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

Willow Master Development Plan

Supplemental Environmental Impact Statement

FINAL

Volume 16: Appendices I to J

January 2023

Prepared by:
U.S. Department of the Interior
Bureau of Land Management
Anchorage, Alaska
In Cooperation with:
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Native Village of Nuiqsut
Iñupiat Community of the Arctic Slope
City of Nuiqsut
North Slope Borough
State of Alaska

Estimated Total Costs Associated with Developing and Producing this SEIS: $3,350,000

Mission

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

Cover Photo Illustration: North Slope Alaska oil rig during winter drilling.
Photo by: Judy Patrick, courtesy of ConocoPhillips.

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Willow Master Development Plan

Appendix I
Avoidance, Minimization, and Mitigation Technical Appendix

January 2023

Appendix I.1
Avoidance, Minimization, and Mitigation

Appendix I.2
ConocoPhillips Road Optimization Memorandum

Appendix I.3
Dust Control Plan

Appendix I.4
Permittee-Responsible Wetlands Compensatory Mitigation Plan

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Willow Master Development Plan

Appendix I.1
Avoidance, Minimization, and Mitigation

January 2023

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Table of Contents

1.0 APPLICABLE LEASE STIPULATIONS AND REQUIRED OPERATING PROCEDURES* 1
2.0 DESIGN FEATURES TO AVOID AND MINIMIZE IMPACTS 18
3.0 ADDITIONAL SUGGESTED AVOIDANCE, MINIMIZATION, OR MITIGATION CONSIDERED IN THE 2020 WILLOW EIS 34
4.0 COOPERATING AGENCY SUGGESTED MITIGATION MEASURES IN THE 2022 DRAFT SUPPLEMENTAL EIS* 39
5.0 SUGGESTED MITIGATION MEASURES FROM PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL EIS 48
6.0 NORTH SLOPE BOROUGH REZONING REQUIRED MITIGATION MEASURES* 52
7.0 REFERENCES 59

List of Tables

Table I.1.1. Applicable Lease Stipulations and Required Operating Procedures* 2
Table I.2.1. Design Features to Avoid and Minimize Impacts* 18
Table I.3.1. Additional Suggested Avoidance, Minimization, or Mitigation 34
Table I.4.1. Cooperating Agency Suggested Mitigation Measures* 40
Table I.5.1. Public Comment Period Suggested Mitigation Measures* 48
Table I.6.1. North Slope Borough Rezoning Required Stipulations and Mitigation Measures* 52
Table I.6.2. North Slope Borough Rezoning Conditions of Approval* 57

List of Acronyms

µPa	micropascal
°F	degrees Fahrenheit
ADEC	Alaska Department of Environmental Conservation)
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
agl	above ground level
AOGCC	Alaska Oil and Gas Conservation Commission)
BLM	Bureau of Land Management
BT1	Bear Tooth 1 drill site
BT2	Bear Tooth 2 drill site
BT3	Bear Tooth 3 drill site
BT4	Bear Tooth 4 drill site
BT5	Bear Tooth 5 drill site
CPAI	ConocoPhillips Alaska, Inc.
dB	decibel
DEW	Distant Early Warning
DMLW	Division of Mining, Land, Water
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GIS	geographic information system
GMT-1	Greater Mooses Tooth 1
GMT-2	Greater Mooses Tooth 2
HDD	horizontal directional drilling
IAP	Integrated Activity Plan
ITR	Incidental Take Regulation
LS	lease stipulation

MDP	Master Development Plan
MMPA	Marine Mammal Protection Act
mph	miles per hour
MTI	module transfer island
NMFS	National Marine Fisheries Service
No.	number
NPR-A	National Petroleum Reserve in Alaska
NSB	North Slope Borough
OHW	ordinary high water
PM	particulate matter
Project	Willow Master Development Plan Project
RMS	Regional Mitigation Strategy
ROD	Record of Decision
ROP	required operating procedure
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSM	vertical support member
WSE	water surface elevation
WPF	Willow Processing Facility

1.0 APPLICABLE LEASE STIPULATIONS AND REQUIRED OPERATING PROCEDURES*

The 2022 National Petroleum Reserve in Alaska (NPR-A) Integrated Activity Plan (IAP)/Environmental Impact Statement (EIS) Record of Decision (ROD) established performance-based lease stipulations (LSs) and required operating procedures (ROPs) that apply to oil and gas activities within the NPR-A (BLM 2022). Table I.1.1 summarizes NPR-A IAP LSs and ROPs that would apply to the Willow Master Development Plan Project (Project) and are intended to mitigate Project impacts. In 2021, the Bureau of Land Management (BLM) was directed to reevaluate the 2020 NPR-A IAP. The NPR-A IAP reevaluation resulted in the issuance of a new NPR-A IAP ROD (BLM 2022) that selected an alternative nearly identical to the 2013 NPR-A IAP ROD. Updated ROPs (BLM 2022) adopted in the new NPR-A IAP ROD replaced previous ROPs; however, applicable LSs have not changed because LSs are fixed at the time of the lease issuance. All projects are subject to the LSs and ROPs that are in place at the time the permit for development is issued. (The reader is referred to Section 2.2.7, *Lease Stipulations, Required Operating Procedures, and Lease Notices*, of the 2020 IAP/EIS for further discussion on this topic). The Willow MDP ROD will detail which of the measures described below will be implemented for the Project. Table I.1.1 summarizes the updated 2022 applicable NPR-A IAP LSs and ROPs; full text of the requirements is provided in BLM (2020).

The ROPs are organized to address the following topics:

A. Waste prevention, handling, disposal, spills, air quality, and public health and safety
B. Water use for permitted activities
C. Winter overland moves and seismic work
D. Oil and gas exploratory drilling
E. Facility design and construction
F. Use of aircraft for permitted activities
G. Oil field abandonment
H. Subsistence consultation for permitted activities
I. Orientation programs associated with permitted activities
J. Endangered Species Act Section 7 consultation process
K. Additional protections that apply in select biologically sensitive areas
L. Summer vehicle tundra access
M. General wildlife and habitat protection

Table I.1.1. Applicable Lease Stipulations and Required Operating Procedures*

LS or ROP	Description of Objective	Requirement/Standard
ROP A-1	Protect the health and safety of oil and gas field workers and the general public by disposing of solid waste and garbage in accordance with applicable federal, State, and local law and regulations.	Areas of operation shall be left clean of all debris.
ROP A-2	Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil field workers and the general public. Avoid human-caused changes in predator populations.	Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the AO for approval, as part of a plan of operations or other similar permit application. Waste generation shall be addressed in the following order of priority: 1) prevention and reduction, 2) recycling, 3) treatment, and 4) disposal. The plan shall consider the following requirements: a. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. b. Requirements prohibit the burial of garbage. Users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the AO. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility. The burial of human waste is prohibited. c. BLM requires all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, DEC, and AOGCC regulations and procedures. d. BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.
ROP A-3	Minimize pollution through effective hazardous-materials contingency planning.	A hazardous materials emergency contingency plan shall be prepared before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. The plan shall include a list of resources available for response. In addition, contingency plans shall include requirements to: a. Provide refresher spill-response training to NSB and local community spill-response teams on a yearly basis b. Plan and conduct a major spill-response drill annually c. Develop spill prevention and response contingency plans and participate in the North Slope Subarea Contingency Plan [superseded by the Alaska Inland Area Contingency Plan] for Oil and Hazardous Substances Discharges/Releases for the NPR-A operating area.

LS or ROP	Description of Objective	Requirement/Standard
ROP A-4	Minimize the impact of contaminants on fish, wildlife, and the environment, including wetlands, marshes, and marine waters, as a result of fuel, crude oil, and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety.	Before initiating any oil and gas or related activity or operation, develop a comprehensive spill prevention, control, and countermeasure plan per 40 CFR 112. The plan shall consider the following requirements: a. Sufficient oil-spill-cleanup materials shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by crews on all overland moves. b. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Fuel, petroleum products, and other liquid chemicals that in total exceed 1,320 gallons shall be stored within an impermeable lined and diked area or within approved alternate storage containers. Within 500 feet of waterbodies, fuel containers are to be stored within appropriate containment. c. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. d. Permanent fueling stations shall be lined or have impermeable protection. e. All fuel containers shall be marked with the responsible party's name, product type, and year filled or purchased. f. Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the authorized officer as soon as possible, but no later than 24 hours after occurrence. g. All oil pans (i.e., “duck ponds”) shall be marked with the responsible party’s name.
ROP A-5	Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.	Refueling of equipment within 500 feet of the active floodplain of any waterbody is prohibited. Fuel storage stations shall be located at least 500 feet from any waterbody with the exception that small caches (up to 210 gallons) for motorboats, float planes, ski planes, and small equipment.
ROP A-6	Minimize the impact on fish, wildlife, and the environment from contaminants associated with the exploratory drilling process.	Surface discharge of reserve-pit fluids is prohibited.
ROP A-7	Minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment.	Discharge of produced water in upland areas and marine waters is prohibited.
ROP A-8	Minimize conflicts resulting from interaction between humans and bears during oil and gas activities.	Lessees will prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a. Minimize attraction of bears to the drill sites. b. Organize layout of buildings and work sites to minimize human-bear interactions. c. Warn personnel of bears near or on work sites and identify proper procedures to be followed. d. Establish procedures, if authorized, to discourage bears from approaching the work site. e. Provide contingencies in the event bears do not leave the site or cannot be discouraged by authorized personnel. f. Discuss proper storage and disposal of materials that may be toxic to bears. g. Provide a systematic record of bears on the work site and in the immediate area.
ROP A-9	Reduce air quality impacts.	All operations (vehicles and equipment) that burn diesel fuels must use “ultra-low sulfur” diesel as defined by EPA.

LS or ROP	Description of Objective	Requirement/Standard
ROP A-10	Prevent unnecessary or undue degradation of the lands and protect health.	This measure includes the following elements: a. BLM may require a project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutants of concern. If BLM determines baseline monitoring is required, this pre-analysis data must meet DEC and EPA air monitoring standards and cover the year prior to the submittal. b. BLM may require monitoring for the life of the project, depending on the potential air emissions' magnitude, proximity to a federal Class I area, Class II area, or population center, proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, existing area development, or issues identified during the project's NEPA analysis. c. For an application to develop a potential substantial air pollutant emission source, the proponent shall prepare an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project. d. For an application to develop a potential substantial air pollutant emission source, BLM may require the proponent to provide an emissions reduction plan. e. For an application to develop a potential substantial air pollutant emission source, the AO may require air quality modeling analyzing the project's direct, indirect or cumulative impacts to air quality. The modeling shall compare predicted impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds. f. BLM may require air quality mitigation measures and strategies within its authority, in addition to regulatory requirements and proponent committed emission reduction measures. g. If ambient air monitoring indicates project-related emissions are causing or contributing to impacts that would cause undue degradation, exceedances of NAAQS, or fail to protect health, the AO may require changes to reduce emissions. h. Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results shall be provided by the project proponent to the NSB and to local communities and Tribes.
ROP A-11	Ensure that permitted activities do not create human health risks through the contamination of subsistence foods.	A lessee proposing a permanent development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The study shall examine subsistence foods for all contaminants that could be associated with the proposal. The study shall identify the level of contaminants in subsistence foods prior to the proposed development and monitor the level of these contaminants throughout the development's operation and abandonment phases. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the lessee shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the lessee's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the lessee's activities, the AO may require changes in the lessee's processes to reduce or eliminate the contaminant's emissions.
ROP A-12	To minimize negative health impacts associated with oil spills.	If an oil spill with potential impacts to public health occurs, BLM will consider: a. Immediate health impacts and responses for affected communities and individuals. b. Long-term contamination monitoring of subsistence food sources. c. Long-term monitoring of potential human health impacts. d. Perceptions of contamination and subsequent changes in consumption patterns. e. Health promotion activities and communication strategies to maintain traditional food consumption.
ROP B-1	Maintain populations of, and adequate habitat for, fish and invertebrates.	Withdrawal of unfrozen water from rivers and streams during winter is prohibited. The removal of ice aggregate from grounded areas ≤4-feet deep may be authorized from rivers on a site-specific basis.

LS or ROP	Description of Objective	Requirement/Standard
ROP B-2	Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, invertebrates, and waterfowl.	Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-specific basis. Current water use requirements are: a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep. b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are ≤5-feet deep. c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume. d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations. e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern. f. Any water intake structures shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. Note: All water withdrawal equipment must be equipped and must use fish screening devices approved by the ADF&G. g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.
ROP C-1	Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.	a. Grizzly bear dens: Cross-country use of vehicles, equipment, and oil and gas activity is prohibited within 0.5 mile of occupied grizzly bear dens, unless protective measures are approved by BLM. b. Polar bear dens: Cross-country use of vehicles, equipment, and oil and gas activity is prohibited within 1 mile of known or observed polar bear dens, unless alternative protective measures are approved by BLM. c. To limit disturbance around known polar bear dens, implement the following: 1. Onshore activities in known or suspected polar bear denning habitat during the denning season (approximately November to April) must make efforts to locate occupied polar bear dens. All observed or suspected polar bear dens must be reported to USFWS prior to the initiation of activities. 2. Permittees must observe a 1-mile operational exclusion zone around all known polar bear dens during the denning season (or until the female and cubs leave the areas). Should previously unknown occupied dens be discovered, work must cease and USFWS must be contacted for guidance. Potential actions may range from cessation or modification of work to conducting additional monitoring. 3. Use the den habitat map developed by USGS. 4. Restrict activity timing to limit disturbance around dens. d. To limit disturbance of activities to seal lairs in the nearshore area (< 9.8-foot water depth): 1. Prior to the initiation of winter seismic surveys on marine ice, the permittee will conduct a sound source verification test approved by BLM and NMFS. 2. For all activities: i. Maintain airborne sound levels of equipment below 100 db re 20 µPa at 66 feet. ii. On-ice operations after May 1 will employ a full-time protected species observer on vehicles to ensure that all basking seals are avoided by vehicles by at least 500 feet and will ensure that all equipment with airborne noise levels are operating at distances from observed seals that allow for the attenuation of noise to levels below 100 decibels. iii. Sea ice trails must not be greater than 12-feet wide. iv. No unnecessary equipment or operations will be placed or used on sea ice.

LS or ROP	Description of Objective	Requirement/Standard
ROP C-2	Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.	a. Ground operations shall be allowed only when frost and snow cover are sufficient to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 15); the exact dates will be determined by the AO. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River.
ROP C-3	Maintain natural spring runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality, and protect stream banks.	Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice ("bridges") shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.
ROP C-4	Avoid additional freeze-down of deep-water pools harboring over-wintering fish and invertebrates used by fish.	Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts to over-wintering fish or invertebrates. Rivers, streams, and lakes shall be crossed at areas of grounded ice whenever possible.
ROP C-5	Minimize the effects of high-intensity acoustic energy from seismic surveys on fish.	a. When conducting vibroseis-based surveys above potential fish overwintering areas (water 6 feet deep or greater, ice plus liquid depth), operators shall follow recommendations by Morris and Winters (2005): only a single set of vibroseis shots should be conducted if possible; if multiple shot locations are required, these should be conducted with minimal delay; multiple days of vibroseis activity above the same overwintering area should be avoided if possible. b. When conducting air gun-based surveys in freshwater, operators shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): operators will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be used. c. When conducting explosive-based surveys, operators shall follow setback distances from fish-bearing waterbodies based on requirements outlined by ADF&G (1991).
ROP D-1	Minimize surface impacts from exploratory drilling.	Construction of permanent or gravel oil and gas facilities shall be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.
ROP E-1	Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish, and wildlife resources.	All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence use areas.
ROP E-2	Protect fish-bearing waterbodies, water quality, and aquatic habitats.	Permanent oil and gas facilities are prohibited within 500 feet of fish-bearing waterbodies (as measured from the ordinary high water mark). Essential pipeline and road crossings will be permitted on a case-by-case basis. Note: Also refer to Stipulations K-1 and K-2.
ROP E-3	Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing.	Linear infrastructure that connects to the shoreline (e.g., causeways, docks) is prohibited in river mouths or deltas. Artificial gravel islands and permanent bottom-founded structures are prohibited in river mouths or active stream channels on river deltas.

LS or ROP	Description of Objective	Requirement/Standard
ROP E-4	Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents.	All pipelines shall be designed, constructed, and operated under an AO-approved Quality Assurance/Quality Control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.
ROP E-5	Minimize impacts of the development footprint.	Facilities shall be designed and located to minimize the development footprint. Issues and methods to be considered include: a. Use of maximum extended-reach drilling for production drilling. b. Sharing facilities with existing development. c. Collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads. d. Integration of airstrips with roads. e. Use of gravel-reduction technologies (e.g., insulated or pile-supported pads). f. Coordination of facilities with infrastructure in support of offshore development. Note: Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.
ROP E-6	Reduce the potential for ice-jam flooding, impacts to wetlands and floodplains, erosion, alteration of natural drainage patterns, and restriction of fish passage.	Stream and marsh crossings shall be designed and constructed to ensure free passage of fish, reduce erosion, maintain natural drainage, and minimize adverse effects to natural stream flow. Note: Bridges, rather than culverts, are the preferred method for crossing rivers. When necessary, culverts can be constructed on smaller streams, if they are large enough to avoid restricting fish passage or adversely affecting natural stream flow.
ROP E-7	Minimize disruption of caribou movement and subsistence use.	Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. The accepted design practices are: a. Elevating aboveground pipelines a minimum of 7 feet as measured from the ground to the bottom of the pipeline at VSMs. b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the AO. c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road will be considered by the AO.
ROP E-8	Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.	Gravel mine site design and reclamation will be in accordance with a plan approved by the AO. The plan shall consider: a. Locations outside the active flood plain. b. Design of gravel mine sites within active flood plains to serve as water reservoirs for future use. c. Potential use of the site for enhancing fish and wildlife habitat. d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.
ROP E-9	Avoidance of human-caused increases in populations of predators of ground nesting birds.	a. Lessee shall use best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the AO with an annual report on the use of facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding wildlife is prohibited.
ROP E-10	Minimize bird collisions with infrastructure, especially during migration and inclement weather.	Flagging of structures (e.g., elevated utility lines, guy wires) shall be required to minimize bird collision. All facility external lighting shall be designed to direct artificial exterior lighting inward and downward or be fitted with shields to reduce reflectivity in clouds and fog conditions.

LS or ROP	Description of Objective	Requirement/Standard
ROP E-11	Minimize impacts on bird species, particularly those listed under the Endangered Species Act and BLM special status species, resulting from direct or indirect interaction with infrastructure.	Bird species with special status are protected under ROP E-10 and ROP E-21, and by the protections outlined below. Before the approval of infrastructure construction, the following studies shall be conducted and recommended design elements shall be incorporated. *Special Conditions in Spectacled and/or Steller's Eiders Habitats:* a. BLM requires submittal of a minimum of 3 years of site-relevant survey data before authorization of construction, if such construction is within spectacled and Steller's eider habitats. BLM will evaluate adequacy of survey data and ecological mapping to determine if ground-based nest surveys are required. Information gained from these surveys shall be used to make infrastructure siting decisions. b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their habitats. *Special Conditions in Yellow-billed Loon Habitats:* The permittee shall determine and submit to BLM information on yellow-billed loon habitat presence within a project area using the most current data and analysis results from research conducted within the NPR-A. a. If yellow-billed loon habitat is determined to be present within the project area, BLM will require submittal of a minimum of 3 years of site-relevant survey data of lakes greater than 25 acres within 1 mile of the proposed infrastructure. b. The design and location of infrastructure must minimize disturbance. The default standard mitigation shall be a minimum 0.5-mile buffer around all recorded nest sites and shall be up to 1 mile, where feasible. Lakes with yellow-billed loon occupancy shall also include a minimum 1,625-foot buffer around the shoreline. Development would generally be prohibited within buffers; BLM would consider waivers or modifications to this requirement if no other feasible option exists.
ROP E-12	Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities to conserve important habitat types during development.	An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives.
ROP E-13	Protect cultural and paleontological resources.	Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity. Upon finding any potential cultural or paleontological resource, the lessee shall notify the AO and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the AO.
ROP E-14	Ensure the passage of fish at stream crossings.	To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the ROPs outlined in "Stream Crossing Design Procedure for Fish Streams on the North Slope Coastal Plain" by McDonald et al. (1994), "Fundamentals of Culvert Design for Passage of Weak-Swimming Fish" by Behlke et al. (1991), and other generally accepted best management procedures prescribed by the AO.
ROP E-15	Prevent or minimize the loss of nesting habitat for cliff nesting raptors.	a. Removal of more than 100 cubic yards of bedrock outcrops, sand, and/or gravel from cliffs shall be prohibited. b. Any extraction of sand and/or gravel from an active river or stream channel shall be prohibited unless preceded by a hydrological study that indicates no potential impact to the integrity of the river bluffs.

