016). Much of the research and conclusions related to harvester avoidance are based on pre-Alpine hunting patterns. While avoidance has continued to occur, and has been documented in the Caribou Subsistence Monitoring Project, it is important to note that as industry has moved closer to Nuiqsut, it has become more difficult for residents to avoid industry. Future research will reveal how harvesters respond when infrastructure is established closer to town or in their core hunting areas. Avoidance may be less of an option as fewer areas without development are present. The GMT2 Project could contribute to those changes. Subsistence use of the GMT2 Access Road after its 2 to 3 year construction phase could present a countervailing impact in that it would facilitate access via road vehicle to the GMT2 area, although adverse impacts associated with the road are anticipated.

Contribution of the Alternatives to Cumulative Impacts

Under Alternatives A, B, and C, Nuiqsut residents would experience direct impacts to subsistence use areas, particularly those used for caribou and furbearers (wolf and wolverine) but also for geese and fish. Direct impacts on the subsistence use area would be most intense during the 2 to 3 year construction period for all action alternatives, but particularly under Alternatives A and B because those alternatives would involve construction of linear components (permanent gravel road) that would physically block access to subsistence users until it is complete. During drilling and operation, direct impacts would be lowest during the summer months because many of the subsistence activities that occur in the GMT2 area peak in the late fall through early spring. User access would not be physically restricted by the pipelines except in areas of high snow drifting. User access will be facilitated for users who have permission and choose to travel on the GMT2 Access Road after construction. Tundra travel should not be physically blocked by the road because ramps will be constructed to facilitate crossing; however, hunters may have to travel farther or reroute in order to find or access a nearby ramp. User avoidance is expected to be the primary impact related to user access because Nuiqsut hunters may avoid the GMT2 area due to disturbance from air and road traffic and drill pad activities and perceived or real reduced availability of resources. Subsistence use of the GMT2 Access Road may partly offset some of the negative impacts related to deflection of caribou and other resources and reduced resource availability.

The cumulative impacts of Alternatives A and B would be similar because both of these alternatives could lead to future expansion of oil and gas exploration and development in other areas on the west side of the Colville River. Expansion would result in increased impacts on Nuiqsut subsistence use areas and could potentially introduce oil and gas development into areas used by other North Slope communities (i.e., Utqiagvik, Atqasuk). A continued shifting of Nuiqsut hunting to areas south along the Colville and its tributaries could affect Anaktuvuk Pass. Nuiqsut hunters' use of the permanent road built under these alternatives and roads that would likely be built for any additional development projects on the west side of the Colville may partly offset some of the negative impacts.

Alternative C would be less likely to facilitate westward oil and gas development. However, Alternative C would result in greater aircraft traffic in the GMT2 area, a larger direct impact due to the larger pad(s), and would not provide the potentially offsetting benefit of subsistence use of a permanent gravel road.

In terms of overall subsistence impacts, Alternatives A and B would likely have fewer than Alternative C because these alternatives would result in a smaller increase in aircraft traffic and would include a road that subsistence hunters can use. Alternative C would result in greater impacts to subsistence because of the increased air traffic and no offsetting benefit of a road. For Alternatives A and B, high-intensity impacts to subsistence would be greatest during the 2 to 3 year construction period; impacts would be partly offset but not eliminated by facilitated access during drilling and operation. For Alternative C, impacts would likely be intense during construction and would continue to have high negative impacts to subsistence during drilling and operation due to larger pad(s), larger increases in air traffic, and lack of road access.

The BLM (2004) found that additive impacts that could affect subsistence resources include potential oil spills, seismic noise, road and air traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Based on potential cumulative, long-term displacement and/or functional habitat loss, habitat available for caribou may be reduced, unavailable, or undesirable for use. Changes in population distribution due to the presence of oil field facilities or activities may affect availability for subsistence harvest in traditional subsistence use areas. Overall, impacts to subsistence harvest and use may have synergistic impact with community health, welfare, and social structure. To the extent that subsistence hunting success is reduced in traditional use areas near Nuiqsut, hunters may need to travel further, to unfamiliar areas, or make more frequent trips to harvest sufficient resources in order to meet community needs. This could result in greater time spent away from the community for some and competition for resources with other communities. The changes in subsistence patterns may result in stress within households, family groups, and the community.

Conclusion

Overall, the GMT2 Project in addition to other current and reasonably foreseeable activities could increase the severity of existing impacts on Nuiqsut subsistence uses in addition to introducing impacts on subsistence uses for other North Slope communities. These impacts include 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. In addition, if displacement of subsistence resources occurs in Nuiqsut subsistence use areas, hunters may travel farther west to access hunting grounds, increasing the potential for competition between hunters from different communities. These impacts could result in increased investments in time, money, fuel, and equipment and potentially affect hunting success.

The GMT2 Project would introduce industrial infrastructure and activity into subsistence use areas west/southwest of the community, reducing the area in which residents can hunt and fish without the presence of nearby industrial infrastructure to only the area south of town. As oil and gas activities occur over a larger area and affect a greater portion of subsistence use areas, North Slope subsistence users may alter their harvesting patterns. This could potentially result in a loss of opportunities to harvest subsistence resources in traditional use areas. This loss of opportunity could have impacts on future generations, because harvesters will no longer be able to teach future generations about subsistence uses in traditional harvesting areas.

The effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue as predicted (Arctic Climate Impact Assessment 2004). The reduction, regulation, and/or loss of subsistence resources or reduced ability to access subsistence resources at appropriate times (Brinkman et al. 2016) would have severe impacts on the subsistence way of life for residents of NPR-A communities. 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. These synergistic effects could necessitate relocating communities or their population, shifting the population to places with better subsistence hunting, and causing a loss or dispersal of community (National Research Council 2003; Arctic Climate Impact Assessment 2004).

The implementation of Lease Stipulations, best management practices, and potential new mitigation measures required for the protection of subsistence resources under all alternatives should reduce the cumulative effect to subsistence resources from oil and gas and non-oil and gas activities in the planning area.

4.6.8.10 Public Health

Impacts to public health under the GMT2 action alternatives include: no impacts to water and sanitation and infectious disease; low impacts to specific health issues related to accidents and injuries; food, nutrition, and subsistence; and non-communicable chronic diseases; medium impacts as a result of exposure to hazardous materials (i.e., air quality emissions) and social determinants of health (i.e., depression, anxiety and resulting social ills); and high positive impacts to public health as a result of increased access to health care and facilities. Potential contributing factors to negative health under the proposed project could include hunters and animals being diverted, noise from increased air traffic, perception that traditional foods are contaminated, increased travel time and costs for subsistence, and poor air quality episodes. Cumulative impacts to public health are discussed more fully in BLM (2012, Section 4.8.7.21).

Past and Present Impacts and Their Accumulation

The 2012 Integrated Activity Plan/EIS public health cumulative effects analysis (BLM 2012, Section 4.8.7.21) described both positive and negative health impacts for North Slope residents due to changes that have occurred in the last 50 to 100 years, as well as reasonably foreseeable future actions such as oil and gas exploration and development, scientific research activities, mining projects, military developments and activities, transportation plans, community development projects, and recreation and tourism activities. As stated in the analysis, rapid modernization has led to significant changes in diet, housing, employment, and traditional culture. This has led to positive health changes including an increase in life expectancy, a decrease in infant mortality and infectious disease rates, improved health care services, public health programs, and municipal health infrastructure such as sanitation and water treatment facilities. This same transition has also led to negative health outcomes including increases in chronic diseases such as cancer, cardiovascular disease and metabolic disorders, and increases in alcohol and substance misuse, suicide, violence and other social dysfunction.

The pattern of oil and gas development that has taken place in and near the NPR-A, combined with the area's unique culture and geography, has led to the creation of certain health concerns that are of particular importance. These health concerns represent areas of vulnerability whereby further oil and gas-related development may have a disproportionate impact on health and safety, and include: injury and trauma, which may be linked to the adaptation by hunters to travel further away from development to conduct subsistence activities; increases in social pathologies such as alcohol and drug misuse, social dysfunction and violence, in part due to increased opportunities to import alcohol and drugs; and health disparities due to the uneven distribution of the rewards and risks of development.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Future non-oil and gas activities that could impact public health include scientific research activities, mining projects, military developments and activities, transportation plans, community development projects, and recreation and tourism activities. The common components of these future actions that are most likely to drive public health and safety outcomes were evaluated in BLM (2012, Section 4.8.7.21): potential growth in population in the communities in the project study area; in-migration of workers, visitors, or temporary residents not originally from the area; economic changes at the level of both individual residents and the Native corporations; changes in the level or success of subsistence activities; changes to public infrastructure; potential exposure to environmental contaminants; changes in access to or use of the land; continued acculturation of the Iñupiat people and alteration of sociocultural traditions.

As the reasonably foreseeable future actions continue the path and progress of development seen in the past, it can be expected that the changes in public health and safety outcomes will follow the same trends that have been observed in recent years as described above.

Nearby Pending Development

Impacts to human health associated with the Nanushuk and Liberty Development Projects would be similar to those under the range of action alternatives for the GMT2 Project, specifically those impacts that could be attributed to changes in subsistence harvest and availability of resources, and social and cultural impacts that lead to greater overall stress and anxiety for community residents. Development of Nanushuk and Liberty would have additive negative impacts with respect to public health. The additional Nanushuk development to the east would likely have an additive impact with respect to diverting animals and hunters away from infrastructure, and an increased amount of air emissions (including from the Nanushuk processing facility) and potential for spills. Further, the increased gravel required to construct Nanushuk is currently proposed to come from the Arctic Slope Regional Corporation Mine site, resulting in increasing noise and stress from blasting, and potentially affecting air quality due to fugitive dust. Personnel needed during the construction phase could also be an additive strain on existing medical care and emergency services. Potential impacts from the Liberty Project center around impacts to subsistence whaling and sea mammal hunting by the community of Nuiqsut. Currently, Nuiqsut has a robust yearly seasonal round that includes harvesting resources from the land, rivers, and lakes, and the ocean when they are available. Much like any predominantly subsistence community, subsistence users can adapt to small changes in one resource (such as fish), by harvesting more of another (such as caribou). However, should one resource be majorly disproportionately affected, such as failing to harvest any bowhead whale, in conjunction with a poor fish or caribou harvest, there would be synergistic impacts to subsistence. As with the GMT2 Project, these impacts would be greatest during the construction phase and would be reduced once operations are underway. The greatest potential impact during the operational period of either project would be the potential for a large-scale oil spill or other catastrophic industrial disaster.