LS or ROP	Description of Objective	Requirement/Standard
ROP E-17	Manage permitted activities to meet Visual Resource Management class objectives described below.	Class I: Natural ecological changes and very limited management activity are allowed. The level of change to the characteristic landscape should be very low and must not attract attention. Class II: The level of change to the characteristic landscape should be low. Management activities may be seen but should not dominate the view of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. Class III: The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. Class IV: The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize impacts through location and design by repeating form, line, color, and texture. Requirement/Standard: At the time of application for construction of permanent facilities, the lessee/permittee shall submit a plan to minimize visual impacts consistent with the Visual Resource Management class for the lands on which facilities would be located. VRM classes: • Class II: Wainwright Inlet and those areas where new infrastructure is not allowed. • Class III: Except for those areas designated as VRM Class II, rivers and lands within 3 miles of segments of rivers identified as eligible for Wild and Scenic River designation in the 2013 IAP or the 2008 Northeast NPR-A Supplemental IAP. • Class IV: The rest of the area.
ROP E-18	Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests.	Ground-level activity (by vehicle or on foot) within 656 feet (200 meters) of occupied Steller's and/or spectacled eider nests from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 656 feet of occupied Steller's and/or spectacled eider nests will be prohibited. In cases in which oil spill response training is proposed to be conducted within 656 feet of shore in riverine, marine, or inter-tidal areas, BLM will work with USFWS to schedule the training at a time that is not a sensitive nesting/brood-rearing period or require that nest surveys be conducted in the training area prior to a decision on approving the training.
ROP E-19	Provide information to be used in monitoring and assessing wildlife movements during and after construction.	GIS-compatible shape-files of all new infrastructure construction shall be provided to the AO. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines.

LS or ROP	Description of Objective	Requirement/Standard
ROP E-20	Minimize the impacts on bird species from direct interaction with aboveground utility infrastructure.	a. To reduce the possibility of birds colliding with aboveground utility lines, such lines would either be buried in access roads or suspended on VSMs. Exceptions are limited to the following situations: 1. Overhead utility lines may be allowed when located entirely within the boundaries of a facility pad. 2. Overhead utility lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a VSM. 3. Overhead utility lines may be allowed in situations when human safety would be compromised by other methods. b. To reduce the likelihood of birds colliding with them, communication towers would be located on existing pads and as close as possible to buildings or other structures and on the east or west side of buildings or other structures, if possible. Support wires would be avoided to the extent practicable. If support wires are necessary, they would be clearly marked along their entire length to improve visibility to low-flying birds. c. Design of other utility infrastructure, such as wind turbines, would be evaluated under a specific development proposal. d. The permittee shall comply with current industry-accepted practices for raptor protection on power lines, such as the most recent Avian Power Line Interaction Committee suggested practices.
ROP F-1	Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities.	The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (Note: This ROP is not intended to restrict flights necessary to survey wildlife. Flights necessary to gain this information will be restricted to the minimum.): a. Aircraft shall maintain an altitude of at least 1,500 feet aboveground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level over caribou winter ranges from December 1 through May 1. c. Land user shall submit an aircraft use plan as part of an oil and gas development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities. d. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Adjustments, including suspension of all flights, may be required by the AO if resulting disturbance is determined to be unacceptable. e. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. f. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum. g. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level over the Teshekpuk Lake Caribou Habitat Area from May 20 through August 20. Aircraft use by oil and gas lessees in the Goose Molting Area should be minimized from May 20 through August 20. h. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level over the Utukok River Uplands Special Area from May 20 through August 20. i. Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. j. Fixed-wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet when within a 0.5 mile of walrus haulouts. Helicopters used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1.0-mile buffer from walrus haulouts. k. Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet when within 1.0 mile of all listed marine mammal species.

LS or ROP	Description of Objective	Requirement/Standard
LS G-1	Ensure long-term reclamation of land to its previous condition and use.	Prior to final abandonment, land used for oil and gas infrastructure shall be reclaimed to ensure eventual restoration of ecosystem function. The leaseholder shall develop and implement an abandonment and reclamation plan approved by BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, and habitat condition.
ROP H-1	Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities.	Lessee/permittee shall consult directly with affected communities using the following guidelines: a. Before submitting an application to BLM, the applicant shall consult with directly affected subsistence communities, NSB, and the NPR-A Subsistence Advisory Panel to discuss the siting, timing, and methods of their proposed operations. The applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. b. The applicant shall submit documentation of consultation efforts as part of its operations plan. The applicant must allow time for BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it. c. A plan shall be developed that shows how the activity will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan should address the following items: 1. A detailed description of the activities to take place. 2. A description of how the lessee/permittee will minimize and/or address potential impacts identified by the AO. 3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community. 4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts with subsistence activities. 5. Procedures necessary to facilitate access by subsistence users to the permittees' area of activity or facilities. d. During development, monitoring plans must be established for new permanent facilities to assess an appropriate range of potential effects on resources and subsistence. e. Permittees that propose barging facilities, equipment, supplies, or other materials to the NPR-A in support of activities in the NPR-A shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and NSB to minimize impacts from barging on subsistence whaling activities. f. Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters. g. All vessels over 50-feet long engaged in operations requiring a BLM permit must have an Automatic Identification System transponder system on the vessel.

LS or ROP	Description of Objective	Requirement/Standard
ROP H-2	Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration.	Before activity to conduct seismic exploration begins, applicants shall notify the local search and rescue organizations of proposed survey locations. A potentially affected cabin/campsite is defined as any camp or campsite used for subsistence purposes and located within the boundary of the exploration area and/or within 1 mile of operation travel routes. a. The permittee will notify all potentially affected subsistence-use cabin and campsite users. b. The official recognized list of subsistence-use cabin and campsite users is the NSB's most current inventory. c. A copy of the notification, a map of the proposed exploration area, and the list of potentially affected users shall also be provided to the office of the appropriate Native Tribal government. d. The AO will prohibit seismic work within 1 mile of any known subsistence-use cabin or campsite unless an alternate agreement between the cabin/campsite owner/user is reached through the consultation process and presented to the AO. e. The permittee shall notify the appropriate local search and rescue organization of their current operational location within the NPR-A on a weekly basis.
ROP H-3	Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals.	Hunting and trapping by lessee's/permittee's employees, agents, and contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Fairbanks, Barrow, Nuiqsut, or Deadhorse). Use of lessee/permittee facilities, equipment, or transport for personal access or aid in hunting and trapping is prohibited.
ROP I-1	Minimize cultural and resource conflicts.	All personnel shall be provided information concerning applicable stipulations, ROPs, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. All personnel involved in permitted activities shall attend an orientation program at least once a year and the orientation program should: a. Provide sufficient detail to notify personnel of applicable stipulations and ROPs, as well as specific types of environmental, social, and traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of local community values, customs, and lifestyles. e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans. j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel. k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities.

LS or ROP	Description of Objective	Requirement/Standard
ROP J	Endangered Species Act – Section 7 consultation process	The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. BLM may require modifications to or disapprove a proposed activity that is likely to adversely affect a proposed or listed endangered species, threatened species, or critical habitat. BLM will not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended (16 USC 531 et seq.), including completion of any required procedure for conference or consultation.
LS K-1	*River Setbacks* Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values. *Colville River Special Area Management Plan—Protection 1* Minimize the loss of arctic peregrine falcon nesting habitat in the Colville River Special Area.	*River Setbacks* Permanent oil and gas facilities, including gravel pads, roads, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below. On a case-by case basis, essential pipeline and road crossings will be permitted through setback areas. a. Colville River: A 2-mile setback from the boundary of NPR-A where the river determines the boundary along the Colville where BLM-manages both sides of the river up through T5S, R30W, U.M. Above that point to the juncture of Thunder and Storm creeks, the setback is 0.5 mile. b. Fish Creek: A 3-mile setback from the creek downstream from the eastern edge of section 31, T11N, R1E., U.M. and a 0.5-mile setback farther upstream. c. Judy (Kayyaaq) Creek: A 0.5-mile setback. d. Ublutuoch (Tiŋmiaqsiuġvik) River: a 0.5-mile setback. *Colville River Special Area Management Plan—Protection 1* To minimize the direct loss of arctic peregrine falcon nesting habitat and to protect nest sites in the Colville River Special Area, the following protective measures apply: Permanent oil and gas facilities, including gravel pads, roads, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below. On a case-by-case basis, essential pipeline and road crossings will be permitted through setback areas.
LS K-2	*Deepwater Lakes* Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deepwater lakes; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; impacts to subsistence cabin and campsites; and the disruption of subsistence activities.	Generally, permanent oil and gas facilities are prohibited on the lake or lakebed and within 0.25 mile of the ordinary high water mark of any deep lake as determined to be in lake zone III (i.e., depth greater than 13 feet [4 meters]; Mellor 1985). On a case-by-case basis, essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.

LS or ROP	Description of Objective	Requirement/Standard
LS K-3	*Waterbodies and Riparian Areas* Protect fish-bearing rivers, streams, and lakes from blowouts and minimize alteration of riparian habitat.	Exploratory drilling is prohibited in rivers and streams, as determined by the active floodplain, and fish-bearing lakes.
LS K-4	*Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon* Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, and marine mammals), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies.	The Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon, and their associated Islands are unavailable for leasing. With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 0.75 mile seaward of the shoreline of the major coastal waterbodies or the natural coastal islands. Elsewhere, permanent facilities within the major coastal waterbodies will only be permitted on or under the water if they can meet all the following criteria: a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources. b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources. c. The location of oil and gas facilities shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal waterbodies as identified by the NSB. d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts on area resources and subsistence uses. f. Before conducting open water activities, the permittee shall consult with the Alaska Eskimo Whaling Commission and the NSB to minimize impacts to the fall and spring subsistence whaling activities of North Slope communities.
LS K-5	*Coastal Area Setbacks* Protect coastal waters and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect the summer and winter shoreline habitat for polar bears, and the summer shoreline habitat for walrus and seals; prevent loss of important bird habitat and alteration or disturbance of shoreline marshes; and prevent impacts to subsistence resources and activities.	a. Drill pads and central processing facilities would not be allowed in coastal waters or on islands between the northern boundary of the NPR-A and the mainland, or in inland areas within 1 mile of the coast. Other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Lessees/permittees shall consider the practicality of locating facilities that necessarily must be within this area at previously occupied sites such as various Husky/USGS drill sites and Distant Early Warning-Line sites. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, NSB, and local whaling captains associations to minimize impacts to subsistence whaling activities. b. Marine vessels used as part of a BLM-authorized activity shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals, Steller's sea lions, or walruses using a terrestrial haulout. Marine vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast, except when necessary for the safe operation of the vessel.

LS or ROP	Description of Objective	Requirement/Standard
LS K-6	*Goose Molting Area* Minimize disturbance to molting geese and loss of goose-molting habitat in and around lakes in the Goose Molting Area.	*General*: Within the Goose Molting Area, no permanent oil and gas facilities, except for pipelines, will be allowed within 1 mile of the shoreline of goose molting lakes. No waiver, exception, or modification will be considered. *Development*: In the Goose Molting Area, the following standards will be followed for permitted activities: a. From June 15 through August 20, all off-pad activities and major construction activities using heavy equipment (but not drilling from existing production pads) shall be suspended unless approved by the AO. b. Water extraction from any lakes used by molting geese shall not alter hydrological conditions that could adversely affect identified goose-feeding habitat along lakeshore margins. c. Oil and gas activities will avoid altering critical goose-feeding habitat types along lakeshore margins (e.g., grass, sedge, moss) and salt-marsh habitats. d. Permanent oil and gas facilities (including gravel roads, pads, and airstrips, but excluding pipelines) and material sites will be sited outside the identified buffers and restricted surface occupancy areas. e. Between June 15 and August 20, oil and gas facilities shall incorporate features (e.g., temporary fences, siting/orientation) that screen or shield human activity from view of any Goose Molting Area lake, as identified by the AO. f. Strategies to minimize ground traffic shall be implemented from June 15 through August 20. These strategies may include limiting trips, use of convoys, different vehicle types, etc. The permittee shall submit a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. g. Aircraft use shall be restricted from June 15 through August 20 unless doing so endangers human life or violates safe flying practices. Restrictions may include: (1) limiting flights to two roundtrips per week, and (2) limiting flights to corridors established by BLM. The permittee shall submit an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. h. Any permit for development will include a requirement for the permittee to conduct monitoring studies necessary to adequately determine consequences of development and any need for change to mitigations.
LS K-8	*Brant Survey Area* Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing brant in the Brant Survey Area. None of the area is available for oil and gas leasing or exploratory drilling.	a. Aerial surveys for brant nesting colonies and brood-rearing areas shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. The survey area shall include the proposed development site and the surrounding 0.5 mile area. b. Development may be prohibited, or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.

LS or ROP	Description of Objective	Requirement/Standard
LS K-9	*Teshekpuk Lake Caribou Habitat Area* Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Teshekpuk Lake Caribou Habitat Area that are essential for all season use, including calving and rearing, insect-relief, and migration.	In the Teshekpuk Lake Caribou Habitat Area, the following standards apply to permitted activities: a. Before authorization of construction , the permittee shall design and implement and report a study of caribou movement unless an acceptable study specific to the Teshekpuk Caribou Herd has been completed within the last 10 years. The study shall include a minimum of four years of current data on the Teshekpuk Caribou Herd movements. The study should provide information necessary to determine facility (including pipeline) design and location. b. Within the Teshekpuk Lake Caribou Habitat Area, permittee shall orient linear corridors when laying out developments to address migration and corralling effects and to avoid loops of road and/or pipeline that connect facilities. c. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required in the Teshekpuk Lake Caribou Habitat Area. d. Major construction activities using heavy equipment (but not drilling from existing production pads) shall be suspended within Teshekpuk Lake Caribou Habitat Area from May 20 through August 20, unless approved by the AO. e. The following ground and air traffic restrictions shall apply in the areas and time periods indicated: 1. From May 20 through August 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc. The permittee shall submit a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. 2. The permittee shall observe caribou movement from May 20 through August 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped: i. Temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. ii. By direction of the AO throughout a defined area for up to four weeks to prevent calving caribou displacement. 3. Major equipment, materials, and supplies to be used at work sites in the Teshekpuk Lake Caribou Habitat Area shall be stockpiled outside the period of May 20 through August 20.
LS K-10	*Teshekpuk Lake Caribou Movement Corridor* Minimize disturbance and hindrance of caribou, or alteration of caribou movements (that are essential for all-season use, including calving and rearing, insect-relief, and migration) in the area extending from the eastern shore of Teshekpuk Lake eastward to the Kogru River.	Within the Teshekpuk Lake Caribou Movement Corridor, no permanent oil and gas facilities, except for pipelines or other infrastructure associated with offshore oil and gas exploration and production, will be allowed.
LS K-11	*Southern Caribou Calving Area* Minimize disturbance and hindrance of caribou, or alteration of caribou movements (that are essential for all season use, including calving, post-calving, and insect-relief) in the area south/southeast of Teshekpuk Lake.	Within the Southern Caribou Calving Area, no permanent oil and gas facilities, except pipelines or other infrastructure associated with offshore oil and gas exploration and production, will be allowed.

LS or ROP	Description of Objective	Requirement/Standard
LS K-12	*Colville River Special Area* Prevent or minimize loss of raptor foraging habitat (also see LS K-1).	If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as feasible. Additionally, within 15 miles of raptor nest sites, significant alteration of high-quality foraging habitat shall be prohibited unless the lessee can demonstrate on a site-specific basis that impacts would be minimal. Of particular concern are ponds, lakes, wetlands, and riparian habitats. Note: On a case-by-case basis, essential pipeline and road crossings will be permitted where no other feasible or prudent options are available.
ROP L-1	Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities.	On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in ROP C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the AO of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. b. Submitted surveys satisfactory to the AO of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the AO. c. Designed and/or modified the use proposal to minimize impacts to the AO's satisfaction. Design steps to achieve the objectives may include, timing restrictions, shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the AO, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan.
ROP M-1	Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the NPR-A.	Chasing wildlife with ground vehicles is prohibited. Particular attention will be given to avoid disturbing caribou.
ROP M-2	Prevent the introduction, or spread, of non-native, invasive plant species in the NPR-A.	Certify that all equipment and vehicles (intended for use either off or on roads) are weed-free prior to transporting them into the NPR-A. Monitor annually along roads for non-native invasive species and initiate effective weed control measures upon evidence of their introduction. Prior to operations in the NPR-A, submit a plan for the BLM's approval detailing the methods for cleaning equipment and vehicles, monitoring for weeds, and weed control.
ROP M-3	Minimize loss of populations of, and habitat for, plant species designated as Sensitive by the BLM in Alaska.	If a development is proposed in an area that provides potential habitat for a BLM Sensitive Plant Species, the development proponent would conduct surveys at appropriate times of the summer season and in appropriate habitats for the Sensitive Plant Species that might occur there. The results of these surveys will be submitted to BLM with the application for development.
ROP M-4	Minimize loss of individuals of, and habitat for, mammalian species designated as Sensitive by BLM in Alaska.	If a development is proposed in an area that provides potential habitat for the Alaska tiny shrew, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats in an effort to detect the presence of the shrew. The results of these surveys will be submitted to BLM with the application for development.

Source: BLM 2022

Note: < (less than); ≤ (less than or equal to); ADF&G (Alaska Department of Fish and Game); AOGCC (Alaska Oil and Gas Conservation Commission); AO (authorized officer); BLM (Bureau of Land Management); dB re 20 µPa (decibels referencing 20 microPascal); DEC (Alaska Department of Environmental Conservation); EPA (U.S. Environmental Protection Agency); IAP (Integrated Activity Plan); LS (lease stipulation); NAAQS (National Ambient Air Quality Standards); NEPA (National Environmental Policy Act); NMFS (National Marine Fisheries Service); NPR-A (National Petroleum Reserve in Alaska); NSB (North Slope Borough); ROP (required operating procedure); USFWS (U.S. Fish and Wildlife Service); USGS (U.S. Geological Survey); VSM (vertical support member).

2.0 DESIGN FEATURES TO AVOID AND MINIMIZE IMPACTS

The Project proponent has incorporated measures to avoid and minimize impacts into the Project design. These are listed in Table I.2.1; the measures are part of the Project and were used to evaluate the impacts described in the Willow MDP EIS, Chapter 3.0, *Affected Environment and Environmental Consequences*. Some of these measures are similar to existing NPR-A LSs and ROPs or other requirements and are included to show the Project proponent's commitment to adhering to them. The Project proponent may propose additional measures in subsequent permitting phases.