Oil and Gas Exploration and Foreseeable Development Activities

The pattern of development and modernization that has taken place in and near NPR-A combined with the area's unique culture and geography has led to the creation of certain health areas that are of particular importance. These areas include injury and trauma, social pathologies such as alcohol and drug misuse, social dysfunction and violence, and health disparities within the population.

New development tying into existing infrastructure to the west of the NPR-A will exacerbate some of these impacts. The potential extension of seasonal or permanent roads into the northeast of the NPR-A might compound issues of conflict and smuggling in Nuiqsut and other North Slope Borough communities. Air and water quality across the region are currently good. Local impacts due to site-specific activity are possible, but will depend on the characteristics of individual site plans and the presence of exposed villages or camps. More widespread development will result in a greater number of individuals on the land or in camps being exposed to local air, and possibly water, exposures. Any road or pipeline that is proposed in a primarily eat-to-west linear route, such as one from the Smith Bay area to existing infrastructure, will be of primary concerns in terms of the availability of Teshekpuk Lake Caribou. Likewise, additional exploration leading to future development within the Greater Mooses Tooth Unit (i.e., Willow Discovery) will have the potential to further displace caribou away from Nuiqsut, resulting in indirect negative health effects.

Of particular significance for public health and safety is the potential for further increases in offshore oil and gas exploration, development and production. A ramp-up of offshore development is expected to lead to potentially substantive changes in public health outcomes via three pathways: (1) the displacement of marine mammals and the subsequent reduction of success and safety of subsistence marine hunting; (2) the potential for contamination and the fear of contamination through oil spills or routine discharge; and (3) substantially increased economic returns to the North Slope Borough, village corporations and individuals with resulting positive and negative health impacts and disparities (BLM 2012, Section 4.8.7.21). The direct and indirect employment resulting from oil and gas exploration and development combined with the government and Native corporation revenues are all major contributors to the positive health changes in the North Slope Borough over the last few decades.

Contribution of the Alternatives to Cumulative Impacts

Under all of the action alternatives, an increase in workers could impact the local community with respect to availability of medical care and emergency services. Impacts under all of the action alternatives are expected to be similar, with a few notable exceptions, discussed below. Alternative C, which does not include the construction of a GMT1–GMT2 Access Road, would have the least impact of any of the action alternatives in terms of potential impacts related to perception of food contamination and avoidance of infrastructure at subsistence sites. Alternative C would cause none of the impacts associated with the presences of a road (dust, emissions, noise, accidents) between GMT1–GMT2, but would increase the traffic, emissions, noise, and other public health issues associated with annual ice road construction and would have comparable impacts resulting from gravel extraction as the Arctic Slope Regional Corporation Mine site. Alternative C would have greater impacts on public health concerns related to environmental security (e.g., oil spill response, evacuation routes, air pollution). Alternative D (no action) would result in no change from the current baseline conditions.

Conclusion

When evaluating the currently proposed project in conjunction with the conceptual Nanushuk, Liberty, and other reasonably foreseeable future projects, these projects could have an additive cumulative effect, generating potentially substantive changes, with respect to public health as described above and in BLM (2012, Section 4.8.7.21). The community of Nuiqsut will be most impacted by the proposed and conceptual projects and affected by other reasonably foreseeable future projects in the area. The cumulative impacts of increased development to the east, west, and north of Nuiqsut; exploration of the Greater Mooses Tooth Unit, Bear Tooth Unit, and on Kuukpik Corporation and State of Alaska lands; and offshore development, may have 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, and the general overall effect of increasing stress and anxiety within the community as a result of the rapid changes that are taking place. Other reasonably foreseeable future developments are not likely to have a direct impact on the availability of local emergency services.

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 Iñupiat 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.

4.6.8.11 Environmental Justice

The analysis of impacts related to environmental justice considers if implementation of one of the proposed alternatives would result in disproportionately high and adverse environmental effects to the minority community of Nuiqsut. Environmental justice analyses weigh the benefits of a proposed project (e.g., increased economic activity or access) on the minority community, which may offset the adverse environmental effects from construction, drilling, or operation. The potentially affected resource in the environmental justice analysis is the community of Nuiqsut. The duration of effects under all the action alternatives would be long term.

Effects to subsistence comprise direct effects to the Iñupiat, a recognized minority population and the primary subsistence harvesters on the North Slope. Impacts from GMT2 to human health and well-being, social systems, and cultural values of the Iñupiat would cumulatively lead to disproportionate effects on this minority population.