Table I.2.1. Design Features to Avoid and Minimize Impacts*

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
1	Use directional drilling to reduce the overall gravel footprint for drill site pads.	Gravel infrastructure	ROP E-5; AOGCC	All
2	Construct road surfaces to the minimum width required for Project operations to minimize the placement of gravel fill: 32-feet-wide Willow access and BT1 and BT2 roads 24-feet-wide water source access pads roads, airstrip lighting roads, BT3, BT4 (Alternatives B, C, and D), and BT5 infield roads. Roads designed with a smaller top (crown) surface avoid additional fill placement where wider roads are not required.	Gravel infrastructure	ROP E-5; ADNR DMLW	All
3	Use 20-foot well spacing (instead of 30-foot well spacing) to reduce the overall gravel footprint for drill site pads.	Gravel infrastructure	ROP E-5; AOGCC; ADNR DMLW	Wetlands and vegetation
4	Share use of existing equipment and facilities (e.g., camps, seawater treatment plant, warehouses, maintenance shops, emergency response equipment) to reduce the overall Project gravel- and ice-pad footprint.	Gravel infrastructure	ROP E-5; ADEC	Water resources; wetlands and vegetation
5	Use single-season ice roads to support winter construction of gravel roads, pads, and pipelines to avoid the need for additional gravel roads for construction. This includes accessing Tiŋmiaqsiuġvik mine sites via ice road instead of gravel.	Gravel infrastructure, mine site	ROP E-5; ADNR DMLW	Wetlands and vegetation
6	Use 2:1 side slopes (i.e., gravel road and pad embankment slopes) instead of 3:1 to reduce the Project's overall gravel footprint.	Gravel infrastructure	ROP E-5	Wetlands and vegetation
7	Locate drill site BT4 (and associated roads and pipelines under Alternatives B, C, and D) outside of the Teshekpuk Lake Caribou Habitat area which would reduce the overall gravel footprint and eliminate the need for a bridged crossing of the Kalikpik River.	Gravel infrastructure, pipelines	LS K-9; ADNR DMLW; ADEC; AOGCC	Wetlands and vegetation; terrestrial mammals
8	Avoid permanently flooded wetlands by locating Project infrastructure on higher, and relatively drier areas, when practicable. This practice applies to drill sites and other pads, road alignments, the new airstrip, and other Project components.	Gravel infrastructure	None	Wetlands and vegetation; water resources
9	Suspend communications and power cables from horizontal support members to avoid additional fill associated with utility poles and to reduce the potential for bird strikes and perches for predators.	Utilities	ROP E-20	Wetlands and vegetation; birds

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
10	Use ice roads and pads, including multi-season ice pads, to support Project construction, including using ice pads to house construction camps; stage construction equipment; allow stockpiling of gravel and mine site overburden during construction activities; and support construction activities at bridge crossings, along the Project's pipeline alignment, at the HDD crossing of the Colville River, and at other locations as needed near the proposed infrastructure.	Construction activity	ROP E-5; ADEC; ADNR DMLW	All
11	Design pipelines to minimize redundant parallel pipelines to the extent practicable. (For example, infield pipelines from drill site BT2 would tie into drill site BT1 pipelines at BT1; and then drill site BT1 infield pipelines would connect with the WPF. Additionally, the Willow export pipeline would tie into the existing Alpine Sales oil pipeline at a tie-in pad near Alpine CD4N to connect the Project to the Trans-Alaskan Pipeline System.)	Pipelines	ROP E-7; AOGCC; ADEC	Wetlands and vegetation; birds; terrestrial mammals; spill risk
12	Colocate the WPF with drill site BT3 to eliminate the need for an additional gravel pad and associated gravel fill (Alternative D only).	Gravel infrastructure	ROP E-5; AOGCC	Wetlands and vegetation
13	Construct oil and gas facilities and other Project infrastructure more than 500 feet from fish-bearing waterbodies, to the maximum extent practicable. Only essential pipeline road crossings are proposed for the Project that would encroach on this minimum distance. (For example, the intersection between the BT1 and BT3 access roads was realigned and shifted west to locate the BT1 road outside of the 500-foot buffer of swale 2, an anadromous waterbody.) Construction camps would not be sited on frozen lakes or rivers. (Anticipated deviations are noted in the EIS.)	Gravel infrastructure, pipelines	ROP E-2; ADF&G; ADEC; ADNR DMLW	Water resources; fish
14	Consult with appropriate federal, state, and NSB agencies regarding the mine site design and reclamation plan. Design mine site to minimize impacts to wildlife, air quality, and water resources. Mine site operation and reclamation would include the storage and reuse of organic overburden (for the mine sites). Site the mine pits outside of the active floodplain to minimize impacts to water resources.	Gravel source	ROP E-8; ADF&G; ADEC; NSB; ADNR DMLW	Soils, permafrost, and gravel resources; visual resources; water resources; wetlands and vegetation; fish; birds; subsistence and sociocultural systems
15	Design, construct, maintain, and operate roads in ways to minimize environmental impacts and protect subsistence use areas and access. Gravel road alignments and pad layouts would consider topography, maintenance of natural drainage patterns, and the effects of spring breakup and other potential flood events. Road and pad layouts would also avoid ponds, lakes, and streams to the extent practicable.	Gravel infrastructure	ROP E-1; ADEC; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; subsistence and sociocultural systems

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16	Restrict summer tundra vehicle travel for Project personnel to emergency response or to permitted activities required by statute or regulation.	Personnel	ROP L-1; ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals
17	Conduct overland (i.e., tundra) moves and similar off-road or cross-country activity use in accordance with ROP C-2 to minimize impacts to streambanks, soil substrate, and vegetation.	Off-road vehicle use	ROP C-2; ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals
18	Use low-angle approaches for ice road waterway crossings to protect streambanks. Waterway crossings reinforced with additional snow or ice ("bridges") would be removed, breached, or slotted prior to spring breakup to maintain normal spring runoff patterns and fish passage. All constructed ice ramps and ice bridges would be substantially free of debris (e.g., sticks, brush).	Ice infrastructure	ROP C-3; ADF&G; ADEC; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; fish; terrestrial mammals; marine mammals
19	Prohibit travel along streambeds unless it can be demonstrated that there would be no additional impacts from such travel to over-wintering fish or the invertebrates they rely on. Rivers, streams, and lakes would only be crossed with ice infrastructure at areas where waterbody or waterway ice has grounded, when practicable.	Ice infrastructure	ROP C-4; ADF&G; ADEC; ADNR DMLW	Water resources; fish
20	Inject produced water into the reservoir and do not discharge it to surface lands, surface waters, or marine waters.	Waste management	ROPs A-2 and A-7; ADF&G; ADEC	Water resources; wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems; public health
21	Use recent ecological mapping to assess wildlife habitat types to inform the design, placement, and development of permanent (i.e., gravel) infrastructure.	Gravel infrastructure	ROP E-12; ADF&G	Wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals
22	Remove, slot, breach, or score ice road stream crossings prior to spring breakup to ensure adequate flow and drainage conditions at stream crossings.	Ice infrastructure	ROP C-3; ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; fish; birds
23	Place gravel roads perpendicular to the general flow direction when crossing natural drainages to maintain the existing flow patterns and characteristics.	Gravel infrastructure	ROP E-6; ADNR DMLW; ADF&G	Water resources; wetlands and vegetation; fish; birds
24	Design and construct stream and swale crossings to ensure the free passage of fish, minimization of erosion, maintenance of natural drainage characteristics, and the minimization of impacts to natural stream flow. Bridges would be used to cross rivers and major streams.	Gravel infrastructure	ROP E-6; ADF&G; ADNR DMLW	Water resources; wetlands and vegetation; fish; birds

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25	Collect 3 years of hydrologic and fish data at stream crossing and ensure fish passage at stream crossings.	Gravel infrastructure	ROP E-14; ADF&G; ADEC	Fish
26	Design fish-passage culverts in consultation with ADF&G.	Gravel infrastructure	ADF&G; ADEC	Fish
27	Install cross-drainage culverts as needed to maintain natural surface drainage to mitigate the risk of sheet flow interruption and thermokarsting. The estimated spacing of culverts is approximately every 1,000 feet. (Exact placement would be adjusted based on a field survey of in-field local drainage patterns.)	Construction	ROP E-6; ADF&G	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; birds
28	Place bridges and river crossings at narrow river sections, where practicable, to avoid gravel fill and minimize the number of piers/pilings placed below ordinary high water.	Gravel infrastructure	ADF&G	Water resources; wetlands and vegetation; fish
29	Construct bridge abutments from sheet pile to reduce the overall gravel footprint and protect the structures from embankment erosion and stream scour.	Construction	ROP E-6; ADF&G; ADEC	Soils, permafrost, and gravel resources; water resources; fish
30	Do not stockpile gravel in Waters of the U.S., including wetlands. Gravel would be stockpiled in upland areas or on ice pads.	Gravel infrastructure	ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; birds
31	Install vertical support members (for pipelines) from ice roads and pads, and ensure drill cuttings are temporarily stored on ice and removed to the gravel mine site prior to spring breakup.	Construction	AOGCC; ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation
32	Conduct trenching activity (e.g., pipeline road crossings) during winter and temporarily store trench materials on plywood, plastic sheeting, or an ice pad to avoid additional impacts to wetlands (e.g., fill).	Construction	ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation
33	Minimize heat transfer and impacts to permafrost from Project infrastructure on gravel pads by: designing flare stack height to reduce radiant heating; filling the gap between well conductors and inner pipes with polyurethane foam; using thermosyphons adjacent to well rows and at-grade structures; and installing insulation below the foundation floors of heated, at-grade structures.	Construction and operations	ADEC; ADNR	Soils, permafrost, and gravel resources
34	Elevate on-pad heated buildings or structures using pilings, to the extent practicable, to prevent or reduce heat transfer to underlying soils and preserve the thermal integrity of the permafrost.	Facilities	ADEC	Soils, permafrost, and gravel resources
35	Implement snow removal management measures to reduce the potential for gravel to be pushed off roads and pads during snow removal operations.	Construction and operations	ADNR DMLW	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation

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36	Implement dust control measures for gravel roads, pads, and mining operations to reduce fugitive dust that can settle on vegetation or snow, which could increase thermal conductivity (i.e., reduce albedo), lead to thermokarsting, and promote earlier spring thaw in affected areas.	Gravel infrastructure	ROP A-10; ADEC	Soils, permafrost, and gravel resources; air quality; visual resources; water resources; wetlands and vegetation; fish; birds; terrestrial mammals; public health
37	Implement strict guidelines for travel on ice roads to avoid tundra damage, including requiring ice road driver training, establishing speed and weight limits, and installing road-edge delineators along both sides of roads.	Ice road travel	ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; wetlands and vegetation; birds; terrestrial mammals
38	Install Colville River pipeline crossings (e.g., diesel, seawater) with insulation and placed within an outer pipeline casing, which would inhibit heat transfer to permafrost, contain fluids in the event of a pipeline leak, and provide structural integrity to the pipeline crossing.	Pipelines	ADEC	Soils, permafrost, and gravel resources; Water resources; Spill risk
39	Design, construct, and use ice roads that are a minimum of 6 inches thick during winter construction to eliminate or minimize impacts to wetlands and tundra.	Ice infrastructure	ROP C-2; ADF&G; ADNR DMLW	Soils, permafrost, and gravel resources; wetlands and vegetation; birds; terrestrial mammals
40	Implement an erosion control plan to detail ways the Project would prevent or mitigate erosion that could impact terrestrial and aquatic environments. The plan would include CPAI's operations, monitoring, and maintenance procedures that detail the actions CPAI would undertake to monitor, maintain, and if needed, remediate gravel fill impacting surrounding tundra and wetlands.	Erosion control	ROP E-6; ADF&G; ADEC; ADNR DMLW	Soils, permafrost, and gravel resources; visual resources; water resources; wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems
41	Place cleared (i.e., plowed) snow in designated snow-storage areas and manage stormwater from all gravel pads to prevent contaminants from being released during spring breakup. Select snow push areas annually based on avoiding areas of thermokarsting, proximity to waterbodies, and evaluations of areas used the previous year.	Snow management	ROP A-3; ADNR; ADEC	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation
42	Use a minimum of 5-foot-thick section for gravel pads and roads to maintain a stable thermal regime by insulating the underlying tundra and offsetting the loss of insulating effect caused by the compression of the vegetated tundra beneath the gravel.	Gravel infrastructure	ROP E-5; ADNR DMLW	Soils, permafrost, and gravel resources
43	Route ice roads to avoid shrub areas and large areas of tussock tundra to the extent practicable.	Ice infrastructure	ROP C-2; ADF&G; ADNR DMLW	Wetlands and vegetation; birds; terrestrial mammals
44	Construct pipelines aboveground, to the extent practicable, to minimize permafrost impacts.	Pipelines	ADEC; ADNR	Soils, permafrost, and gravel resources

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45	On BLM-managed lands, withdraw unfrozen water from lakes and not rivers and streams during winter to maintain populations of, and adequate habitat for, fish and invertebrates. Ice aggregate would not be removed from areas of grounded ice less than or equal to 4 feet in depth (on BLM-managed lands) without authorization from the BLM, on a site-specific basis.	Water withdrawal	ROP B-1; ADNR DMLW; ADEC	Water resources; fish
46	Do not construct causeways or docks in any river mouth or delta. Causeways, docks, artificial islands, or other bottom-fast structures, if employed, would be designed to ensure free passage of fish and prevent changes to water circulation patterns or water quality.	Gravel infrastructure	ROP E-3; ADNR DMLW; ADF&G	Water resources; fish; birds
47	Maintain air-traffic altitudes consistent with NPR-A ROP F-1, except during takeoffs and landings, and unless doing so would endanger human life or violate safe flying practices, to avoid disturbing caribou, birds, and subsistence users, when feasible. (Some air traffic would be required to support the Project or for regulatory compliance [e.g., wildlife studies, hydrology studies] and to ensure cleanup following the ice-road season could require flying at lower altitudes.)	Air traffic	ROP F-1; ADF&G	Noise; visual resources; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems
48	Develop a bear-interaction plan for Project personnel to minimize conflicts between bears and humans.	All	ROP A-8; ADF&G	Terrestrial mammals; marine mammals
49	Minimize disruption to caribou movement by maintaining a minimum clearance of 7 feet between the bottom of pipelines and the ground surface.	Pipelines	ROP E-7; ADF&G; ADEC	Terrestrial mammals; subsistence and sociocultural systems; spill risk
50	Design facilities to minimize nesting, denning, or sheltering opportunities for ravens, raptors, and foxes. Prohibit intentional feeding of wildlife.	Facilities	ROP E-9; ADF&G	Birds; terrestrial mammals
51	Minimize the amount of light visible from outside of facilities, including directing artificial exterior lighting inward and downward during all months of the year, which would prevent waterfowl (including species listed under the ESA) from striking facilities during low light conditions.	Facility lighting	ROP E-10; typical ESA conservation measure; ADF&G	Birds
52	Minimize the take of species, particularly those listed under the ESA and BLM Special Status Species, by conducting eider and yellow-billed loon surveys and working with resource agencies to ensure facilities minimize impacts to species found (e.g., ensure off-pad utility lines are either buried or suspended from pipe racks to the extent feasible, locate towers on pads near existing buildings to the extent feasible, minimize the use of tower guy wires, clearly mark guy wires that are used to prevent collisions).	Facilities	ROPs E-11 and J; typical ESA conservation measure; ADF&G	Birds

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53	Develop a new gravel mine site that would not result in the loss of raptor nesting habitat because it would not take gravel from cliffs, river channels, or stream channels in a manner that would affect river bluffs.	Gravel source	ROPs E-8 and E-15; ADF&G	Birds
54	Minimize the electrocution hazard by suspending electrical distribution lines from pipe racks or burying cables (versus the use of overhead power lines) off pad.	Utilities	ROP E-20; typical ESA conservation measure; ADF&G	Birds
55	Provide the BLM authorized officer with GIS-compatible location information to facilitate agency monitoring and assessment of wildlife movements through the Project area after Project construction.	Facilities	ROP E-19; ADF&G	Birds; terrestrial mammals
56	Locate pipelines parallel to new and existing gravel roads and maintain a minimum separation distance of 500 feet, where feasible, to minimize caribou disturbance and prevent excessive snow accumulation from snowdrifts and snow removal.	Pipelines	ROP E-7; ADF&G	Terrestrial mammals; spill risk
57	Contract with a state-registered Primary Response Action Contractor to assist with quick spill response impacts in the event of a spill.	Operations	ROP A-4; ADEC	Spill risk
58	Align pipe racks installed adjacent and parallel to existing pipeline racks so vertical support members for each pipe rack are in line, to the extent practicable, to reduce obstructions to caribou and subsistence user movements.	Pipelines	ADNR	Birds; terrestrial mammals; subsistence and sociocultural systems
59	Use a muted (i.e., non-reflective) coating on pipelines to avoid glare.	Pipelines	ADNR	Visual resources; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems
60	Implement policies, procedures, and training to prevent wildlife attraction to Project facilities, including use of predator-proof dumpsters for food waste collection; a strict policy prohibiting the feeding of wildlife; and the use of Ziploc bags or other sealed containers for meals-on-the-go to conceal food odors.	Waste management and wildlife interaction	ROPs A-8 and I-1; ADEC	Birds; terrestrial mammals; marine mammals
61	Implement a Wildlife Avoidance and Interaction Plan that would include procedures to eliminate, minimize, and mitigate bear interactions. CPAI conducts training on waste management practices and would conduct Project-specific training on waste management to guide employees and contractors on managing predators.	Waste management	ROPs A-1, A-2, A-8, and I-1; typical ESA conservation measure; ADF&G; ADNR; ADEC	Birds; terrestrial mammals; marine mammals
62	Protect grizzly and polar bear denning sites by prohibiting cross-country travel or use of heavy equipment within 0.5 mile of a grizzly bear den and within 1.0 mile of a polar bear den. Where necessary, CPAI would conduct surveys near coastal areas to locate potential polar bear dens, in consultation with the U.S. Fish and Wildlife Service, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.	All	ROP C-1; typical ESA conservation measure; ADF&G; ADNR DMLW	Terrestrial mammals; marine mammals

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63	Conduct training for Project personnel on NPR-A ROPs, standards, and environmental, social, traditional, and cultural concerns specific to the Project region, including training on community interactions. This training would be designed to ensure strict compliance with local and corporate drug and alcohol policies.	Personnel	ROP I-1; NSB	Subsistence and sociocultural systems; cultural resources
64	Prohibit Project employees from hunting and trapping activities while employees are on active work status to avoid increased competition for subsistence and recreational wildlife resources.	Personnel	ROP H-3; ADF&G	Subsistence and sociocultural systems
65	Use the results of cultural and paleontological resource surveys to inform Project design and facilities placement. The Project would avoid known cultural and paleontological resources during ground-disturbing activities, including the construction of ice roads.	Construction	ROP E-13; ADNR	Cultural and paleontological resources
66	Implement a Visual Resources Management Plan to minimize visual resource impacts, consistent with the Visual Resources Management Class for the lands on which Project facilities would be located.	Project infrastructure	ROP E-17; ADNR	Visual resources
67	Avoid disturbance of caribou and strictly prohibit chasing wildlife with vehicles.	Personnel	ROP M-1; ADF&G	Birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems
68	Continue to consult with affected subsistence communities, tribes, Alaska Native Corporations, and NSB, as well as the Kuukpikmuit Subsistence Oversight Panel, Alaska Eskimo Whaling Commission, Nuiqsut Whaling Captains, and Barrow Whaling Captains to mitigate potential impacts to subsistence activities. Plans would be maintained to ensure these consultations continue both periodically and robustly.	All	ROP H-1; NSB	Subsistence and sociocultural systems
69	Continue to consult with the Kuukpik Subsistence Oversight Panel, the Native Village of Nuiqsut, and Kuukpik Corporation to ensure Project activities do not adversely affect subsistence activities. CPAI would continue to hold frequent public community meetings well in advance of future activities. Travel would be scheduled with flexibility and managed through the use of speed limits, rerouting, and traffic stoppages to avoid conflict with subsistence use and hunting areas during seasonal periods.	All	ROPs E-1, F-1, H-1, H-3, and I-1; NSB	Subsistence and sociocultural systems
70	Continue to provide annual funding for the Kuukpik Subsistence Oversight Panel to help support the executive director and coordinate panel activities.	All	ROPs E-1, F-1, H-1, H-3, and I-1; NSB	Subsistence and sociocultural systems
71	Conduct high-disturbance construction activities such as gravel mining and placement, and pipeline and facility construction, primarily during the winter months when subsistence activity levels are relatively low and disruptions to water flows can be minimized.	Construction	ADF&G	Water resources; fish; birds; terrestrial mammals; subsistence and sociocultural systems

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72	Include subsistence tundra access ramps and pullouts on gravel roads with locations based on community input. The pullouts would allow local residents to access the areas adjacent to roadways. The tundra access ramp and pullouts would be designed with considerations of lessons learned from the Greater Mooses Tooth 1 and 2 projects.	Gravel infrastructure	ADNR DMLW; NSB	Subsistence and sociocultural systems
73	Prohibit the use of airboats on rivers within BLM-managed lands and within a 50-mile radius of Nuiqsut, except for emergencies and emergency response training.	Operations	ADNR DMLW; ADF&G	Noise; birds; fish; terrestrial mammals; marine mammals; subsistence and sociocultural systems
74	Continue the internship program (CareerQuest) to introduce Nuiqsut high school students to jobs and careers in the oil fields and in their community.	Community outreach	NSB	Economics; subsistence and sociocultural systems
75	Continue to strive to hire qualified Nuiqsut, NSB, and Alaska residents for oil field jobs.	Personnel	NSB	Economics
76	Ensure current communications protocols for CPAI helicopter, fixed-wing aircraft, and marine-vessel traffic are adequate to address community (Nuiqsut) concerns about traffic-related impacts to subsistence activities.	Air and vessel traffic	ROP F-1; NSB	Subsistence and sociocultural systems
77	Allow Nuiqsut residents reasonable use of Project roads to access subsistence areas throughout the life of the Project.	Gravel infrastructure	ROPs E-1 and H-1; NSB; ADNR DMLW	Subsistence and sociocultural systems
78	Implement avoidance measures to ensure protection of cultural resource sites during Project activity by establishing a 500-foot avoidance buffer consistent with NSB regulations.	All	NSB	Cultural resources
79	Reduce and minimize air pollution through air quality monitoring and modeling, as appropriate. Develop an emissions inventory and apply additional mitigation measures and activity modifications, as appropriate, in response to the air quality information generated. Make reports generally available to the NSB and local communities.	Air emissions	ROP A-10; ADEC; NSB	Air quality; public health
80	Adhere to the BLM's oil and gas air resources ROPs, as applicable. These practices would minimize air emissions resulting from both Project construction and operations and would include: watering gravel roads to minimize fugitive dust, using clean fuels such as ultra-low sulfur diesel and natural gas, and the use of low emissions emitting equipment (including maximum use of electrical power, Tier IV final engines - or similar emission reduction technology for drill rigs and hydraulic fracturing equipment prior to WPF facility startup – storage tank closed vent systems to the extent practicable, and green completions).	All	ADEC	Air quality; climate change; water resources; wetlands and vegetation; public health
81	Use ultra-low sulfur diesel fuel (as defined by ADEC) in all diesel-fueled vehicles and equipment.	Vehicles and equipment	ROP A-9; ADEC	Air quality; public health