Cumulative impacts to environmental justice are discussed more fully in BLM (2004, Section 4G.7.4; BLM 2012, Section 4.8.7.15; and BLM 2014, Section 4.6.10.10).

Past and Present Effects and Their Accumulation

Sustained contact with Euro-Americans and oil exploration and development conducted by the federal government and industry have directly impacted the habitat use and behavior of subsistence species and resulted in additive impacts on subsistence resources, harvest patterns, and users. In addition, development associated with villages on the North Slope has impacted subsistence resources. These activities cumulatively resulted in the loss of approximately 2,500 acres of habitat for subsistence species. These effects have disrupted subsistence livelihoods and account for some of the social problems seen in Iñupiaq villages today. The economic benefits that North Slope Borough communities have accrued due to oil revenues have greatly helped to ameliorate social problems, although dependence on an undiversified economy based on the extraction of natural resources creates other anxieties. Climate change impacts to date have caused social anxiety and climate change is increasingly understood as an environmental justice issue (BLM 2012, Section 4.8.7.15).

Future Effects and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Non-oil and gas activities on the North Slope, including archaeological and paleontological digs, camps and aircraft traffic associated with scientific studies, recreational use, and overland moves by transport vehicles, would continue to disturb Iñupiaq subsistence resources and cause users to avoid hunting in such areas while these activities are underway. Contaminated sites that persist can have long-term effects that constitute environmental justice issues. BLM anticipates that several existing military sites will undergo remediation efforts in the next decade. Cleanup projects could potentially have short-term effects (a “plume” created by clean-up activities) that could include a temporary increased potential for contamination of subsistence species, particularly fish, in the area around the cleanup site (BLM 2012, Section 4.8.7.15).

Military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century. However, a housing shortage and out-migration from North Slope villages is a concern in the North Slope Borough. The effects of climate change are expected to become more significant in the future and it is likely that Iñupiaq communities will bear a disproportionate burden of those effects (BLM 2012, Section 4.8.7.15).

Oil and Gas Exploration and Development Activities

BLM (2012) evaluated the cumulative impacts of oil and gas activities to environmental justice in the NPR-A. That evaluation considered impacts associated with the then-proposed Umiat Road/Pipeline, offshore development in the Chukchi and Beaufort Seas, commercial oil and gas pipelines, and conventional oil and gas exploration and development. BLM (2014) considered cumulative impacts more specific to the community of Nuiqsut, as does this analysis.

Disturbance of caribou and other subsistence resources caused by additional development would accumulate with impacts from existing disturbances. Oil and gas activities near the project area have already deterred subsistence hunters from using traditional hunting, fishing, and camping sites. Continued expansion of activity and infrastructure near the project area will increase the area considered less desirable by resource users, could deflect or divert important subsistence resources from their normal routes, and require users to travel further to harvest subsistence foods at a greater cost in terms of time, fuel, wear and tear on equipment and people, and lost wages

Impacts to Nuiqsut’s subsistence resources and use areas from future oil and gas activities are expected to be additive with respect to impacts from other past, present, and future non-oil and gas activities and past and present oil and gas activities. The number and proximity of current and reasonably foreseeable future oil exploration and development projects within 40 miles of Nuiqsut (listed in the cumulative effects to subsistence analysis above, Section 4.6.10.8) is substantially greater now than it has been for previous cumulative effects analyses. These projects in the Nuiqsut region will increase the total level of disturbance and the amount of subsistence use areas impacted by oil and gas development.

Contribution of the Alternatives to Cumulative Effects

The cumulative impacts of Alternatives A and B would be similar, in that each of these alternatives could lead to future expansion of oil and gas exploration to the west of the Colville River. Specifically, development of the Willow prospect is dependent on construction of GMT2 with a road. Expansion further to the west of the Colville River would result in increased impacts on Nuiqsut subsistence use areas, particularly those along Fish Creek, and could potentially introduce oil and gas development into areas used by other North Slope communities such as Utqiagvik (formerly Barrow) and Atqasuk. An important difference in the economic and thus sociocultural impact of Alternative B is that the road would not be located on Kuukpik Corporation land, thus the corporation would not receive rental payments. Economic benefits of oil development are the primary countervailing impact for residents of the North Slope and Nuiqsut.

Alternative C, the roadless alternative, would be less likely to facilitate westward oil and gas development. However, this alternative would create a greater increase in aircraft traffic in areas used by Nuiqsut subsistence users. In Nuiqsut, disturbance from helicopter traffic is the most frequently reported impact associated with oil and gas development (Stephen R. Braund and Associates 2017a); Alternative C would contribute a greater amount to the cumulative impacts of helicopter traffic.

Overall, impacts to the minority community resulting from GMT2 Alternatives A, B, and C are expected to be long term. Under Alternatives A and B, the improved permanent access to subsistence use areas is expected to have a long-term, offsetting effect for many residents of Nuiqsut while diminishing the value of the area for others. Alternative C would result in greater increases of aircraft noise in the project study area and would not include the mixed effects of the road.

Conclusion

The finding of the Alaska National Interest Lands Conservation Act Section 810 analysis for the proposed project under all action alternatives is that development of the GMT2 Project may significant restrict subsistence use for the community of Nuiqsut.