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82	Use totally enclosed or acoustically packaged permanent electric power generator sets to abate noise.	Generators	ADEC	Noise; birds; terrestrial mammals; marine mammals
83	Generate Project power using the power plant at the WPF following facility startup and provide power to drill rigs except during periods when power from the WPF is unavailable. Use ultra-low-sulfur diesel powered portable generators to supply Project power prior to facility startup or during periods of facility maintenance, shutdown, or upsets.	Utilities	ADEC; AOGCC	Air quality; public health
84	Power off vehicles and heavy equipment (i.e., rolling stock) used for oil and gas operations when not in active use, to the extent practicable.	Vehicles	ROP A-7; ADEC	Air quality; climate change; public health
85	Equip vehicles with block heaters and institute Project practices to power off and plug in vehicle engines when temperatures are -30°F or above to conserve fuel and reduce emissions.	Vehicles	ADEC	Air quality; climate change; public health
86	Use Finewater Mist for process module fire protection and a non-ozone depleting agent for drill site and non-process module fire protection in lieu of Halon.	Fire protection	ADEC	Air quality; water quality
87	Manage all waste in accordance with a comprehensive waste management plan to reduce impacts to human health and safety and to minimize potential effects to subsistence resources, including fish and wildlife. This would be accomplished using the Alaska Waste Disposal and Reuse Guide (the "Red Book"). This guide addresses: waste prevention and reduction, recycling, treatment, and disposal. The waste management plan would include measures to avoid attracting wildlife, disposal of putrescible waste, disposal of pumpable waste, and disposal of wastewater. As allowed, injectable waste would be injected into the subsurface via disposal wells or used for enhanced oil recovery.	Waste management	ROP A-2; ADEC	Water resources; wetlands and vegetation; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems
88	Audit contractors' health, safety, and environment performance to ensure safe practices are followed.	Personnel	ADEC	Water resources wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals; subsistence; public health
89	Audit the Project on a scheduled basis to ensure compliance with all environmental laws, regulations, and local requirements, company policies and procedures, and other regulations regarding safety, land use, fire codes, etc.	All	ADNR DMLW; ADEC	All
90	Employ Field Environmental Coordinators to monitor compliance with permits and other Project requirements.	All	ADNR	All
91	Evaluate environmental considerations when purchasing new storage tanks or adding new emissions sources that may affect the environment or operating permits.	All	ROP A-10; ADEC	All

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92	Review new chemicals being considered for use on the Project to ensure the materials would minimize the generation of hazardous waste or risk to employees.	Operations	ROP A-3; ADEC	All
93	Develop and implement a spill prevention and response contingency plan for the Project (in accordance with 40 CFR 112) to reduce impacts to human health and safety and to minimize potential effects to subsistence resources, including fish and wildlife. The Plan would cover Project operations and describe spill prevention measures and on-site cleanup materials for permanent fueling stations, use of proper storage containers and liner materials, proper container identification, and notice of reportable spills. Identification of drip pans (i.e., "duck ponds") would be addressed through Project operating procedures.	Spill prevention and response	ROP A-4; ADEC	All
94	Use a hazardous materials contingency plan (also known as a spill prevention and response contingency plan), prepared pursuant to NPR-A ROP A-3, that would detail response actions, drills, and responder training.	Spill prevention and response	ROP A-3; ADEC	All
95	Build and operate pipelines with the best available technology for detecting and preventing corrosion or mechanical defects to minimize impacts related to point source pollution from oil spills or leaks.	Pipelines	ROP E-4; ADEC	All
96	Install pipeline valves on each side of Judy (Kayyaaq) and Fish creek crossings, to allow isolation of produced fluids pipelines on either side of bridges and minimize potential spill impacts in the event of a leak or break. These valves would reduce subsistence user concerns related to downstream contamination from the Project. Isolation valves or vertical loops would be installed on the Willow (sales oil) pipeline at each side of the Ublutuoch (Tiŋmiaqsiuġvik) River, and on each side of the segment crossing the Nigliagvik Channel, Niġliq Channel, and lakes L9341 and L9323. Vertical loops would be installed on the diesel pipeline at each side of the Miluveach River, Kachemach River, and Colville River. Two methods of leak detection will be used for the seawater and diesel pipeline crossings under the Colville River: (1) leak detection mass balance (primary), and (2) optical leak detection (secondary, within casing).	Pipelines	ADEC	All
97	Implement CPAI's "Target Zero" spill prevention program, which is designed to raise awareness around spill prevention and pass on lessons learned, for the Project.	Spill prevention and response	ROP A-3, A-4, and A-5; ADEC	All
98	Implement a fuel transfer standard operating procedure and use secondary containment on regulated oil and hazardous materials storage tanks.	Spill prevention and response	ROPs A-4 and A-5; ADEC	All

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99	Continue to implement an extensive corrosion inspection program which includes ultrasonic inspection, radiographic inspection, coupon monitoring, metal loss detection pigs and geometry pigs (applicable to pig-capable pipelines), and infrared (heat signature detection) technology. The inspection programs are American Petroleum Institute Standard 570-based programs that focus inspection efforts on areas of greatest potential for spills.	Spill prevention and response	ROP A-3; ADEC	All
100	Continue CPAI's operating practice to immediately and completely clean up all spills, recovering 100% of spilled material for recycling when possible.	Spill prevention and response	ROP A-3; ADEC	All
101	Periodically treat pipeline fluids, as appropriate to product types, with chemicals to limit corrosion potential.	Pipelines	ROPs A-3 and E-4; ADEC	All
102	Equip and maintain oil spill response equipment intended for use in winter conditions for effective use in Arctic conditions (i.e., in a manner to prevent the freezing or icing of the equipment).	Spill prevention and response	ROPs A-3 and A-4; ADEC	All
103	Hydrostatically test pipelines prior to placing them into operation.	Pipelines	ROP E-4; ADEC	All
104	Provide access to the GMT and Alpine developments (under Alternatives B, C, and E) to offer additional response capabilities and minimize response time in the event of a spill or other unintended release or emergency.	Spill prevention and response	ROPs A-3 and A-4	All
105	Stage spill response equipment in strategic locations (e.g., drill sites) for initial spill response. On-site staged equipment would facilitate the rapid deployment of response personnel and may minimize or reduce the overall impacts associated with a spill or other accidental release.	Spill prevention and response	ROPs A-3 and A-4; ADEC	All
106	Designate Spill Response Teams and Hazardous Materials Response Teams, consisting of trained volunteer spill and hazardous materials response personnel on site.	Spill prevention and response	ROP A-3; ADEC	All
107	Continue to participate in the Mutual Aid Agreement among North Slope operators to supply labor and equipment for immediate spill response. Spill response drills and exercises would ensure response readiness and awareness; these drills would be scheduled according to the National Preparedness and Response Exercise Program guidelines and typically involves production, drilling, or pipeline spill response scenarios	Spill prevention and response	ROP A-3; ADEC; NSB	All
108	Do not refuel equipment within 500 feet of the active floodplain of any waterbody unless approved by the BLM authorized officer. Fuel-storage stations, except as approved by the BLM authorized officer, would be located at least 500 feet from waterbodies except for small caches (up to 210 gallons) for fueling motorboats, float planes, and small equipment.	Spill prevention and response	ROP A-5; ADNR DMLW; ADEC	All

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
109	Design well cellars to contain fluid drips and leaks.	Spill prevention and response	ROP A-4; ADEC	All
110	Continue philanthropy programs from local oil fields to provide income and other benefits to the residents of Nuiqsut.	All	None	Economics; sociocultural systems; public health
111	Design all bridges to maintain bottom chord clearance of at least 4 feet above the 100-year design flood elevation, or at least 3 feet above the highest documented flood elevation, whichever is higher. Additionally, design the Judy (Kayyaaq) Creek and Fish Creek bridges to maintain bottom chord clearance of at least 13 feet above the 2-year design flood elevation (open water) to provide vessel clearance.	Bridges	ROP E-6	Soils, permafrost, and gravel resources; water resources; wetlands and vegetation; fish; birds; terrestrial mammals; marine mammals; subsistence and sociocultural systems; public health
112	Include construction of up to three subsistence boat ramps to provide local residents with improved river access. Locations would include the Ublutuoch (Tiŋmiaqsiuġvik) River near the existing GMT-1 access road, Judy (Kayyaaq) Creek at the proposed Willow BT1 access road crossing, and Fish Creek at the proposed access road crossing (BT4 under Alternatives B, C, and D; BT2 under Alternative E).	All	ROP E-1	Subsistence and sociocultural systems; public health
113	Implement a speed limit of 35 mph and stop traffic when caribou are crossing the road on all 32-foot-wide (surface width) roads. On roads with a 24-foot-wide surface width, implement a 25-mph speed limit for health, safety, and environmental purposes, including to reduce potential impacts to vegetation from dust and to wildlife.	Gravel infrastructure	None	All
114	Build a constructed freshwater reservoir to ensure a reliable source of fresh water for the Project while minimizing the need for water withdrawals from Willow-area lakes. Adaptively manage water levels by installing a flow control gate and valve to allow reduction of flow velocity into the reservoir based on monitoring of water levels in Lake M0015 and the lake outlet into Willow Creek if necessary.	Water withdrawal	None	Water resources; wetlands and vegetation; fish; birds
115	Place pipelines at Fish Creek and Judy (Kayyaaq) Creek on structural steel supports attached to the bridge girders below the bridge deck to avoid placement of pipeline VSMs below OHW.	Pipelines	LS K-1	Water resources; fish; birds
116	Remove the airstrip approach lighting access and secondary access roads from the proposed Project design to reduce the gravel footprint.	Gravel infrastructure	ROP E-5	All
117	Develop a module delivery option that uses the existing Oliktok Dock and staging pad to avoid the need to construct an MTI.	Gravel infrastructure, module delivery	ROP E-5	All
118	Minimize the footprint of the gravel mine based on amount of gravel needed (i.e., less gravel needed for Option 3).	Gravel infrastructure, mine site	ROP E-5	All

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
119	Reduce potential fugitive methane emissions by processing and compressing produced gas for reinjection and gas lift to enhance production.	Pipelines	None	Air quality; Climate change
120	Minimize vented methane gas volumes by initially depressurizing pipelines to the production system, flare, and then purge lines with nitrogen prior to opening. By using nitrogen sweep and purge, little to no natural gas should be released when opening the equipment to atmosphere.	Pipelines	None	Air quality; Climate change
121	Use flaring to support process safety only (no flaring for production).	Processing facility	None	Air quality; Climate change
122	Use electric solenoids or instrument air driven pneumatics instead of natural gas driven pneumatics.	Processing facility	None	Air quality; Climate change
123	Use high efficiency turbines at the WPF (versus older frame style units employed at Prudhoe Bay and Kuparuk.	Processing facility	None	Air quality; Climate change
124	Use waste heat from the power generation turbines at the WPF to provide building and process heat for the WPF. No gas fired process heaters would be required during normal operations.	Processing facility	None	Air quality; Climate change
125	Use waste heat from fuel gas fired drill site heaters to supply building heat at drill sites to reduce electrical demand.	Drill site facilities	None	Air quality; Climate change
126	Prevent hydrocarbon emissions by installing vapor recovery units on hydrocarbon process tanks and vessels to prevent hydrocarbon emissions. (Note: these are process vessels and not storage vessels in the regulatory sense of the word. The infield flowlines, processing facility, and sales pipeline design obviate the need for permanent oil storage capacity onsite.)	Processing facilities and storage tanks	None	Air quality; Climate change
127	Use three-phase (gas, oil, and water) lines, which flow from each drill site to the Willow processing facility, and gas injection pipelines which flow from the Willow processing facility to each drill site, instead of gas gathering lines. Both types of overland pipelines have connections that are welded by design and largely avoid flanged connections minimize potential for leaks. These pipelines would employ the same leak detection surveys as the existing Alpine development (i.e., the lines will be surveyed in accordance with state regulations 18 AAC 75.080).	Pipelines	None	Air quality; Climate change; Spill risk
128	Conduct leak surveys (including methane) in accordance with New Source Performance Standard (40 CFR 60 OOOa or OOOOb [whichever regulation is applicable at the time]). Recycle the produced gas, not used for fuel or safety flare, and inject it for gas lift for reservoir pressure support (see also measure number 119).	Processing facilities and pipelines	40 CFR 60	Air quality; Climate change

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
129	Prior to WPF commissioning, use gas from the GMT-2 production pipeline to power the Willow Operations Center turbine via fuel gas rather than diesel fuel, which would produce less emissions than diesel fuel.	Processing facility	None	Air quality; Climate change
130	Use centrifugal compressors equipped with dry seals. Dry seal systems minimize methane leakage (versus wet seals).	Processing facility	None	Air quality; Climate change
131	Use electric power (from Project gas-fired turbines) for drilling and completion activities (e.g., drill rig and hydraulic fracturing equipment), versus using diesel fuel powered units.	Processing facility and drill site equipment	None	Air quality; Climate change
132	Capture and reinject produced gas during drilling, well completions, flowbacks, and well maintenance once the wellsite is connected by pipeline to the WPF to reduce combustion and methane emissions.	Processing facility and drill site equipment	None	Air quality; Climate change
133	Voluntarily comply with the Oil and Gas Methane Partnership, administered by the United Nations, which aims to improve methane measurements and drastically reduce methane emissions. As part of the program, the Willow Project would develop and implement methane measurement, reporting, and reduction plan, which would be subject to verification under the Oil and Gas Methane Partnership.	Processing facilities, drill sites, and pipelines	None	Air quality; Climate change
134	Implement a vehicle management plan (as required under the NSB rezoning ordinance), including traffic reduction measures.	Vehicles	None	Air quality; Climate change
135	Use mineral oil-based drilling muds where technically feasible to reduce vented methane emissions.	Well drilling	None	Air quality; Climate change
136	Use insulation in gravel roads and gravel pads where practicable to reduce the overall embankment height and gravel fill volume requirements while still maintaining thermal stability of the underlying permafrost.	Gravel infrastructure	NSB rezoning ordinance requirement	Permafrost and gravel resources; Terrestrial mammals; Subsistence

No.	Measure	Project Component or Activity	LS, ROP, or Other Stipulation[a]	Primary Affected Resource or Subject
137	CPAI will institute the following restrictions to ground-vehicle traffic in the Willow Project area (i.e., gravel and ice roads extending south/southwest from GMT-2): • The maximum speed limit on Willow gravel roads will be 35 mph to reduce the potential for vehicular accidents and disturbance of caribou. Infield roads that are 25 feet wide will have a maximum speed of 25 mph. • Periodic traffic closures will be instituted when groups of 25 or more caribou appear to be approaching the road and current traffic exceeds 15 vehicles per hour. • Wildlife will always have the right-of-way and vehicle traffic will be slowed or stopped to allow animals to cross Project roads. • Bus transportation will be used as the primary means to transport personnel between camps and their assigned work locations, as well as between camps and the Alpine CD1 airstrip during mobilization and demobilization.	Vehicles	None	Air quality; Birds; Terrestrial mammals; Subsistence
138	CPAI will institute the same safety access and use guidelines for Project roads as the operating Alpine development and Greater Mooses Tooth facilities.	Gravel roads	None	Subsistence

Note: °F (degrees Fahrenheit); ADEC (Alaska Department of Environmental Conservation); ADF&G (Alaska Department of Fish and Game); ADNR (Alaska Department of Natural Resources); AOGCC (Alaska Oil and Gas Conservation Commission); BLM (Bureau of Land Management); BT1 (Bear Tooth 1 drill site); BT2 (Bear Tooth 2 drill site); BT3 (Bear Tooth 3 drill site); BT4 (Bear Tooth 4 drill site); BT5 (Bear Tooth 5 drill site); CPAI (ConocoPhillips Alaska, Inc.); DMLW (Division of Mining, Land, Water); EIS (Environmental Impact Statement); ESA (Endangered Species Act); GIS (geographic information system); GMT-1 (Greater Mooses Tooth 1); GMT-2 (Greater Mooses Tooth 2); HDD (horizontal directional drilling); LS (lease stipulation); mph (miles per hour); MTI (module transfer island); No. (number); NPR-A (National Petroleum Reserve in Alaska); NSB (North Slope Borough); OHW (ordinary high water); ROP (required operating procedure); VSM (vertical support member); WPF (Willow Processing Facility). All cited lease stipulations and required operating procedures are from the National Petroleum Reserve in Alaska Integrated Activity Plan/Environmental Impact Statement Record of Decision (BLM 2022).

[a] Other stipulations include typical State of Alaska or NSB permit stipulations for North Slope activities or typical ESA conservation measures or LSs or ROPs. The table lists the agency from which the typical stipulation would arise.

3.0 ADDITIONAL SUGGESTED AVOIDANCE, MINIMIZATION, OR MITIGATION CONSIDERED IN THE 2020 WILLOW EIS

In addition to Project design features, LSs, and ROPs already applicable to the Project, the EIS also considers additional suggested avoidance, minimization, and mitigation measures designed to further reduce or compensate for impacts from the Project. These measures are discussed in the relevant resource sections in both the Willow MDP Final EIS (2020), Chapter 3.0, *Affected Environment and Environmental Consequences,* and this Willow MDP Supplemental EIS and are summarized in Table I.3.1. They were developed based on suggestions from cooperating agencies, stakeholders, public comments, and BLM staff.

The decision whether to adopt each new measure will be made in the BLM's Willow MDP ROD.

Table I.3.1. Additional Suggested Avoidance, Minimization, or Mitigation

Section Number and Resource	Additional Suggested Avoidance, Minimization, or Mitigation
3.2 – Climate and Climate Change	None
3.3 – Air Quality	Implement a Fugitive Dust Control Plan to mitigate impacts from fugitive particulate matter emissions from the Project. This plan would require regular watering of pads and unpaved roads, enforcing speed limits on unpaved access and haul roads, and several other measures to reduce fugitive dust emissions and impacts. See Appendix I.3, *Dust Control Plan*, for additional details.
3.4 – Soils, Permafrost, and Gravel Resources	Use the following in design of roads and embankments: • Separate native soils from Project fill materials using geotextiles or fabrics • Use thick embankments and shallow slopes • Monitor thermokarsting, depth of active layer, and compression of soil and vegetation in annual resupply ice road footprint, for footprints that are used consecutively each year
3.5 – Contaminated Sites	None
3.6 – Noise	Alter flight paths to avoid sensitive areas (such as Nuiqsut) Limit blasting to the hours of 10:00 a.m. to 8:00 p.m.
3.7 – Visual Resources	Include the following in the plan to minimize visual impacts (plan is required as per ROP E-17): • Ensure structures are a color that blends in with the background colors of the natural landscape. All colors would be pre-approved by the BLM. • ROP E-7 and CPAI's design measure 58 (Appendix I.1, Table I.1.2) state that a non-reflective coating would be used on pipelines; that could be expanded to all metal structures not otherwise painted, including but not limited to communications towers and drill rigs. Minimize light visible from outside of Project facilities *at all times of the year* by using lighting fixtures with lamps contained within the reflector and shading externally facing windows on buildings. This will minimize impacts on visual aesthetics (i.e., reduce contrast from glare and artificial lighting).
3.8 – Water Resources	Appendix E.8 provides detail about culvert, bridge, and pipeline design and how that influences potential effects to water resources. Additional suggested measures to reduce impacts created by culvert, bridge, and pipeline crossings, could include: Unless a more appropriate method is available, when estimating flood-peak discharge at locations within the Fish (Iqalliqpik) Creek, Judy (Iqalliqpik) Creek, and Ublutuoch (Tiŋmiaqsiġvik) River basins, use a weighted average from a single station analysis of the BLM long-term monitoring station data on each of these streams and the Shell regression equations (Appendix E.8). Weight the results of the two computations based on the uncertainty associated with each estimate. As appropriate, consider both 1) snow- and ice-impacted conditions and 2) ice-free conditions in the hydraulic design of bridges, culverts, and pipeline river crossings. Cross-section data at the time of the peak stage and peak discharge that are available for many rivers and streams indicate that the WSE was affected by snow and/or ice blockage. Based on the available information, develop designs that would perform satisfactorily during the design event considering both the possibility of open water conditions and the possibility that snow and ice blockage is occurring at the time of the design event. At a minimum, the magnitude of the blockage used in the designs should be similar to the magnitude of the blockage that has been observed. At a minimum, design culverts to perform satisfactorily for all flood events up to and including the 50-year event. The headwater-to-diameter ratio at the maximum design condition should be no greater than 1.0.