The BLM (2004, 2013, 2014) found that development as contemplated in the cumulative case could cause long-term displacement and/or functional loss of habitat to caribou over the life of the proposed development. This could result in a significant impact on this important subsistence resource. Impacts would be considered as having disproportionately high adverse effects on Alaska Natives. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources, could change if oil development were to reduce the availability of resources or alter their distribution patterns. Potential spill impacts would also have disproportionately high adverse effects on Alaskan Natives (BLM 2004, Section 4G.7.4).

Climate change can be understood as an environmental justice issue and the Iñupiaq of the North Slope are disproportionately impacted by it both by the fact that climate changes effects are more pronounced in the western Arctic and by the fact that Iñupiaq subsistence activities are particularly dependent on ice, wind, and permafrost conditions. Climate change is perceived as causing changes to the environment of the North Slope is affecting subsistence users' ability to access subsistence resources at appropriate times (Brinkman et al. 2016). The reduction of sea ice has exacerbated coastal erosion, the weather has become less predictable, the shore ice in spring is less stable for whaling, fall travel for caribou is hampered by a late and unreliable freeze up, spring hunting for geese is hampered by an early breakup, ice cellars provide less reliable food storage. All of these issues create significant concerns for many Iñupiat because they are perceived as factors that cannot be controlled and that are threatening their way of life.

In evaluating GMT2 and other current and reasonably foreseeable future activities, the cumulative impacts to the community of Nuiqsut would likely be additive to the extent that other current and reasonably foreseeable future developments within the cumulative effects evaluation area could deflect or divert subsistence resources further away from the community. The development of other reasonably foreseeable future projects would also increase the footprint of development into currently undeveloped areas, which would have further reaching effects. Reasonably foreseeable future projects, outside of the GMT2 Project, would not be countervailing because they are not connected to the local transportation network.

Overall, the GMT2 Project in addition to other current and reasonably foreseeable future activities will increase the severity of existing impacts on Nuiqsut. Most relevantly, the proposed Nanushuk project on the east side of the community could result in major impacts to subsistence because of impacts to caribou hunting areas, according to the Corps of Engineers' Draft EIS (U.S. Army Corps of Engineers 2017). As oil and gas development activities occur over a larger area and/or in closer proximity to Nuiqsut, direct effects to the Inupiaq residents of Nuiqsut will likely be significant and have long-term effects.

Alternative E would have incremental adverse cumulative impact to environmental justice on the North Slope.

The implementation of lease stipulations, best management practices, and other mitigation outlined in the records of decision for the 2013 NPR-A Integrated Activity Plan/EIS (BLM 2013) and the 2014 GMT1 Supplemental EIS (BLM 2014), designed to ensure the continued health of subsistence resources and wildlife, in addition to Lease Stipulation H-1, required for the protection of environmental justice under all alternatives, should reduce the cumulative effect to environmental justice from oil and gas activities and non-oil and gas activities in the planning area.

4.6.9 Cumulative Impacts of Oil, Saltwater and Hazardous Materials Spills

This section tiers to the GMT1 Supplemental EIS (BLM 2014, Section 4.6.11) and the NPR-A Integrated Activity Plan EIS (BLM 2012, Sections 4.8 and 4.12). Section 4.5 of this document describes the potential impacts of spills associated with the GMT2 Project.

The majority of spills on the North Slope have been less than 100 gallons, primarily occurring within secondary containment or onto gravel pads or roads. A review of the Alaska Department of Environmental Conservation spills database shows that the total number of spills reported on the North Slope has decreased from a maximum number of 581 reported spills in 2006 to a minimum of 311 reported spills in 2016.

Spills from non-oil and gas activities, as well as some types of oil and gas exploration activities, are expected to be relatively small fuel spills associated with construction activities or vehicle use. Drilling and operation activities have the potential for a very large oil spill. The NPR-A Integrated Activity Plan EIS (BLM 2012) Section 4.12 discusses low-probability, very large oil spills from loss of well control, and includes historic incidents and modeled frequencies. Depending on the timing, size, and resource, a very large oil spill can result in serious long-term consequences.

Future development and production could occur on the North Slope in the NPR-A, the Chukchi and Beaufort Seas, and onshore between the NPR-A and Arctic National wildlife Refuge. New development would most likely occur near existing fields so infrastructure systems could be shared (BLM 2012, Section 4.8). Reasonably foreseeable future projects identified in Table 4.6-2 are within the Harrison Bay and Lower Coleville River watersheds. The risk of spills in these locations would be additive.

Cumulative impacts from each of the GMT2 action alternatives are similar. Alternatives A and B have a road located near the pipeline, allowing better access for surveillance and monitoring of the pipeline and for rapid emergency and spill response actions. Alternative C would rely on aircraft access for pipeline surveillance and monitoring, and emergency and spill response.

Small spills of less than 100 gallons are inevitable events that have the potential to occur at any time. Spills resulting from development of GMT2 will add to the number of spills annually from the oil industry and other reasonably foreseeable future developments on the North Slope. Implementing best management practices and spill prevention and response planning, and performing regular maintenance and monitoring can reduce the potential for a large spill to occur.

4.7 Mitigation Measures and Monitoring

NEPA regulations (40 CFR 1508.20) define mitigation as avoiding, minimizing, rectifying, reducing over time, or compensating for impacts of a proposed action. For actions on federally managed land in the NPR-A, the BLM has developed a series of protective measures to mitigate potential impacts. These are defined and evaluated as part of the Integrated Activity Plan/EIS process, and adopted in the record of decision. Records of decision and permits may include additional mitigation, and mitigation may also be incorporated into project design (Council on Environmental Quality 2011, page 5). State of Alaska regulatory standards and permits also have requirements designed to protect environmental health and serve to mitigate the impacts of development; however, the BLM does not have the authority to enforce or modify these regulatory requirements.

In analyzing the GMT2 Project, protective measures required by BLM for activities in the NPR-A, mitigating requirements of BLM (2004a), and mitigation incorporated by ConocoPhillips into Alpine Satellite Development Plan project design and practices are considered for their effectiveness in avoiding or reducing potential environmental impacts.

Due to the timeframe from exploration to development, the GMT2 Project has been subject to various BLM requirements, as summarized below:

- The BLM approval for permitting the Alpine Satellite Development Plan (including GMT2) included prescriptive lease stipulations adopted by the 1998 Northeast NPR-A Integrated Activity Plan/EIS Record of Decision, as well as other project-specific measures to mitigate potential impacts of development (2004 Alpine Satellite Development Plan Record of Decision).
- In 2008, in adopting a new Integrated Activity Plan for the Northeast NPR-A, the BLM adopted two types of performance-based protective measures analogous to those that had been adopted in the Northeast NPR-A (BLM 2008): lease stipulations and required operating procedures. The analysis included a comparison of the 1998 stipulations and the 2008 lease stipulations and required operating procedures (BLM 2008, Section 2.7, Tables 2-2 and 2-3). ConocoPhillips updated GMT2 lease obligations to comply with the 2008 lease stipulations.
- The 2008 performance-based lease stipulations and required operating procedures differ from the 1998 prescriptive stipulations in two general ways. The 2008 lease stipulations and required operating procedures: (1) reduced replication of other laws and regulations; and (2) provided more utility and effectiveness in accommodating the variation and complexity associated with North Slope activities, as well as greater ability to adapt management as new information becomes available and construction/operations methods improve. By focusing on results, the performance-based measures provide BLM with greater flexibility achieving resource protection objectives (BLM 2008, Section 2.3.5);
- In 2013, BLM adopted an Integrated Activity Plan for all lands and waters administered by the BLM in the NPR-A. BLM (2013) supersedes BLM (2004a) and BLM (2012, Section 1.6.1). The two types of protective measures were maintained, and although the term best management practice replaced the term required operating procedure, the definition was retained. [16]

The Record of Decision (2013) for the NPR-A establishes performance-based stipulations and best management practices, which apply to oil and gas and, in some cases, to non-oil and gas activities within the NPR-A and requires studies and monitoring. The following is a summary of these best management practices, which can be found in Appendix J:

- Waste Prevention, Handling, Disposal, Spills, and Public Safety

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[16] *Required Operating Procedure:* Mitigation developed through the BLM planning process/NEPA process that is not attached to the oil and gas lease but is required, implemented, and enforced at the operational level for all authorized (not just oil and gas) activities in the planning area (BLM 2008a, NE NPR-A Supplemental Integrated Activity Plan Record of Decision, page 35). *Best Management Practice (BMP):* Mitigation developed through the BLM planning process/NEPA process that is not attached to the oil and gas lease but is required, implemented, and enforced at the operational level for all authorized (not just oil and gas) activities in the planning area (2013 NPR-A Integrated Activity Plan Record of Decision, page 39).

  - Eleven measures include, for example, requirements for waste management, spill prevention and response, and HazMat emergency contingency plans; air quality monitoring; and monitoring for potential contamination of subsistence foods.
- Water Use for Permitted Activities
  - Limits water withdrawal from streams and lakes to protect fish and other wildlife.
- Winter Overland Moves and Seismic Work
  - Regulates winter travel to protect the soil, vegetation, streams, and denning bears.
- Oil and Gas Exploratory Drilling
  - Prohibits exploratory drilling in rivers, streams, and fishbearing lakes and construction of permanent facilities (gravel pads) for exploratory drilling.
- Facility Design and Construction
  - Twenty measures include, for example, requirements that permanent facilities minimize footprint; remain 500 feet from water bodies except for crossings; allow fish passage, caribou movement, and subsistence user access (e.g., 7-foot-high pipeline and 500-foot road/pipeline separation); and USFWS-designed threatened or endangered species protections.
- Use of Aircraft for Permitted Activities
  - Requires a plan to minimize impacts to subsistence users and establishes seasonal minimum flight altitudes over raptor nest habitat and caribou calving, insect relief, and winter areas.
- Oil and Gas Field Abandonment
  - Requires that all oil and gas infrastructure "be reclaimed to ensure eventual restoration of ecosystem function."
- Subsistence Consultation for Permitted Activities
  - Requires lessees/permittees consult with subsistence communities on their proposed activities, submit a plan to show how their activities will prevent unreasonable conflicts with subsistence activities, monitor for impacts to subsistence use, and constrain employees from engaging in recreational hunting and fishing at the work-site. In addition, seismic operations are to avoid subsistence cabins.
- Orientation Programs Associated with Permitted Activities
  - Requires personnel receive orientation on range of North Slope issues, including protecting resources, subsistence, and local lifestyles and laws.
- Endangered Species Act-Section 7 Consultation Process
  - Alerts lessees that BLM may recommend modifications to exploration and development proposals to avoid impacts to species currently listed under the Endangered Species Act or that could lead to an Endangered Species Act listing and that BLM will not approve any activity until it completes any necessary Endangered Species Act consultations.
- Summer Vehicle Tundra Access
  - Establishes requirements (studies of impacts of specific vehicles to be used and resource surveys) of applicants for approval of vehicle use on the tundra during summer.