Section Number and Resource	Additional Suggested Avoidance, Minimization, or Mitigation
	Identify the locations requiring cross-drainage culverts during spring breakup prior to construction, by noting all locations where water is flowing over the proposed alignment. This is necessary because it is often not possible to determine where water flowing in polygon troughs will cross the alignment during a summer or fall inspection. At the same time, identify the ends of the proposed culverts and the invert elevation of the ends of the culvert in order to maintain the flow in the historic flow path. At a minimum, design road bridges to pass the 50-year flood-peak discharge with a minimum of a 3-foot freeboard (assuming snow and ice conditions have been considered in estimating the design water surface elevation). Design for bridge foundation scour equal to the maximum scour depth produced by floods up through a magnitude equal to the 100-year flood event, and a geotechnical design practice safety factor of from 2 to 3. Check the bridge design using a superflood and a geotechnical design practice safety factor of 1. The superflood is defined as the 500-year event, 1.7 times the magnitude of the 100-year event, or the overtopping flood, whichever is the least. These are standard criteria used by Alaska Department of Transportation and Public Facilities for bridges on the North Slope in non-designated flood hazard areas. At a minimum, design pipeline river-crossings to perform satisfactorily for all floods up to and including the 200-year event (including crossings on bridges or VSM). This is the magnitude of the design event that has typically been used for common carrier pipelines on the North Slope and a higher level of design than is being proposed for the Project. Start bridge and culvert hydraulic computations sufficiently downstream so that the downstream boundary assumptions do not affect the performance of the proposed design. Consider the USACE (1986) report "Accuracy of Computed Water Surface Profiles" in determining the location of the downstream boundary for hydraulic computations. If the highest observed WSE or high-water mark is higher than the predicted 50-year WSE at a culvert, bridge, or pipeline, re-evaluate the design water surface elevation to confirm that snow and ice blockage, and other details of the computation are accurate. Given the conditions on the North Slope, it is unlikely that high water marks from a 50-year flood or greater would be recognizable unless it occurred in the last 10 to 20 years. Additionally, it is improbable that a 1- to 5-year field program would experience a 50-year flood. It is more likely that snow and ice blockage greater than accounted for in the model used to predict the 50-year WSE or an error in the downstream boundary condition used in the model has occurred. Use a freeboard at bridges and pipeline crossings which considers the uncertainty in the magnitude of the design flood, the uncertainty in the hydraulic computations, and the height of the ice and debris that may be carried by the flood but is not less than 3 feet. Where an aboveground pipeline crossing is *immediately* upstream from a road, backwater from the road during the pipeline design event should be considered when setting the bottom of pipe elevation. Additionally, if the road is designed for a smaller flood than the pipeline, the changes in hydraulic conditions at the pipeline as a result of the road wash-out should be considered (i.e., changes in location of the concentrated flow and the impact on erosion at the VSM). Where an aboveground pipeline crossing is *immediately* downstream from a road, the impact of the road on where water would be flowing and the velocity of the water at the pipeline VSM should be considered. Additionally, if the road is designed for a smaller flood than the pipeline, the changes in hydraulic conditions at the pipeline as a result of the road wash-out should be considered (i.e., changes in the location of the concentrated flow and the impact on erosion at the VSM). Breach ice road crossings sufficiently that ice from crossing would not contribute to ice jams or increase snow and ice blockage during spring breakup. Avoid placing multi-season ice pads in floodplains (e.g., construction pads at the mine site). Prior to HDD construction, provide a monitoring and response plan for determining if drilling mud is being lost to formation or making it to the river or groundwater during drilling. Should any spills occur on the MTI, the affected gravel would be addressed immediately and removed prior to MTI abandonment. If Option 1 or 2 is selected, place and maintain appropriate navigation aids on the MTI after it is decommissioned (the top of the MTI is expected to drop to or below the water surface) Provide annual surveillance of bridge, culvert, and pipeline river crossings to confirm that structures are functioning properly and provide maintenance as required.

Section Number and Resource	Additional Suggested Avoidance, Minimization, or Mitigation
	Continue to collect baseline data regarding discharge, ice and liquid water conditions and distribution, and bank conditions on the Colville River near Ocean Point throughout winters every year until ice bridge construction so that an ice bridge plan can be drafted that would include exact crossing location for bridge and ramps, plans for flow and fish passage management (should they be needed), and actions to be taken at the end of ice bridge use (such as slotting). Prepare an adaptive management plan that provides detail regarding how any unanticipated surface water flow blockages would be identified and corrected as quickly as possible, to avoid lasting environmental impacts. Include erosion mitigation features or options in engineering design of boat ramp(s) to prevent or minimize erosion potential at the boat ramp(s) and along adjacent riverbanks. Develop a maintenance plan for the boat ramps to ensure long-term viability and use of the site(s) while minimizing impacts to the adjacent waterbodies. Include the following points at a minimum: • Identify entity responsible for site maintenance • Annual maintenance (grading) of parking pads, turning pads, access ramps, and road access • Maintain a gravel supply (off-site) to reinforce boat ramps and pads when necessary • Regular clean-up of pads and surroundings, including back-haul of trash to suitable disposal site Before construction and continuing through operations, test and monitor freshwater sources that intersect the Project for hydrocarbons.
3.9 – Wetlands and Vegetation	If Alternative C or D is selected, monitor vegetation damage, and compression of soil and vegetation in annual resupply ice road footprint (footprints that are used consecutively each year). Because wetter landscapes show less impact from multiyear ice roads (Yokel, Huebner et al. 2007) and ADNR monitors only tussock tundra and soil compaction, this suggested measure would focus on non-tussock wetlands (including patterned ground) with a Cowardin water regime class of Temporarily Flooded, Saturated, or Seasonally Flooded Ground by vegetation type (total live cover of graminoid, shrub, forb, moss) and percentage of bare soil would be monitored with control points and points within ice road footprints to determine changes. Use vehicle and equipment wash stations and inspect vehicles and equipment for organic matter (e.g., invasive species) prior to moving equipment west of the Colville River to reduce the risk of introducing invasive species. Clean tires and wheel wells so they are free from soils, seeds, and plant parts. Provide stations to clean footwear and gear so they are free from soils, seeds, and plant parts. Provide training to employees and contractors in identification, control, and prevention of known invasive plant species. Confine loading and unloading of soils for gravel stockpiles to the downwind side of the pile; if piles would be on-site for longer periods of time, seed with appropriate vegetation to reduce wind erosion. Wind barriers (such as snow fences) may also be appropriate in some situations.
3.10 – Fish	Identify overwintering fish habitat (maximum water depths, particularly free-water depth under ice cover) in the Itkillik River and other tributaries to the Colville River that might intersect the Option 3 ice road. Avoid crossings of potential overwintering habitat. Adopt best management practices suggested by National Marine Fisheries Service for essential fish habitat for invasive species (Limpinsel, Eagleton et al. 2017): • Uphold fish and game regulations of the Alaska Board of Fisheries (AS 16.05.251) and Board of Game (AS 16.05.255), which prohibit and regulate the live capture, possession, transport, or release of native or exotic fish or their eggs. • Adhere to regulations and use best management practices outlined in the State of Alaska Aquatic Nuisance Species Management Plan (ADF&G 2002). • Encourage vessels to exchange ballast water in marine waters (in accordance with the U.S. Coast Guard's voluntary regulations) to minimize the possibility of introducing invasive estuarine species into similar habitats. Ballast water taken on in the open ocean would contain fewer organisms, and these would be less likely to become invasive in estuarine conditions. • Discourage vessels that have not exchanged ballast water from discharging their ballast water into estuarine receiving waters.

Section Number and Resource	Additional Suggested Avoidance, Minimization, or Mitigation
3.11 – Birds	Locate mast poles away from the pad edge. Minimize light visible from outside of Project facilities *at all times of the year* by using lighting fixtures with lamps contained within the reflector and shading externally facing windows on buildings to minimize the potential for bird strikes. Implement lighting controls to turn off exterior lighting at satellite pads and other unoccupied facilities when personnel are not present, between August 1 and October 31. Minimize the number of tall towers. Limit water withdrawal to lakes without sensitive fish or breeding yellow-billed loons. Route ice roads around identified yellow-billed loon nesting sites and nesting lakes to avoid vegetation compaction at nesting sites and delayed melt-out of nesting lakes. Restrict speed limits to minimize collision hazard and dust production (35 miles per hour except in areas of congestion, on bridges, and on pads, which should be slower). Haze birds out of the blast area before blasting (if resident birds are present in winter). Minimize noise impacts between June 1 and July 15 when birds on nests would be unable to move away from the disturbance. Minimize air traffic during the nesting period when the movements of incubating birds are restricted, and the molting period when birds may be energetically stressed and sensitive to disturbance. Avoid routine use of helicopters during drilling and operations activities to minimize noise and impacts related to birds. Consider revising traffic patterns, altitude, and location to minimize conflicts with molting geese. Avoid preferred habitats, where possible. Minimize barge and support vessel speed to reduce potential for bird strikes. Complete upgrades to the Kuparuk gravel road system involving wetland fill before or after the nesting season (June 1 through July 31), if possible.
3.12 – Terrestrial Mammals	ROP E-6 describes requirements related to caribou ramps over pipelines or buried pipelines. The Project could designate specific locations for these, such as northeast of the airstrip in Alternative B, or areas where caribou movements could be funneled or where roads and pipelines would be close together. The decision to add a crossing ramp over a buried pipeline should consider potential negative effects of reduced access to the pipeline for oil spill detection and response and thermokarst or changes in surface flow due to the resulting long-linear ditch that would fill with water. Install game cameras to study the effectiveness of measures used to reduce vehicle traffic impacts, such as stopping traffic or caravanning. Include the following in the vehicle use plan to minimize traffic impacts (plan is required as per ROP M-1): • Require vehicles to stop traffic when 25 or more caribou appear to be approaching the road. • Require vehicles to caravan or require periodic traffic closures when groups of caribou are near a road and the road has traffic rates of more than 15 vehicles per hour. Caravanning has limited ability to lower calving displacement (Lawhead, Prichard et al. 2004), but it may increase crossing success on roads with high traffic levels (more than 15 vehicles per hour) by providing periods without traffic to allow caribou to cross. It may be easier logistically to close the road for a specified number of hours a day (as determined by BLM) rather than caravanning. Spring, fall, and winter would likely be the periods of greatest concern for caribou crossing Project roads. Restrict Q400 traffic between Alpine and Willow at certain times of year to reduce impacts to caribou. Require the use of propylene glycol for deicing and for vehicle cooling systems, which is not toxic to wildlife.
3.13 – Marine Mammals	None
3.14 – Land Ownership and Use	Develop a coordination plan with other stakeholders who are permitted to use the NSB Community Winter Access Trail snow road (i.e., Nuiqsut residents) by BLM to prevent access conflicts during sealift module movement across the Colville River.
3.15 – Economics	None

Section Number and Resource	Additional Suggested Avoidance, Minimization, or Mitigation
3.16 – Subsistence and Sociocultural Systems	Inform employees who are North Slope residents of company subsistence leave policies and ensure that leave policies are flexible to account for annual variation in the timing and length of subsistence activities. Employ subsistence representatives who receive daily communications on Project activities and report potential conflicts with subsistence users. Subsistence representatives should be provided with clear communication protocols and training, be local and knowledgeable residents, and be included in field activities the community believes have a high potential of conflicting with subsistence uses (e.g., helicopter-based surveys). In coordination with local organizations, such as the KSOP (required in CPAI design measure 68), ensure communications include the timing and location of development activities such as air traffic, blasting, and other construction activities. Identify areas with high drifted snow accumulation along pipelines after construction and implement a snow management program to clear drifts and create access points (i.e., openings) in areas where drifts accumulate for a long distance (e.g., quarter- and half-mile lengths) along pipelines. Consult with Nuiqsut residents on an appropriate distance for cleared access areas as well as the depth of snowdrifts that impede travel under pipelines. As part of the Subsistence Plan (required in ROP H-1) and as part of the Proponent's notification and consultation with Alaska Native groups (ROP H-1), provide equal opportunities for various local entities (e.g., KSOP, NVN, City of Nuiqsut, Kuukpik), in addition to knowledgeable subsistence users, to provide input. Continue to consult with local subsistence users and community organizations regarding the appropriate design and location of subsistence boat ramps, pullouts, and subsistence tundra access ramps. Consult with other operators regarding other boat ramp projects on the North Slope that may inform future designs. Participate in Conflict Avoidance Agreements with the Alaska Eskimo Whaling Commission to reduce potential impacts on bowhead whale hunting resulting from barge and vessel traffic. Work with community organizations to establish measures to reduce impacts of vehicle traffic on subsistence activities, particularly during the Project's construction phase. Install traffic control signs (e.g., stop signs) to halt industry vehicle traffic at all subsistence access ramps to ensure that subsistence users can cross safely Place development-free buffer around Native Allotment of at least 1 mile to ensure the viability of the allotment for subsistence use. Exceptions would be made for allotment owners who agree to having development closer than 1 mile.
3.17 – Environmental Justice	Continue to use the KSOP to maintain meaningful engagement in the Project and identify continuing concerns and specific Project impacts. Attend government to government meetings between NVN and BLM, as requested by NVN or BLM, to discuss issues and resolution strategies through construction and operations.
3.18 – Public Health	Limited health data are available for Nuiqsut. The best data available date from the NSB's 2010 survey. Funding a collection of health information for Nuiqsut and studies of contaminant levels in local subsistence resources would provide better data for evaluation of potential health effects associated with oil field development and operation. Create a public health monitoring program 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 should be responsible for the development and implementation of the monitoring program; however, the NSB and the Alaska Native Tribal Health Consortium should be consulted in the identification of appropriate indicators, thresholds, and responsive actions. Establish a Nuiqsut public health coordination group to conduct health education and engage the community in the public health monitoring program described above.
3.19 – Cumulative Effects	None
4.0 Spills	None

Note: ADNR (Alaska Department of Natural Resources); BLM (Bureau of Land Management); CPAI (ConocoPhillips Alaska, Inc.); HDD (horizontal directional drilling); KSOP (Kuukpik Subsistence Oversight Panel); MTI (module transfer island); NSB (North Slope Borough); ROP (required operating procedure); USACE (U.S. Army Corps of Engineers); VSM (vertical support member); WSE (water surface elevation).

4.0 COOPERATING AGENCY SUGGESTED MITIGATION MEASURES IN THE 2022 DRAFT SUPPLEMENTAL EIS*

During development of this Supplemental EIS' range of alternatives, BLM and cooperating agencies suggested additional mitigation measures during cooperating agency meetings and in correspondence that may reduce Project impacts. BLM developed potential mitigation measure comments made by cooperating agencies into potential mitigation measures by further developing the comment into an objective and a standard or requirement. Potential mitigation measures not enforceable by BLM were included if the measure could be imposed or mandated by another agency within their regulatory or permitting authority. Measures that were already included as part of Project LSs or ROPs, covered under other permit conditions (e.g., North Slope Borough rezoning), or would not be legal, were removed from further consideration.

The 2015 Greater Mooses Tooth 1 (GMT-1) ROD directed BLM to prepare a Regional Mitigation Strategy (RMS) to serve as a road map for mitigating impacts from GMT-1 and future oil and gas projects enabled or assisted by the existence of GMT-1 (such as the Willow MDP Project). The RMS identifies areas of potential impacts from oil and gas developments and provides examples of mitigation measures that may reduce those impacts. Additional suggested mitigation measures for the Willow MDP Project that were developed for the 2020 Final EIS and this Supplemental EIS are guided by the principles outlined in the RMS. The decision whether to adopt each new measure will be made in BLM's Willow MDP ROD.

Table I.4.1 presents the proposed cooperating agency mitigation measures under consideration in this Supplemental EIS.

Table I.4.1. Cooperating Agency Suggested Mitigation Measures*

No.	Objective	Standard/Requirement	Affected Resource(s)
1	Provide time between development projects to observe impacts and changes to baseline conditions. Observations from developed projects may result in additional NEPA review and analysis, changes to proposed projects (including phases), and/or new mitigation measures.	Proposed projects that would have a gravel footprint exceeding 300 acres would be limited to developing no more than 65% of the proposed project before instituting a minimum 2-year pause to observe project impacts (e.g., permafrost, hydrology, caribou, subsistence). The authorized officer will be responsible for determining the need for permit review based on the monitored findings.	All
2	Provide time before the construction of Project drill site BT5 is authorized to observe overall Project impacts and changes to environmental baseline conditions.	Drill site BT5 and the gravel roadway to BT5 will not be authorized for construction for three years after the construction of the Project's other three drill sites is complete.	All
3	Provide Nuiqsut with a guaranteed minimum proportion of the NPR-A impact mitigation fund as the Nuiqsut is the community most directly impacted by oil and gas development.	The NPR-A Impact Mitigation Fund will direct a minimum of 15% of the grant funding to the City of Nuiqsut. This direct funding would not prevent Nuiqsut from applying for grants from the NPR-A Impact Mitigation Fund.	Economics; Environmental justice
4	Provide additional resources to Nuiqsut to support search and rescue efforts. With expanded oil and gas development, many Nuiqsut residents travel further from the village to pursue subsistence opportunities. This expanded range strains the current search and rescue program in the community.	CPAI will provide Nuiqsut $250,000 for search and rescue equipment and operations with the start of Project construction (i.e., gravel placement). CPAI will provide a second $250,000 payment to Nuiqsut for additional search and rescue equipment following commissioning of the Willow processing facility.	Economics; Environmental justice; Public health
5	Reduce the amount of equipment traveling on Project roads at specific times to reduce impacts to caribou and subsistence users.	Install caribou monitoring stations that use real time caribou GPS telemetry data (i.e., caribou collars) and manage road use for successful caribou passage. The applicant and BLM will consult with the NSB wildlife department and ADF&G caribou experts to identify the minimum percentage of the Teshekpuk Caribou Herd that should have active GPS telemetry collars and the caribou density and distance from Project roads that will initiate traffic restrictions.	Caribou; Subsistence; Environmental justice
6	Reduce impacts to calving caribou (approximately May 20 through June 20).	Outdoor construction activity (e.g., gravel working, building fabrication) will be halted during caribou calving season when calving caribou are within 1 mile of the activity. Drilling and operations activity will be minimized at drill site pads during caribou calving season to the extent that is safely practicable; new activities (e.g., initiating drilling for a new well, hydraulic fracturing) will not be initiated at drill sites during this time.	Caribou; Subsistence; Environmental justice
7	Collect air quality monitoring data in the immediate area of development, between Nuiqsut and the Willow Project, to confirm the Project is operating at anticipated emissions levels (i.e., as modeled) and provide a record of regulatory emissions violations.	Install air quality monitoring stations at a predominantly down-wind location on a gravel pad used to directly support drilling or operations (e.g., drill site pad, processing facility pad). One air monitoring station will be required for every five drill site pads or single processing facility, per development project. This data will be collected and be made publicly available in real time through the North Slope Science Initiative website.	Air quality; Public health; Environmental justice