For the GMT2 Project, the 2013 best management practices will be in effect, but no changes to the current lease stipulations—from the 2008 NE NPR-A EIS—will occur without further evaluation and discussion with the BLM. Certain 2008 lease stipulations (D1, D-2, E-2, E-3, G-1, K-1, and K-2) applicable to this project present essentially the same level of protection as the 2013 best management practices. In 2013, the 2008 Stipulation E-17 was dropped in deference to required operating procedure E-11; however, due to project location, Stipulation 17 is not applicable to GMT2. To BLM's knowledge, these stipulations and best management practices are not inconsistent with each other. To the extent any are found to be inconsistent, the 2008 lease stipulations would control.

4.8 Unavoidable Adverse Impacts

Adverse impacts from oil and gas activities, resulting from construction, operation, and abandonment of the proposed project and alternatives were described in BLM (2004, Section 4H.1) and in BLM (2012, Section 4.9). Many adverse impacts could be lessened by mitigation, but would not be completely eliminated or reduced to negligible levels. Some are short-term impacts, while others may be long-term impacts. These have been described for each resource in Sections 4.2 through 4.5. Depending on the preferred alternative and adopted mitigation, these impacts potentially include:

- Loss of soil productivity and sand and gravel resources largely from construction of roads and pads and gravel mine development;
- Loss of petroleum resources;
- Change in surface drainage due to construction of roads and pads;
- Increased air emissions, including fugitive dust, pollutants, and greenhouse gases;
- Loss of wetlands and associated functions largely from construction of roads and pads and gravel mine development;
- Loss or fragmentation of wildlife habitat;
- Continued change in access to and availability of subsistence resources; and
- Increased risk of spills.

To assist with abandonment and reclamation, BLM has a bonding process in place for leases which are issued within NPR-A. The bond is held by BLM, and certifies that the company will cover the full cost of reclamation. This bond provides monetary assurance to BLM that the company will reclaim the pads, wells, and any associated surface disturbance to the standards of the BLM authorized officer. This is determined at the time of reclamation, thus allowing BLM to take an adaptive management approach. Upon abandonment, BLM will consider current data, technologies available, and the current resource situation in its determinations on specific reclamation. Additionally, BLM retains the ability to increase the bond amount at any time during the lease based on a recalculation of liability (i.e., increased number of wells, or a history of non-compliance with BLM's operational standards).

4.9 Relationship Between Local Short-Term Uses and Long-Term Productivity

The short term uses of the study area for hydrocarbon development and production activities versus the maintenance and enhancement of potential long-term productivity of environmental resources of the area were discussed in BLM (2004, Section 4H.2) and in BLM (2012, Section 4.10). In this supplemental EIS, "short-term" refers to the duration of hydrocarbon development and production activities at GMT2; "long-term" refers to an unspecified period beyond hydrocarbon production at GMT2. Long-term productivity is the capability of the land to provide natural resources indefinitely.

The proposed GMT2 Project is consistent with terms of federal oil and gas lease AA-081798. Hydrocarbons developed from the GMT Unit would help offset declines in production from the Alaska North Slope and maintain throughput of the Alpine Sales Pipeline and ultimately, the Trans-Alaska Pipeline System. Hydrocarbon production would help meet the U.S. domestic energy demand. At some future date, the GMT2 Project will be abandoned, and elements of lost productivity may be restored.

4.10 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources were described in Section 4H.3 of the Alpine Satellite Development Plan EIS (BLM 2004) and in BLM (2012, Section 4.11). An irreversible or irretrievable commitment of resources refers to the consumption, commitment, or loss of resources due to project development. These distinctions refer primarily to non-renewable resources. No irreversible or irretrievable impacts are expected on air quality, water quality, or noise. Depending on the final abandonment plan, irreversible and irretrievable commitments of gravel resources, vegetation, bird habitat, and visual resources may be reduced. Lease Stipulation G-1 includes requirements for site restoration at abandonment. There would be some irreversible or irretrievable commitments of resources. These include:

- Removal of hydrocarbons from the reservoir;
- Energy consumption associated with construction and operation of the project;
- Ground disturbance/change resulting from gravel removal;
- Surface water consumption for drilling and other industrial purposes with wastewater disposal via underground injection;
- Loss or change in vegetation and wetlands where gravel is placed, regardless of whether it is removed at abandonment;
- Increased access to resources of the NPR-A; and
- Loss or change in subsistence use of the area, depending on final abandonment plans.