No.	Objective	Standard/Requirement	Affected Resource(s)
8	Limit overall activity or minimize air traffic at specific times to reduce impacts to caribou.	ROP F-1 requires the use of an Aircraft Use Plan. The plan will include the following: • Minimize Q400 traffic between Alpine and Willow during calving (May 20 to June 20) to reduce impacts to caribou. Q400 traffic between Willow and Kuparuk or Deadhorse is necessary and would be allowed. • Plans to minimize the disturbance to calving caribou (description of areas avoided, how flight numbers were minimized, and that low altitude flights were avoided or limited).	Noise; Caribou; Subsistence; Environmental justice; Wilderness characteristics
9	Maintain subsistence ramp access, including pullout surface area, free of obstructions, including equipment and material storage.	Materials and equipment shall not be staged on gravel road pullouts or in such a way as to block subsistence ramps or the roadway view for subsistence ramp users. Safe access to subsistence ramps will be maintained. Operators will incorporate staff training on the importance of maintaining clear and safe areas around pullouts and subsistence ramps into their orientation and safety programs. Operators will install signs at roadway pullouts stating, “Equipment and Materials Shall Not be Staged Here”.	Subsistence; Environmental justice
10	Dispose all Project waste properly and in a timely manner.	Waste management plans shall specify the intervals for total site cleanup at areas of activity. Cleanup intervals will not exceed 72 hours during periods of activity, including on Project pads.	Water resources; Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice
11	Further reduce impacts to nesting Yellow-billed loons from vehicle traffic.	In areas where roads cross through Yellow-billed loon nesting buffers, maximum vehicle speeds will be restricted to 25 mph within the buffer zone during the nesting season (approximately June 1 through July 31). These speed limits will be prominently signed during this period.	Birds
12	To minimize or avoid environmental harms caused by greenhouse gas emissions and ensure NEPA adequacy over the life of the Project. Analysis by the EPA indicates that with technological advances and new data provided by infield drilling following a development and production environmental impact statements, more petroleum hydrocarbons are often extracted from the target reservoir than originally estimated. This results in more greenhouse gas emissions produced than estimated or disclosed to the public.	A NEPA adequacy review will be completed if the barrels per day gross annual average is greater than 10% of the original barrels per day production target (disclosed in the development’s most recent NEPA document) over a two-year period; or when the cumulative recovered reserves are greater than 10% of the original estimated recoverable reserves (disclosed in the development’s most recent NEPA document).	Climate change
13	Protect surface waters in the Project area through monitoring and mitigation.	The Project will include an adaptive management plan "that provides detail regarding how any unanticipated surface water flow blockages would be identified and corrected as quickly as possible, to avoid lasting environmental impacts" for monitoring and mitigation of potential surface water flow impacts throughout the Project area.	Water resources; Wetlands and vegetation; Fish
14	Protect and minimize impacts to surface waters at Ocean Point and across the Project area.	The Project will include an adaptive management plan for the Colville River crossing activity at Ocean Point.	Water resources; Fish

No.	Objective	Standard/Requirement	Affected Resource(s)
15	Minimize floodplain impacts where gravel roads, pads, or boat ramps may block or restrict the flow of surface waters during spring breakup through timely detection and corrective action.	The Project will prepare an adaptive management plan to address potential floodplain impacts where gravel roads, pads, or boat ramps may block or restrict the flow of water during spring breakup. The adaptive management plan will provide methods for detecting and correcting unanticipated blockages before they lead to further environmental degradation. The adaptive management plan will address the potential for spring breakup surface waters to: • Increase the depth and duration of water impoundment • Increase thermokarsting • Cause a change in flow direction • Cause channel instability or a change in alignment • Result in erosion of the tundra or a stream channel • Result in the deposition of sediment on the tundra or in a stream channel	Water resources; Wetlands and vegetation; Fish
16	Minimize impacts to the water levels of Willow Creek 3 and Lake M0015 resulting from the construction of the constructed freshwater reservoir.	CPAI will collect stage monitoring data for Willow Creek 3 and Lake M0015 during ice-free periods for three consecutive years prior to the start of construction of the constructed freshwater reservoir (under Alternatives B, C, and D). This information will be used to ensure adequate water levels are maintained during the filling and operations of the constructed freshwater reservoir.	Water resources; Wetlands and vegetation; Fish
17	Minimize the potential impacts of thawing and thermokarst from climate change on Project structures, including roads, pads, and the constructed freshwater reservoir to protect the TLSA.	CPAI will prepare an adaptive management plan that will be responsive to climate change by monitoring and mitigating potential thawing and thermokarst impacts on all Project structures including roads, pads, and the constructed freshwater reservoir.	Climate change; Permafrost; Water resources; Wetlands and vegetation
18	Collect health baseline data for a Community Health Study what will inform evaluation of potential health effects associated with oil and gas developments.	Fund the collection of baseline health information on Nuiqsut residents and a Community Health Study that studies contaminant levels in local subsistence resources. The study shall include a section on potential trends that may have occurred in local health during the Covid-19 activity slowdown in 2020.	Public health; Environmental justice
19	Reduce the concentration and/or intensity of flaring near Nuiqsut.	CPAI will prepare a coordination plan between the Kuparuk, Alpine, and Willow developments to minimize the use flaring across all three developments and to reduce the incidences of multiple facilities flaring simultaneously. When simultaneous flaring must occur, the length of flare overlap shall be minimized to the greatest extent possible.	Air quality; Climate change; Visual resources; Environmental justice; Public health; Wilderness characteristics
20	Improve local understanding and knowledge of traditional and scientific principles related to the oil and gas industry for school age children in Nuiqsut.	Fund traditional and western scientific education programs in Nuiqsut schools to help inform and improve the community's understanding of the oil and gas industry development and its associated impacts.	Environmental justice
21	Utilize local knowledge by including community members (e.g., elders, tribal council members, hunters, NSB wildlife experts) when conducting studies and Project planning.	Include local advisors (e.g., elders, tribal council members, hunters, NSB wildlife experts) as team members when conducting studies, identifying historic sites, and completing Project planning.	Fish; Birds; Terrestrial Mammals; Marine Mammals; Subsistence; Environmental justice; Cultural resources

No.	Objective	Standard/Requirement	Affected Resource(s)
22	Provide the community with information on the health of local subsistence resources.	Fund an NSB wildlife biologist position stationed in Nuiqsut to help the community and NSB monitor wildlife health and provide the community information on the safety of consuming subsistence resources.	Subsistence; Environmental justice; Public health
23	Improve the design and deployment of subsistence access ramps so they are safe and effective for community members.	Develop an adaptive management plan for subsistence access ramps that considers community input for improvements to subsistence ramp design and to address modifications of existing subsistence ramps. New subsistence ramps will be placed at a minimum of 1 ramp for every 3 miles of new gravel road. CPAI will meet with the community of Nuiqsut to establish subsistence ramp design parameters to ensure the designs are adequate for users. Design parameters will include a minimum length "landing ramp" at the top that is level and long enough to accommodate snow machines pulling sleds without sleds having to enter the associated pullout or adjacent road. The design parameters will set a maximum grade of the ramps. The subsistence ramp pullouts will be signed that materials and equipment are not to be stored at pullouts. Warning signs will be placed on the adjacent roadway approaching the subsistence ramp/pullout to warn drivers of the potential for vehicles (e.g., snowmachines, all-terrain vehicles) crossing the road. Subsistence ramp locations will be made available to local search and rescue groups (e.g., Nuiqsut, NSB) as GPS coordinates and on published maps.	Subsistence; Environmental justice; Public health
24	Support the local community's needs for gravel infrastructure maintenance.	Provide Nuiqsut gravel to support road maintenance, specifically the subsistence access road.	Environmental justice
25	Collect additional air pollutant data in Nuiqsut and make the data available to the public.	Expand the air monitoring capabilities in Nuiqsut to include monitoring for hazardous air pollutants, volatile organic compounds, and polycyclic aromatic hydrocarbons. The measured concentrations will be made available in near real time for the community and the public at large.	Air quality; Fish; Birds; Terrestrial mammals; Marine mammals; Public health; Environmental justice
26	Reduce caribou deflection.	Aboveground pipelines shall have a nonreflective finish.	Visual resources; Terrestrial mammals; Subsistence; Environmental justice; Wilderness characteristics
27	Test local subsistence resources for contamination.	Provide periodic testing of consumable subsistence resources for contamination. Testing frequency and the number of samples tested per testing interval will be determined in consultation with the community of Nuiqsut.	Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice; Public health

No.	Objective	Standard/Requirement	Affected Resource(s)
28	Provide independent oversight and management to the air quality monitoring station in Nuiqsut.	CPAI shall fund the Nuiqsut air quality monitoring station. A third-party contractor will be identified to operate and maintain the station. The third-party contractor will develop a training program open to Nuiqsut residents for operating and maintaining the monitoring station, with appropriate technical oversight completed by the contractor.	Air quality; Public health; Environmental justice
29	Provide local subsistence oversight of all field activity being conducted in support of the Project.	A subsistence representative shall be present whenever field activity is occurring, including having representatives scheduled to cover day and night work shifts. Subsistence representatives are to be included in all field activities conducted in support of the Project.	Subsistence; Environmental justice
30	Actively monitor for pollution indicators in the environment for the duration of the Project and modify Project activities as needed to address found contamination.	Develop an ongoing contamination study program (e.g., snow sampling, fish sampling) and adaptive management plan to address found contamination. Any contamination found in excess of State or EPA levels will be reported to ADEC within 72 hours of being determined.	Air quality; Water resources; Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice; Public health
31	Monitor for and minimize impacts from hydraulic fracturing or underground injection control disposal well operation.	Monitor water quality, permafrost, and vegetation near sites where hydraulic fracturing or deep well injection (i.e., underground injection control wells) are occurring for potential contamination or unanticipated impacts. Develop an adaptive management plan that outlines how impacts would be analyzed and potentially addressed.	Air quality; Water resources; Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice; Public health
32	Protect vegetation along ice road routes.	Monitor vegetation along ice road footprints for vegetation damage and compression of soil and vegetation. Because ADNR monitors only tussock tundra and soil compaction, this measure focuses on non-tussock wetlands (including patterned ground) with a Cowardin water regime class of Temporarily Flooded, Saturated, or Seasonally Flooded Ground by vegetation type (total live cover of graminoid, shrub, forb, moss). Additionally, the percentage of bare soil would be monitored with control points and points within ice road footprints to determine changes.	Wetlands and vegetation
33	Provide the Nuiqsut community with a level of control and oversight on baseline studies to Nuiqsut.	The community of Nuiqsut shall be involved in the development of studies in the Project area, from study design to implementation. CPAI shall present planned studies (e.g., study requirements, methodology, timing) to the community and incorporate feedback as practicable. CPAI will provide regular updates to the community about ongoing studies and study planning.	Water resources; Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice
34	New bridges will not interfere with subsistence activity.	CPAI shall consult with Nuiqsut on the design of proposed Project bridges to ensure they provide adequate clearances and safe passage for boaters traveling along waterways.	Subsistence; Environmental justice

No.	Objective	Standard/Requirement	Affected Resource(s)
35	Protect oilfield workers from retaliation for reporting on-the-job issues.	CPAI shall include topics on how to report violations to company policy, regulatory requirements, or state and local laws and whistleblower protections for CPAI employees or their contractors who report such violations.	Economics; Environmental justice
36	Provide adequate agency (State of Alaska and the NSB) oversight of Project construction and operations to ensure permit compliance.	BLM shall coordinate with the State of Alaska and the NSB to provide an adequate number of inspectors on site during construction and operations of the Project to ensure the project is in compliance with its permits. CPAI shall provide site access and accommodations to the required inspection staff.	All
37	Identify important inter-community subsistence areas.	CPAI shall conduct at least two multi-village workshops during project development to identify important inter-community subsistence areas. The communities included for the Project are at a minimum: Nuiqsut, Utqiaġvik, Anaktuvuk Pass, and Atqasuk.	Subsistence
38	Determine potential impacts mine site blasting has on fish returns and caribou migration.	Develop and conduct a study to monitor for and determine potential impacts that may occur to fish returns and caribou migration from mine site blasting.	Fish; Terrestrial mammals; Subsistence; Environmental justice
39	Determine if contaminants potentially migrate off the drill site BT2 North pad.	Institute a monitoring program for drill site BT2 to determine if contamination migrates off the gravel pad. Monitoring shall include water, snow, soil, and vegetation sampling. Any contamination found in excess of State or EPA levels will be reported to ADEC within 72 hours of being determined.	Water resources; Wetlands and vegetation; Fish; Birds; Terrestrial mammals; Marine mammals; Subsistence; Public health
40	Nuiqsut residents must rely on imported foods to a greater extent when subsistence resources are negatively impacted by oil and gas development. Protect imported food supplies during transit through Utqiaġvik and Deadhorse to Nuiqsut.	Imported foods are frequently stored improperly and are damaged or ruined prior to arrival in Nuiqsut. CPAI shall pay to construct food storage facilities at airports in Deadhorse and Utqiaġvik to protect perishable goods from precipitation, freezing, spoiling, and wildlife.	Subsistence; Environmental justice; Public health
41	Provide laboratory testing in Nuiqsut for standard testing protocols to avoid having to send samples for testing to Utqiaġvik, Fairbanks, or Anchorage.	Construct and operate an environmental testing laboratory in Nuiqsut.	Economics; Environmental justice, Public health
42	Minimize the deflection and disruption of caribou migratory patterns.	Restrict noise (e.g., limit drilling, limit construction activity) when caribou are present during the calving and migration periods. When noise is unavoidable, avoid abrupt sounds. A steady drone of noise is easier for caribou to acclimate to, so consider adding a white noise generator if necessary to lessen abrupt sounds.	Terrestrial mammals; Subsistence
43	Minimize the deflection and disruption of caribou migratory patterns.	Limit the overall activity, including outdoor foot traffic, and minimize air traffic at specific times to reduce impacts to caribou (especially during calving and migration periods).	Terrestrial mammals; Subsistence
44	Minimize the deflection and disruption of caribou migratory patterns.	Minimize visual impacts by fencing or otherwise camouflaging or screening pads and areas that have the most activity and movement. Caribou are more likely to turn away from movement than from structures perceived as stationary objects. Caribou also react more strongly and habituate less readily to foot traffic than to vehicle traffic.	Visual resources; Terrestrial mammals; Subsistence; Wilderness characteristics

No.	Objective	Standard/Requirement	Affected Resource(s)
45	Minimize the deflection and disruption of caribou migratory patterns.	Protect hunting success versus biological success by: • Reducing the number of animals required to halt traffic ("let the lead caribou cross"). • Limiting traffic during the fall hunting period (approximately September 15 through October 15) and incorporate local recommendations for the timeframe. • Following the Red Dog Mine model for caribou crossings. • Use recommendations from the subsistence committee. • Stopping traffic as soon as caribou are sighted or when caribou are a half mile or less from the road. • Incorporate crossing ramps, 7-foot tunnels/overpasses, and/or visual windows into road design when possible.	Terrestrial mammals; Subsistence
46	Minimize the deflection and disruption of caribou migratory patterns.	Buffer the Teshekpuk Caribou Habitat area by 5 to 6 kilometers (3.1 to 3.7 miles) to account for the avoidance response of calving caribou to infrastructure.	Terrestrial mammals; Subsistence
47	Minimize deflection and disruption of caribou migratory patterns.	Use convoys and/or checkpoints to moderate traffic flow and to consolidate traffic in space and time.	Terrestrial mammals; Subsistence
48	Minimize the deflection and disruption of caribou migratory patterns through monitoring and awareness.	Employ caribou monitoring personnel to maintain awareness of presence and movements of caribou.	Terrestrial mammals; Subsistence
49	Minimize the deflection and disruption of caribou migratory patterns through suspension of off-pad activities at critical times.	Off-pad activities shall be suspended from May 20 through June 20, unless approved by the authorized officer. The intent of this requirement is to restrict activities that would disturb caribou during calving. The permittee shall submit a stop-work plan that considers this, and other mitigation related to caribou early arrival. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur over the life of the Project (approximately 30 years).	Terrestrial mammals; Subsistence
50	Minimize the deflection and disruption of caribou migratory patterns through ground traffic restrictions on permanent oil and gas-related roads.	The following ground traffic restrictions shall apply to permanent oil and gas-related roads: • From May 20 through August 20, traffic speed shall not exceed 15 mph when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, stockpiling equipment and materials, etc. to the extent practicable. The permittee shall submit with the development proposal a vehicle use plan that considers these and other mitigation measures. • The permittee shall observe caribou movement from May 20 through August 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic would be stopped: o Temporarily to allow a crossing by 10 or more caribou. The permittee shall submit with the development proposal a vehicle use plan that considers these and other mitigation measures. o By direction of the authorized officer, traffic may be stopped through the Project area for a limited amount of time, and only if necessary to prevent displacement of calving caribou. Such closures will not be undertaken without first consulting with permittees to assess operational impacts on permitted activities.	Terrestrial mammals; Subsistence

No.	Objective	Standard/Requirement	Affected Resource(s)
51	Minimize the deflection and disruption of caribou migratory patterns through air traffic restrictions.	ROP F-1 requires the use of an Aircraft Use Plan. The plan will include the following: • Minimize Q400 traffic between Alpine and Willow during calving (May 20 to June 20) to reduce impacts to caribou. Q400 traffic between Willow and Kuparuk or Deadhorse is necessary and would be allowed. • Plans to minimize the disturbance to calving caribou (e.g., description of areas avoided, how flight numbers were minimized, and that low altitude flights were avoided or limited).	Noise; Terrestrial mammals; Subsistence; Wilderness characteristics
52	Reduce the impacts to subsistence users resulting from increased travel requirements for subsistence users.	Provide household level vouchers for fuel (not fixed dollar value) to support subsistence activities on a quarter-annual basis.	Subsistence; Environmental justice
53	Provide a funding source to support Nuiqsut healthcare needs.	Provide funding to support the Nuiqsut healthcare clinic so that treatment options available in the clinic can address the most frequent concerns (e.g., asthma).	Environmental justice; Public health
54	Provide a funding source for a professional third-party contractor to design and administer a human health study.	Provide funding to the City of Nuiqsut to contract with a third-party professional organization or consultant to develop and administer a human health study. The study shall consider unique aspects to life on the North Slope, including the consumption of subsistence food sources.	Environmental justice; Public health
55	Provide BLM with ready access to CPAI's North Slope roads (e.g., Kuparuk, Alpine, Greater Mooses Tooth, Willow).	Develop a road use agreement between CPAI and BLM that provides BLM unfettered access of project gravel and ice roads, except when safety may be jeopardized by road conditions or activity.	All
56	Continue the long-term caribou monitoring project in and near Nuiqsut through the life of the Willow Project to provide better understanding of the effects of North Slope oil and gas development on caribou.	Continue to fund the long-term caribou monitoring project in and near Nuiqsut through the life of the Willow Project.	Terrestrial mammals; Subsistence; Environmental justice
57	Provide funding for a caribou collaring study within the Willow Project area.	Provide a funding mechanism to support ongoing caribou collar studies through construction of the Willow Project and five years of operations only activity to provide a better understanding of caribou responses to increased oil and gas development.	Terrestrial mammals; Subsistence
58	Support the development of a cultural center in Nuiqsut.	Provide funding to help design and develop a cultural center in Nuiqsut for the community's use.	Sociocultural systems; Environmental justice
59	Provide funding for a caribou movement study in the Alpine and Greater Mooses Tooth project areas.	Provide a funding mechanism to support ongoing Teshekpuk Caribou Herd studies in the Alpine and Greater Mooses Tooth project areas with a focus on how caribou respond to roads and vehicle traffic.	Terrestrial mammals; Subsistence; Environmental justice
60	Prevent collisions by birds with overhead power lines and guy wires during mating, inclement weather (e.g., fog), and migration	Add to ROP E-15: Communication towers should be monopoles without guy wires that could be a collision hazard for birds.	Birds
61	Use white strobe lights instead of solid, or pulsating (beacon) red lights to reduce attracting night-migrating birds to tower structures exceeding 200 feet in height with required FAA lighting	Add to ROP E-8: For tower structures exceeding 200 feet in height with FAA required lighting, use white (preferable) or red strobe lights. The strobes should be set at the minimum number of flashes per minute allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided, if possible.	Birds

No.	Objective	Standard/Requirement	Affected Resource(s)
62	Protect birds during nesting season	Construction/placement of gravel for roads and pads should occur in winter to avoid damage to nesting birds, eggs, and hatchlings and adjacent tundra habitats. No gravel placement or tundra disturbance should occur during bird nesting season (June 1 to July 31). For airstrip construction, snow removal and the first layer of gravel for the entire airstrip footprint should take place in late May, prior to the onset of the bird nesting season. Additional gravel layers within the footprint can then be placed and compacted throughout the summer without damage to birds and habitats.	Birds
63	Prevent ponding of sheet flow and maintain natural flow during rain events	Place culverts within long linear roads in sufficient number to prevent ponding of sheet-flow and to maintain natural flow throughout break-up and summer/fall rain events.	Water resources
64	Prevent high-water erosion of roads/pads and stream bottoms	Place erosion control material (e.g., supersacks, revetment) on banks of rivers under and adjacent to bridges and adjacent to and on bottom of stream approach and exit of large culvers (when necessary) to prevent high-water erosion of road or pad and stream bottom.	Water resources
65	Protect surface waters	Prohibit the discharge of any contact fluids into surface waters.	Water resources
66	Implementation of an Adaptive Management Plan	Implement an adaptive management plan that includes regular monitoring and is responsive to floodplain impacts, thermokarst development, changes in hydrology, vegetation damage, seasonal flows, water levels, erosion, deposition throughout the Project area.	Soils
67	Improve and protect food security by providing alternative methods for fresh food production.	Provide gravel and building materials for construction of a public greenhouse suitable for Arctic conditions, to protect food security and allow communities to better adapt to the future climate through the establishment of local fresh food production.	Public health; Environmental justice

Note: ADEC (Alaska Department of Environmental Conservation); ADF&G (Alaska Department of Fish and Game); ADNR (Alaska Department of Natural Resources); BLM (Bureau of Land Management); BT2 North (drill site BT2 North); BT5 (drill site BT5); CPAI (ConocoPhillips Alaska, Inc.); EPA (U.S. Environmental Protection Agency); FAA (Federal Aviation Administration); GMT-2 (Greater Mooses Tooth 2); GPS (global positioning system); mph (miles per hour); NEPA (National Environmental Policy Act); NPR-A (National Petroleum Reserve in Alaska); NSB (North Slope Borough); ROP (required operating procedure); TLSA (Teshekpuk Lake Special Area).