Chapter 5. Consultation and Coordination

Exploration and potential development at the GMT2 site have been subject to various NEPA analyses in the past, involving a wide array of stakeholders. This chapter summarizes the public and agency outreach the BLM has engaged in as it has developed the supplemental EIS, including keeping the public and other federal, state and local agencies informed of the process and offering opportunities for the public and agencies ask questions and provide input. The section also identifies the individuals who prepared the supplemental EIS.

Early in the process, the BLM conducted public scoping to identify the range of issues and alternatives to address in the draft supplemental EIS, as described in Section 1.5.

In addition to the consultation described below, BLM Alaska sought input from the local community in a variety of ways, including the NPR-A Subsistence Advisory Panel, NPR-A Working Group, and regular contact and outreach by the BLM Arctic District Office. The Subsistence Advisory Panel, established in 1998, is comprised of seven representatives from North Slope Tribal governments and the North Slope Borough. The panel makes recommendations to the BLM on how to mitigate issues, concerns, and possible impacts to subsistence resources or harvesting due to oil and gas activities. The Subsistence Advisory Panel held its most recent meeting in November 2016 in Nuiqsut, which included an update on the GMT2 Project. The NPR-A Working Group, established by the BLM (2013), held its last meeting in April 2017, which also included an update on the GMT2 Supplemental EIS. The Working Group's purpose is to consult directly with the BLM on large-scale land management decisions in the NPR-A, including oil and gas leasing. At the end of April 2017, all meetings of advisory groups were postponed at the direction of the Secretary of the Interior. As of October 2017, the NPR-A Working Group and NPR-A Subsistence Advisory Panel meetings had not resumed. Additional public outreach will take place as the project moves through its permitting phases.

5.1 Supplemental EIS Consultation and Coordination

5.1.1 Coordination and Consultation with Local, State, and Federal Agencies

The BLM consulted and coordinated with various stakeholders in setting the scope of analysis and alternatives for the supplemental EIS. Collaboration with the cooperating agencies greatly informed the range of the alternatives and the issues analyzed in the draft supplemental EIS. The BLM also worked closely with its Air Quality MOU Technical Working Group, which provided feedback on air quality modeling and the subsequent Air Quality Impact Analysis, and reviewed the air quality impacts language for Chapter 4 of the supplemental EIS.

Development of the supplemental EIS involved consultation and coordination with the following government agencies:

- U.S. Army Corps of Engineers;
- U.S. Environmental Protection Agency;
- U.S. Fish and Wildlife Service;
- U.S. Bureau of Ocean Energy Management Office of Environmental Programs;
- U.S. National Park Service;
- U.S. Forest Service;
- Alaska Department of Natural Resources;
- Alaska Department of Environmental Conservation;
- North Slope Borough Department of Iñupiat History, Language, and Culture

- North Slope Borough Department of Law
- North Slope Borough Planning Department; and,
- Native Village of Nuiqsut.

5.1.2 Tribal Consultation

The BLM initiated the government-to-government consultation process as required by Presidential Executive Memorandums dated April 29, 1994, and November 5, 2009, and Department of the Interior Policy on Consultation with Alaska Native Claims Settlement Act Corporations, with letters sent on August 1, 2016, to the following Tribes and Alaska Native Claims Settlement Act corporations whose members could be affected by the proposed development of GMT2:

- Native Village of Nuiqsut;
- Iñupiat Community of the Arctic Slope;
- Kuukpik Corporation; and
- Arctic Slope Regional Corporation.

Government-to-government consultation meetings were held on a monthly basis with the Native Village of Nuiqsut. Kuukpik Corporation and the Arctic Slope Regional Corporation also engaged in consultation with BLM Alaska during the NEPA process.

5.1.3 ConocoPhillips Coordination

In addition to the public outreach required as part of the NEPA process, ConocoPhillips has an extensive stakeholder engagement program to inform local communities, including residents of Nuiqsut, of proposed development activities. ConocoPhillips consults regularly with residents of Nuiqsut, including representatives of Kuukpik Corporation, Kuukpik Subsistence Oversight Panel, and the Native Village of Nuiqsut to obtain feedback on proposed activities.

5.2 List of Preparers

This supplemental EIS was prepared by the BLM and their contractors Kleinfelder and Ramboll-Environ, with input from all of the cooperating agencies, the Air Quality Technical Working Group, and technical editing and document management from the Forest Service's Enterprise Team. BLM employees are listed with their office. Technical input was provided by ConocoPhillips. In addition, numerous employees of the cooperating agencies reviewed portions the supplemental EIS and provided constructive suggestions for improvement. Following is a list of Department of the Interior team members involved in the preparation of this supplemental EIS.

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