5.0 SUGGESTED MITIGATION MEASURES FROM PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL EIS

During public comment period on the Draft Supplemental EIS, BLM received suggested additional mitigation measures that may reduce Project impacts. Table I.5.1 presents the proposed mitigation measures suggested by the cooperating agencies, stakeholders, and the public that are considered in this Supplemental Final EIS.

Table I.5.1. Public Comment Period Suggested Mitigation Measures*

No.	Objective	Standard/Requirement	Affected Resource(s)
1	Implement an adaptive management plan to address surface water blockages,	Implement an adaptive management plan that addresses surface water blockages around Project infrastructure.	Water resources
2	Monitor for permafrost thaw and implement an adaptive management plan to address identified permafrost thaw and thermokarsting.	Implement an adaptive management plan that addresses monitoring potential permafrost thawing and thermokarst impacts for all Project structures, including roads, pads, and the constructed freshwater reservoir (under Alternatives B, C, and D) to further protect the TLSA. Share monitoring information with ADF&G and other relevant agencies.	Climate change; Soils and permafrost

No.	Objective	Standard/Requirement	Affected Resource(s)
3	Limit the disturbance of tundra-nesting birds.	Limit road upgrades to times outside of the bird nesting season (generally July 1 through July 31).	Birds
4	Provide access to gravel resources for local community infrastructure projects.	Permittee shall stockpile excess gravel from open cells at the Tinmiaqsiugvik mine site for use in community infrastructure projects. The permittee would operate the mine site on behalf of the community, and the community shall be responsible for obtaining a mineral materials sales contract from BLM.	Environmental justice
5	Improve access for subsistence users and reduce the need for snow road construction.	Provide the State of Alaska's Community Winter Access Trail access to Willow gravel and ice road infrastructure for use to reduce the reliance on constructing snow roads through the Willow Project area.	Subsistence; Air quality; Climate change; Environmental justice
6	Reduce helicopter and fixed-wing aircraft flight impacts to wildlife and subsistence users.	Use unmanned aerial vehicles (i.e., drones) to conduct inspections and surveys to the greatest extent practicable to reduce impacts to wildlife and subsistence users.	Noise; Birds; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice; Wilderness characteristics
7	Prevent spread of invasive species in the Project area.	Use existing and temporary indoor and outdoor vehicle washing facilities and inspection stations in locations as needed to wash and inspect vehicles prior to use in the Project area. Permittee will follow an Invasive Species Monitoring Control Plan for vehicle washing practices and to monitor for invasive species.	Wetlands and vegetation
8	Reduce downstream greenhouse gas emissions resulting from the Willow Project.	The Willow project would cease producing oil 20 years from the date of the spudding of the first well.	Climate change
9	Reduce net greenhouse gas emissions resulting from the Willow Project.	Permittee shall offset 50% of the projected net GHG emissions associated with the final preferred alternative selected in the Project's Record of Decision, in accordance with U.S. commitments under the Paris Agreement, and calculated as follows. GHGs shall be offset through reforestation of land (as opposed to preservation of existing forest land), and the required acreage of reforestation necessary to offset the Project's GHG's shall be calculated by assuming that the average mature tree can sequester (i.e., consume and retain) up to 48 pounds of carbon dioxide per year (European Environment Agency 2011). In its 2022 budget justification, the U.S. Forest Service reported that the National Forest System's reforestation needs are estimated at 4 million acres (USFS 2021). These efforts are accomplished with the help of non-profit partners such as the National Forest Foundation and civic groups who contribute to the agency's capacity for reforestation through partnerships and matching fund agreements. Implementation of this mitigation measure would require the permittee to offset 50% of the projected net GHG emissions associated with the Project (approximately 69 to 73 million metric tons of net CO_2e compared to Alternative A, depending on the action alternative and choice of global warming potential). The U.S. has established an economy-wide target of reducing its net GHG emissions by 50% to 52% below 2005 levels in 2030 in its NDC under the Paris Agreement (UNFCCC 2021); offsetting 50% of the net Willow emissions over the life of the Project would help the U.S. achieve this goal.	Climate change

No.	Objective	Standard/Requirement	Affected Resource(s)
10	Increase food security by providing adaptive measures for food storage	Permittee shall work with the local community to improve food storage capacity and durability. This could include providing gravel and insulation to "harden" existing cellars, providing transportation of chest freezers to the North Slope, etc.	Climate change; Subsistence; Environmental justice; Public health
11	Facilitate clean-up of historic contamination.	Permittee shall work with the BLM to facilitate access to contaminated sites using temporary and permanent Willow Project infrastructure to promote clean-up efforts.	Hazardous materials; Environmental justice; Public health
12	Minimize impacts to soils and vegetation from snow and ice infrastructure.	Permittee would provide BLM with as-built GIS of snow and ice infrastructure at the end of every winter season. Ice road and pad alignments shall be different every year to minimize impacts to soils and vegetation unless otherwise approved by the BLM authorized officer. Snow roads may use the same alignment year to year depending on snow conditions.	Soil; Wetlands and vegetation
13	Provide North Slope residents access to Colville River ice road crossings.	Permittee shall allow reasonable access to North Slope residents to use ice roads built for the Willow Project, including the annual Colville River ice bridge.	Subsistence; Environmental justice
14	Reduce methane emissions from project activities.	Permittee shall use the best available technology to reduce venting of methane to the atmosphere during wellhead and processing facility maintenance. Remote inspections of pipelines and well-pads will occur once per quarter to inspect for methane leaks.	Air quality; Climate change; Public health
15	Monitor water quality for contamination.	Develop a water quality monitoring plan to regularly sample area waterways for contamination downstream from Project facilities.	Water quality; Fish; Subsistence; Public health
16	Provided targeted employment opportunities for NSB residents, particularly Nuiqsut residents.	Provide job training, hiring events, and outreach to local residents in the NSB. These employment outreach efforts will include training for upcoming Project positions, as well as engagement with locally owned support service companies to provide an overview of the types of Project support that will be required. Employment outreach in Nuiqsut will be held at least once per year.	Economics; Environmental justice
17	Protect stream banks, minimize compaction of soils, and minimize breakage, abrasion, compaction, and displacement of vegetation resulting from winter tundra travel.	a. Off-road travel will be allowed by the BLM authorized officer when soils are frozen to sufficient depth (defined by a soil temperature of 23 degrees Fahrenheit or lower at a depth of 12 inches), and 6 inches of snow cover exists. Snow distribution and pre-packing may be used to maintain sufficient snow cover in areas of poor snow coverage. The permittee shall submit data to BLM to show that these conditions have been reached prior to conducting work. Snow survey and soil freeze-down data collected for ice road or snow trail planning and monitoring shall be submitted to BLM with the required weekly report of operations. b. Off-road travel is generally to be conducted with low-ground-pressure vehicles unless otherwise approved by the BLM authorized officer. Low-ground pressure is defined as vehicles with less than 4 pounds per square inch ground pressure, or vehicles that have passed the Alaska Department of Natural Resources low-pressure vehicle qualification certification. c. Ice roads would be designed and located to avoid the most sensitive and easily damaged tundra types, as much as practicable. d. The permittee shall provide the BLM with an as-built of all ice roads, snow trails, and ice pads after the infrastructure is completed. Data must be in a GIS format (Esri shapefiles referencing the North American Datum of 1983).	Wetlands and vegetation; Birds; Terrestrial mammals; Subsistence
18	Minimize impacts to denning polar bears.	Permittee will conduct two airborne infrared surveys for polar bear dens prior to initiating winter activities.	Marine mammals

No.	Objective	Standard/Requirement	Affected Resource(s)
19	Minimize impacts to streams from Project boat ramps.	Develop a maintenance plan for boat ramps to ensure the long-term viability and use of the site(s) while minimizing impacts to the adjacent waterbodies. The initial plan shall be submitted to the BLM authorized officer 60 days prior to initiating the first year's maintenance activities. Any substantive changes to the maintenance plan will be submitted to BLM prior to initiation of maintenance activities impacted by those changes. The plan will include such measure as: a. Determine if erosion mitigation features or options in engineering design of boat ramp(s) are needed to prevent or minimize erosion potential at the boat ramp(s) and along adjacent riverbanks. Describe the evaluation that was completed to determine if erosion control is needed and what type of features are included in the final design. b. Identify entity responsible for site maintenance. c. Describe annual maintenance (grading) of parking pads, turning pads, access ramps, and road access. d. Identify the gravel source for reinforcement of boat ramps and pads when necessary. Describe the location and quantity of gravel available and the frequency of how often the need for additional gravel will be evaluated. e. Include regular clean-up of pads and surroundings, including back-haul of trash to suitable disposal site. f. Describe how spills will be removed or mediated per the Project's spill plan.	Water resources; Fish; Marine mammals; Subsistence
20	Provide economic development opportunities in the community of Nuiqsut.	Permittee shall materially support economic development workshops focused on identifying and developing small business ideas that are not dependent on the extraction industry. Workshops will provide information about how to apply for small business grants, how to craft a business plan, etc.	Economics; Environmental justice
21	Reduce impacts from blasting at the Willow Tiŋmiaqsiuġvik mine site.	CPAI will evaluate the use of a surface miner at the Tiŋmiaqsiuġvik mine site to develop the gravel resource. CPAI will use a surface miner at the Kuparuk Mine Site during the initial winter construction season and shall provide a report to BLM on the efficacy of this equipment in North Slope conditions no later than June following the initial construction season. The report shall describe how the equipment was used, any engineering or logistical challenges of using this equipment, and steps taken to adapt the surface miner for use in North Slope operations. If the surface miner is determined to be technologically feasible as an alternative to blasting, BLM will require its use at the Willow Tiŋmiaqsiuġvik mine site to reduce the impacts of blasting. (Note: some blasting would still be required to remove overburden).	Noise; Terrestrial mammals; Marine mammals; Subsistence; Environmental justice; Wilderness characteristics
22	Permanently protect the most important habitat areas for the maternal and migrating caribou of the Teshekpuk Caribou Herd, including Teshekpuk Lake, a buffer around the lake, and the migration corridors to the east and northwest.	BLM will develop compensatory mitigation that provides durable, long-term protection for the Teshekpuk Caribou Herd to fully offset impacts of the Project on that Herd, to include protecting the surface area of Teshekpuk Lake, a buffer along all shores of the lake, and the LS K-10 Caribou Movement Corridors/K-16 Deferral Areas (under Alternative E in the 2020 National Petroleum Reserve in Alaska Integrated Activity Plan Final Environmental Impact Statement) using existing statutory, management, or administrative authorities, with a focus on restricting future leasing or surface development in those areas.	Visual resources; Water resources; Wetlands and vegetation; Birds; Terrestrial mammals; Marine Mammals; Land ownership and use; Subsistence; Environmental justice; Wilderness characteristics

Note: ADF&G (Alaska Department of Fish and Game); BLM (Bureau of Land Management); GHG (greenhouse gasses); GIS (geographic information system); NSB (North Slope Borough); TLSA (Teshekpuk Lake Special Area).

6.0 NORTH SLOPE BOROUGH REZONING REQUIRED MITIGATION MEASURES*

As part of the North Slope Borough's process to rezone the Willow Project area from Conservation District to Resource District land use designations, the Project received additional review from the NSB. The NSB's rezoning approval included both required stipulations and mitigation measures and conditions of approval. These NSB requirements are intended to further mitigate impacts to wildlife, subsistence use, and public health and safety from the Project.

Table I.6.1. summarizes the NSB rezoning required stipulations and mitigation measures and Table I.6.2 summarizes the NSB rezoning conditions of approval.

Table I.6.1. North Slope Borough Rezoning Required Stipulations and Mitigation Measures*

No.	Category	Stipulation or Mitigation Measure
1	Overall/General – Duck Ponds	CPAI and its contractors shall place or affix permanent ownership identification and unique numbering on every duck pond owned and used.
2	Overall/General – Mitigation Fund	CPAI shall mitigate the impacts on local residents related to the additional infrastructure in the area and the potential for reduction of subsistence resource availability, including the impacts related to displacing resources from high priority subsistence use areas. Commencing with the start of construction and continuing for the life the project, in addition to any other agreements CPAI shall make annual payments in the amount of $50,000 per year to a mitigation fund directed and administered by the NSB.
3	Subsistence – Access	CPAI shall consult with the NSB, NVN, Kuukpik, and KSOP at least annually. Examples of uses and developments requiring consultation include but are not limited to the following: (1) construction of facilities and roads; (2) aircraft movement; (3) drilling; and (4) the selection of water sources. Through this consultation, CPAI shall make reasonable efforts to assure that planned activities are compatible with subsistence activities and will not result in unreasonable interference with subsistence harvests or subsistence resources. CPAI shall submit a report of this consultation, including areas of agreement and identification of any unresolved conflicts, to the Administrator prior to the commencement of the uses/developments at issue. The Administrator may take measures consistent with NSB municipal code Title 19 to address any unresolved conflicts relating to said uses/developments.
4	Subsistence – Due Diligence	CPAI shall exercise due diligence to mitigate all adverse impacts on subsistence use activities caused by CPAI's activities.
5	Subsistence – Timing	To the maximum extent practical, initial project construction activities, such as construction of gravel roads, pad, pipeline and bridges, will be done during the winter season.
6	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	Study designs will be discussed and coordinated with the NSB DWM for submittal to the NSB by March 1, 2021, and each year thereafter as necessary. The NSB DWM and Planning will review, seek revisions as appropriate, and approve the study designs by April 1, 2021, and each year thereafter as necessary.
7	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	An annual report will be prepared and distributed to NSB DWM and Planning departments by February 15 and a meeting scheduled with NSB DWM and Planning, to occur by April 1. This meeting will discuss the results and the potential need for adjustments to scope to assess possible impacts to caribou, waterbirds, fish, and subsistence users. The Land Management Administrator and Director of the DWM will make the final decision of whether study designs need to be altered and/or additional data collection or analyses are required.
8	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	CPAI will consult with KSOP on study design prior to submittal to the NSB and provide KSOP with annual reports.
9	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	CPAI will make data available from their studies annually to the NSB DWM and within a year of completion of the study to the general public through a data archive (e.g., University of Alaska's Geographical Information Network of Alaska, Alaska Ocean Observing System).
10	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	CPAI will provide the DWM with reports from studies (e.g., wildlife, habitat, erosion) required by other agencies involved in permitting lands associated with the Willow Project, and to the maximum extent practical where multiple study requirements can be aligned, avoid duplication of study efforts among the NSB and such other agencies.

No.	Category	Stipulation or Mitigation Measure
11	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	To the extent practicable, CPAI and its contractors will minimize flights by hiring local boat drivers, snow machine drivers, and allowing their contractors to camp at a study site.
12	Wildlife and Habitat Protection – General Provisions for Studies on Wildlife and Subsistence	To the extent practicable, CPAI will involve students from Nuiqsut (or other North Slope communities if no students are available from Nuiqsut) in their studies.
13	Wildlife and Habitat Protection – Caribou	CPAI will fund a caribou study to analyze the distribution and movements of caribou around the Willow Project area and adjacent areas to assess habitat relationships and possible impacts from development. CPAI will fund a third-party contractor to: • Characterize pre-construction caribou movements utilizing historic telemetry data • Assist ADF&G or the NSB DWM in the collection of GPS telemetry data (e.g., potential purchase of additional caribou collars or database management) • Determine caribou pre- and post-construction movement rates in relation to roads pipelines and pads associated with their project • Characterize habitat conditions (e.g., snow melt, vegetation habitat, plant biomass, infrastructure) within the study area using best available technology • Evaluate these indices of habitat conditions, with particular attention to possible impacts from development, on the distribution of caribou utilizing the study area
14	Wildlife and Habitat Protection – Birds	CPAI will conduct a study of molting waterfowl in the vicinity of the Willow Project and farther to the west. The final study area will be determined in consultation with the DWM and after consulting with the USFWS to determine the area that is currently being monitored for molting geese. The study will be conducted for at least three years. After that time, the results will be reviewed and a determination will be made about whether the surveys need to continue and if so, for how long. The final determination will be made by the Land Management Administrator and Director of the DWM.
15	Wildlife and Habitat Protection – Birds	CPAI will fund a third-party contractor to conduct a breeding shorebird study in and adjacent to the Willow Project area. As this is known to be important shorebird breeding habitat, baseline studies will be conducted annually pre-development, and at least once every three years after development has been initiated. This study will document shorebird abundance, density, and nesting success.
16	Wildlife and Habitat Protection – Birds	CPAI will fund a third-party contractor to conduct a Yellow-billed loon study in and adjacent to the Willow Project area. To minimize impacts to breeding Yellow-billed loons, the study will document presence and habitat use (breeding/non-breeding) through techniques such as aerial or ground surveys but will avoid nest examination until termination of nesting.
17	Wildlife and Habitat Protection – Fish	CPAI will fund a third-party contractor to collect baseline data to help detect possible impacts, mitigate impacts, or conduct a damage assessment in the event of oil spills and/or release of oil-related products. Potential impacts are not restricted to population level effects.
18	Wildlife and Habitat Protection – Fish	CPAI will repeat required predevelopment studies (baseline) outlined by BLM and USFWS every four years. Should differences be detected from baseline, then CPAI will consult with NSB DWM on whether additional studies are required to explain differences and/or to monitor change. If CPAI divests, sells, or significantly alters management responsibility for the Willow Project, then CPAI is required to provide funding for another year of those studies to incoming management to be conducted during the subsequent summer season.
19	Wildlife and Habitat Protection – Fish	CPAI will experimentally determine the effect of sublethal hydrocarbon exposure and persistence of detection of exposure on two species of fish (fourhorn sculpin and Arctic Cisco) and two prey items of fish, at four temperatures that reflect local seasonal changes (summer, autumn, and spring and winter) using, Alaska North Slope Crude oil and, when available, hydrocarbon from the Willow Project (i.e., not mixed to produce Alaska North Slope Crude). This experimental method must be developed so that it can used to determine whether fish and their prey items have been exposed during accidental releases of hydrocarbons from CPAI operations. If no accidental releases occur in 10 years, then repeat the experiment using more updated tools, methodologies, and analyses, while making sure that previous experimental results can be used for comparison. If data are not sufficient to fulfill this stipulation, additional studies may be required.

No.	Category	Stipulation or Mitigation Measure
20	Wildlife and Habitat Protection – Fish	Fish detected with water mold or other newly emerging infections in both the Nuiqsut Fall Fishery and in areas associated with CPAI's influence will be recorded, collected, and reported to the NSB DWM.
21	Wildlife and Habitat Protection – Water Quality	CPAI will collect data on water quality and hydrology to help detect potential Project related impacts on fish and the subsistence fishery. CPAI will be required to repeat required predevelopment studies (baseline) outlined by BLM and USFWS every four years. Should differences be detected from baseline, then CPAI will consult with NSB DWM on whether additional studies are required to explain differences and/or to monitor change. If CPAI divests, sells, or significantly alters management responsibility for the Willow Project, then CPAI is required to provide funding for another year of those studies to incoming management to be conducted during the subsequent summer season.
22	Wildlife and Habitat Protection – Subsistence	CPAI will fund a contractor to design and conduct a subsistence study that investigates the effects of CPAI's Willow Project development activities and associated infrastructure, as well as future exploration and development activities and associated infrastructure, to subsistence hunters from Nuiqsut. The study should focus on all of CPAI's facilities and activities within the area that is subject to this re-zone, as well as facilities and activities outside of this area that have the potential to impact subsistence resources and activities within the area, as determined by discussions with the NSB DWM and Planning staff. The project should at a minimum: • Examine possible effects from CPAI developments and activities to subsistence activities, especially on caribou and migratory bird hunting • Document hunter concerns and opinions about impacts from CPAI's facilities and activities associated with this rezone
23	Minimizing Traffic Impacts – General	CPAI shall coordinate with KSOP, Kuukpik, and the NSB DWM and Planning departments to establish standard air traffic routes that will minimize interference with animal concentrations. (Concentrations of caribou herds are of particular concern.) CPAI shall follow these routes unless there is a threat to human safety, or an animal concentration or subsistence user is positioned along the routes.
24	Onshore Oil and Gas Pipelines and Roads – General	Siting, design, construction, and maintenance of pipelines must minimize alteration of shorelines, water courses, wetlands, and tidal marshes and avoid significant disturbance to important habitats and critical migration periods.
25	Onshore Oil and Gas Pipelines and Roads – Consolidation	Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, must be consolidated to the maximum extent possible.
26	Onshore Oil and Gas Pipelines and Roads – Wildlife Crossing	Pipeline design and construction shall be based on the best available information and include adequate pipeline elevation, ramping, or burial to provide for unimpeded wildlife crossing. Aboveground pipelines and all associated infrastructure (including fiber optic and other cables) must be elevated at or above the 7-foot minimum height except at those points where the pipeline intersects a road, pad, or caribou ramp, or is constructed within 100 feet of an existing pipeline that is elevated less than 7 feet.
27	Onshore Oil and Gas Pipelines and Roads – Placement	Pipelines must be separated from roads by a minimum distance of 500 feet (except at those points where the pipeline intersects a road, pad, or caribou ramp).
28	Onshore Oil and Gas Pipelines and Roads – Placement	Pipelines shall not be constructed at a distance greater than 1,000 feet from any access road.
29	Onshore Oil and Gas Pipelines and Roads – Placement	Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within 1,500 feet of the ordinary high-water mark of any fish-bearing deep lake (i.e., depth greater than 4 meters). If the fish-bearing status of a lake is unknown, the burden is on CPAI to demonstrate whether fish are present.
30	Onshore Oil and Gas Pipelines and Roads – Drainage	Appropriate facilities shall be installed to ensure adequate drainage patterns.
31	Onshore Oil and Gas Pipelines and Roads – Sedimentation	CPAI will monitor for sedimentation build-up or scouring resulting from all bridges and provide the Administrator with results of such monitoring on a regular basis. The Administrator may require measures to mitigate sedimentation and scouring, including dredging, to ensure that the subsistence use area is maintained.
32	Economic Opportunity – Job Fairs	CPAI will host a job fair annually in Nuiqsut beginning after the Assembly's approval of CPAI's Application.

No.	Category	Stipulation or Mitigation Measure
33	Economic Opportunity – Employment Reports	CPAI shall submit annual reports to the Administrator by December 1st of each year showing the number of NSB residents employed by CPAI by job type. Overall employment statistics will be part of this reporting, showing the percentage of NSB resident employment, separate for Alaska resident employment. The overall employment report will also reflect the total workforce, by resident location, of CPAI' s workforce in Alaska.
34	Economic Opportunity – Bids	When CPAI solicits bids, it shall invite North Slope suppliers, subcontractors, and regional and village corporations to bid on Willow projects for which they are qualified.
35	Economic Opportunity – Subsistence Policy	NSB strongly urges CPAI to adopt a formal policy to avoid scheduling disruptions and misunderstandings when subsistence leave is needed while employed by CPAI. The use of seasonal employment options as a method of addressing subsistence leave flexibility is not a meaningful method of employment that allows NSB residents to gain CPAI workplace experience. This requirement should be passed onto all CPAI contractors to the maximum extent allowable.
36	Economic Opportunity – Land Management Orientation	NSB shall provide land management orientation for CPAI for its Willow projects on an annual basis.
37	Economic Opportunity – Subsistence Representative	CPAI shall fund a year-round subsistence representative.
38	Cultural and Historical Site Protection – Data Points for Critical Sites	CPAI must contact the NSB IHLC Division at (907) 852-0422 and SHPO to obtain a set of data points for sites of possible historic, prehistoric, cultural, traditional, archeological, and paleontological significance (Critical Sites). CPAI will maintain the data provided by IHLC in a secure place for internal use only and shall not disclose that data to any other person or entity except SHPO and those entities with a need to know for the purposes of the planned Willow and associated developments and associated facilities, including roads, bridges, gravel pads, airstrips, and pipelines. CPAI will retain and update this data throughout the life of the development project. Prior to the completion of the development project, CPAI will come to an agreement with IHLC as to the disposition of IHLC data once the project is completed. Data points provided by IHLC in the form of geographic coordinates may be imprecise. CPAI is nevertheless responsible for ensuring that its operations do not cause any adverse impacts to Critical Sites and for reporting to IHLC the proper coordinates of any such site discovered. CPAI will release NSB from any liability associated with CPAI's use of these data points.
39	Cultural and Historical Site Protection – Buffer Zones	CPAI must maintain an effective buffer zone around all sites of possible historic, prehistoric, cultural, traditional, archeological, and paleontological significance (Critical Sites). An effective buffer zone will be at least 500 feet unless a smaller zone is necessary and can be mutually agreed upon by CPAI and the NSB Planning Department. CPAI must train its staff and contractors to observe this buffer and ensure that Critical Sites are not disturbed.
40	Cultural and Historical Site Protection – Discovery of Remains or Materials	Should any human remains or possible historic, prehistoric, cultural, traditional, archeological, and paleontological significant materials (Critical Site materials), including, but not limited to artifacts, house mounds, grave sites, ice cellars, and fossilized animal remains, be discovered in the course of this field survey that were not already identified by IHLC or SHPO, CPAI must stop all work in the vicinity of the discovery until CPAI has made contact with IHLC at (907) 852-0422, SHPO and, in the case of human remains, the Alaska State Troopers, and has obtained these agencies' approvals to continue work. CPAI must submit any information discovered that may be of historic, prehistoric, cultural, traditional, archeological, and paleontological significance to IHLC (including, but not limited to artifacts, house mounds, grave sites, ice cellars, and fossilized animal remains). CPAI must not disclose that data to any other person or entity except SHPO and those entities with a need to know for the purposes of working on the planned Willow and associated developments and associated facilities (including roads, bridges, gravel pads, airstrips, and pipelines). CPAI must not remove or disturb any items that may be of historic, prehistoric, cultural, traditional, archeological, and paleontological significance, except to the extent needed to document their existence and to comply with state and federal law and this ordinance.
41	Cultural and Historical Site Protection – Allotments	CPAI must not trespass on Native Allotments or private property. Owner permission must be obtained in advance to enter onto the surface of these lands. CPAI must work with the Inupiat Community of the Arctic Slope and Native Allotment owners in and around the area in a beneficial manner.

No.	Category	Stipulation or Mitigation Measure
42	Cultural and Historical Site Protection – Site Visits	Upon IHLC's request, CPAI must allow an IHLC representative to accompany CPAI during field work. The IHLC representative shall comply with all CPAI safety and operational rules and requirements when accompanying CPAI during field work.
43	Reclamation Plan – General	An abandonment/reclamation plan must be submitted to the Administrator within three years of cessation of permitted activities. At a minimum, the plan must contain: • A grading and site plan drawn and certified by an Alaska licensed professional engineer or land surveyor, indicating the areas excavated or filled, the proposed finished grades and contours, drainage directions and any control structures to be installed. • The methods and plans to be employed for reclamation of the site during and after the activity shall be stated along with a timetable for completions. • A description of all roads and structures and a site map showing the locations of all roads and development which will be built indicating which ones will remain after cessation of activities. • A description of any known reclamation requirements of any other governmental entity, and a copy of any reclamation plan under development or in existence for the activity. • All maps shall be submitted at a scale of one inch equals 200 feet extending 200 feet beyond the site area with a maximum contour interval of five feet. The scale requirements may be adjusted by the Administrator to fit unusual circumstances.
44	State, Local, and Federal Compliance – Other Permits	This approval shall not become effective until all other local, state, and federal permits, approvals, and authorizations have been issued. CPAI shall comply with all local, state, and federal laws and regulations for all projects within the Unit area.
45	Tundra Protection – General	Vehicles must be operated in a manner such that the vegetative mat of the tundra is not disturbed, and blading or removal of tundra or vegetative cover is prohibited unless specifically approved by the NSB Land Management Administrator or his designee.
46	Tundra Protection – General	Development is required to maintain the natural permafrost insulation quality of existing soils and vegetation.
47	Tundra Protection – General	Trails, campsites, and worksite must be kept clean. No littering is allowed. All solid waste including incinerator residue must be backhauled to an authorized solid waste disposal facility.
48	Tundra Protection – General	Winter on-tundra travel may begin when six inches of snow cover and twelve inches of frost depth conditions exist, consistent with State regulations, for the activities intended as determined by an authorized field representative of the Administrator. Certain on-tundra activities may begin sooner than others depending on the impact or magnitude of the operations.
49	Tundra Protection – General	After April 15 of each year, on-tundra travel must be subject to termination within 72 hours of notification by the NSB Administrator or his/her designee for protection of surface vegetation.

Note: ADF&G (Alaska Department of Fish and Game); BLM (Bureau of Land Management); CPAI (ConocoPhillips Alaska, Inc.); DWM (Department of Wildlife Management); GPS (global positioning system); IHLC (department of Inupiat History, Language and Culture); KSOP (Kuukpik Subsistence Oversight Panel); Kuukpik (Kuukpik Corporation); NSB (North Slope Borough); NVN (Native Village of Nuiqsut); SHPO (Alaska State Historic Preservation Office); USFWS (U.S. Fish and Wildlife Service).

Table I.6.2. North Slope Borough Rezoning Conditions of Approval*

No.	Category	Condition of Approval
1	Wildlife Disturbance – Gravel Infrastructure	CPAI will use insulation in the Willow gravel infrastructure to reduce the height (and visual barrier) of these features to minimize impacts on caribou movement, subject to obtaining necessary permits and agency authorizations. CPAI will submit a detailed implementation plan, including explanation of where insulation is and is not practicable, to the NSB by September 30, 2021, pursuant to NSBMC Chapter 19.50.
2	Wildlife Disturbance – Airstrip	CPAI will reduce the length of the Willow airstrip to a maximum 5,700 feet long. Final approval of the airstrip dimensions will be determined in accordance with NSBMC Chapter 19.50. CPAI has no plans to use the Willow airstrip for Boeing 737s or similar passenger aircraft, and therefore will leave the surface of the runway as gravel. Any modification of this condition, including the use of Boeing 737s or similar passenger aircraft, will require approval of the NSB Assembly. The airstrip permit application will include an analysis of required runway dimensions based on aircraft manufacturer guidance, Federal Aviation Administration requirements and recommendations, safety considerations, and engineering best practices.
3	Use Plans – Vehicle Plan	CPAI will provide the NSB a vehicle plan that includes restrictions on, and minimization of vehicle use, during sensitive periods (e.g., caribou calving, bird nesting, peak caribou subsistence activity). The objective of the vehicle plan is to mitigate potential impact of Willow project vehicle traffic on caribou calving, bird nesting, and peak subsistence activity. A vehicle plan for construction activities beginning in 2022 will be developed in consultation with the North Slope Borough Wildlife Department, and submitted for review and approval, in accordance with NSBMC Chapter 19.50, no later than September 1, 2021 and updated as needed when drilling and operations commence.
4	Use Plans – Aircraft Plan	CPA will provide the NSB an aircraft plan that minimizes aircraft use during sensitive time periods (e.g., caribou calving, bird nesting, peak caribou subsistence activity) and will include a communication protocol with the local community. The objective of the aircraft plan is to mitigate potential impact of Willow project air traffic on caribou calving, bird nesting, and peak subsistence activity. An aircraft plan will be developed in consultation with the NSB Wildlife Department and submitted for review and approval, in accordance with NSBMC Chapter 19.50, at least six months prior to the Willow airstrip commissioning.
5	Use Plans – Diesel Use Plan	CPAI will submit a diesel use plan for review and approval, in accordance with NSBMC Chapter 19.50, by October 31, 2021. The plan will include an analysis of diesel transportation, including the conversion of existing pipelines or the utilization of Willow pipelines authorized in the Willow Master Development Plan Environmental Impact Statement Record of Decision for diesel transportation. The objective of this plan is to minimize traffic impacts and spill impacts due to human error on roads in high-use subsistence areas.
6	Subsistence – Good Neighbor Policy	During the construction period of the Willow Project (prior to start-up of the central processing facility), if requested by the NSB Subsistence Mitigation Committee, in addition to the existing contributions, CPAI will provide an annual air charter for a group of Nuiqsut hunters and their gear to support caribou subsistence activities. This will be requested and administered by the NSB's Subsistence Mitigation Committee. CPAI will develop a Good Neighbor Policy on caribou in consultation with the community of Nuiqsut and the NSB Wildlife and Planning Departments. CPAI will host at least one community workshop in the Village of Nuiqsut to obtain input from hunters and residents prior to October 31,2021. The Good Neighbor Policy will include support to transport Nuiqsut caribou subsistence hunters and their gear to and from areas where caribou are available if it is determined that the Willow Project has significantly impacted the ability of the hunters to harvest caribou based on criteria in the Good Neighbor Policy. The determination will be made by the Director of the North Slope Borough Planning Department, in consultation with the North Slope Borough Wildlife Department. CPAI will submit a Good Neighbor Policy to the North Slope Borough on or before June 30,2022 for review and approval, in accordance with NSBMC Chapter 19.50.

No.	Category	Condition of Approval
7	Mitigation – Mitigation Fund Agreement Amendments	CPAI will amend Section 1(b) of the Oil Spill Mitigation Fund Agreement for the Alpine Development District (executed August 2019) (“Agreement”), to incorporate the Willow Development District into the Agreement, with an effective date prior to Willow first oil. The Agreement will also be amended to include spills to land. To accomplish that, Section 2(a)(i) of the Agreement will be deleted in its entirety and replaced with the following: "CPAI's oil and gas activities in the Alpine or Willow Development Districts cause oil to be present on land or in the water, or on the ice over water." CPAI will submit this amendment for NSB review and approval, in accordance with NSBMC Chapter 19.50, six months prior to anticipated Willow first oil.

Note: CPAI (ConocoPhillips Alaska, Inc.); NSB (North Slope Borough); NSBMC (North Slope Borough Municipal Code).

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Willow Master Development Plan

Appendix I.2
ConocoPhillips Road Optimization Memorandum

August 2020

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ConocoPhillips Road Route Screening Process

June 5, 2019

Introduction

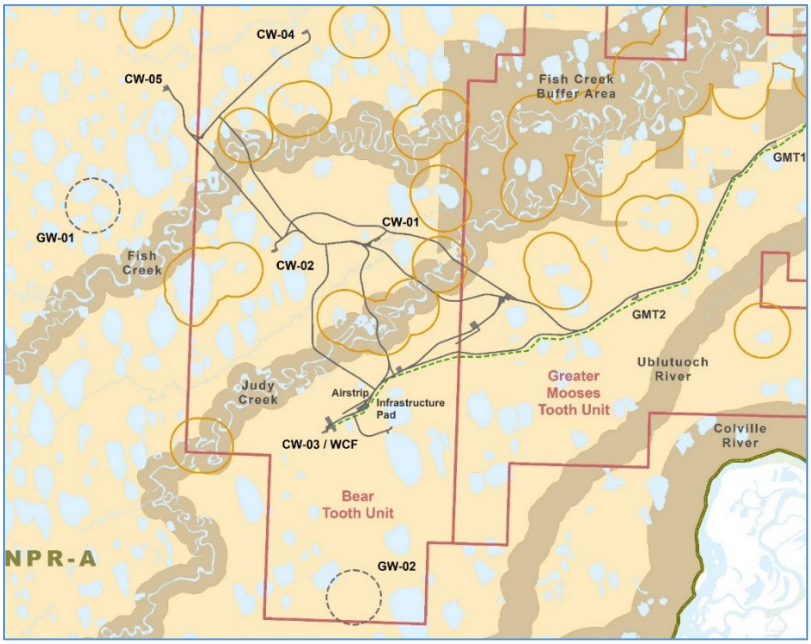
On March 3, 2019, ConocoPhillips Alaska, Inc. (CPAI) hosted a meeting with the Bureau of Land Management (BLM), the U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (USACE). The purpose of the meeting was to review the evolution of road route concepts assessed by CPAI for the Willow development. From 2017 through the first half of 2019, CPAI undertook a significant program of field research and data gathering to inform infrastructure placement and road routing options for the Willow development. CPAI initially considered over 20 road route options, which were screened by CPAI down to three development concepts for analysis in the Environmental Evaluation Document (EED). This memo summarizes the process used by CPAI to generate road route concepts, and to perform screening evaluations of those concepts. This memo also documents information that was discussed during the March 3rd meeting with EPA and the USACE.

Initial Route Creation and Screening

Beginning in 2017, information was compiled and analyzed by a multidisciplinary team of civil engineers, petroleum engineers, environmental scientists, biologists, North Slope operations personnel, geoscientists, and construction planners in order to identify and minimize potential environmental impacts in addition to optimization of the overall road routing.

CPAI personnel and consulting experts identified initial road segments using a combination of satellite imagery and aerial photography, environmental studies (caribou, fish, avian, wetlands, hydrology, and cultural resource surveys), exploration and environmental field expertise, and an awareness of subsistence hunters' perspectives. Twenty-two road segments were developed, which were then organized into eight potential road alignments. Figure 1, below, shows the initial route alignments.

Figure 1. 2017 Initial Willow Road Segments



CPAI screened the road route options considering the following:

- Best Management Practices (BMPs) and Stipulations from BLM's 2013 Integrated Activity Plan for the NPR-A
- Guidelines in the BLM NEPA Handbook

- Section 404 of Clean Water Act and Section 10 of the Rivers and Harbors Act considerations, including a Least Environmentally Damaging Practicable Alternative (LEDPA). Practicability included costs, safety, and logistics.
- National Environmental Policy Act (NEPA) guidelines on alternatives selection
- Key comments from stakeholders on recent developments in the region
- Light Detection and Ranging (LIDAR) survey data, and a preference to avoid higher value wetlands
- Integrated Terrain Unit (ITU) habitat and wetlands mapping
- Avian Studies including yellow-billed loon nest observations
- Fish surveys and lake bathymetry data
- Hydrology studies
- Cultural resource surveys
- Subsistence surveys, including an awareness of locally important resources, methods, and use areas
- Caribou surveys
- Engineering recommendations for suitable bridge crossing locations and bridge span length
- Total road mileage and acreage of gravel fill in wetlands
- Support for future development by potentially reducing impacts from future projects on other CPAI leases
- Spill avoidance, inspection, and response
- Health and safety considerations

During the summer and fall of 2017, CPAI conducted studies to inform initial road routing options from infrastructure in the Greater Mooses Tooth Unit (GMTU) to the early Willow drillsite locations (CW-01 through CW-05).

Note that the early Willow drillsite locations are not the same locations as those now being considered for the Willow Master Development Plan (MDP) Environmental Impact Statement (EIS). Rather, the early locations were determined based on subsurface information known at the time. Drillsite locations have since been refined based on additional information as described below.

The initial eight road alignments were split into three categories:

- Northern routes: The most direct access from GMT2 to the early Willow CW-01 and CW-02 drillsite locations.
- Mid-routes: The most direct access to the full suite of Willow infrastructure including the proposed processing facility location, minimizing road lengths and providing the shortest bridge lengths at stream crossing locations.
- Southern Routes: These routes best complied with stipulations and/or BMPs in the 2013 Integrated Activity Plan (IAP; BLM 2013) and minimized the number of waivers required.

Criteria used to evaluate the eight routes included:

- Total road mileage, used to compare relative wetlands impacts and cost
- Judy Creek bridge crossing location and length, including potential impacts to streams from pier groups.
- Road length within the 3-mile wide Fish Creek setback established by IAP BMP K-1
- Conformance with other BLM stipulations including:
    - Avoidance of yellow-billed loon nest/nesting lake setbacks (IAP BMP E-11)

- Avoidance of 500-foot setback around waterbodies (IAP BMP E-2)
- Avoidance of ¼-mile setback around deepwater lakes (IAP BMP K-2)

- Route uniqueness compared with other routes.

Potential impacts to cultural resources were also considered, however, no impacts to cultural resources were identified for any of the evaluated routes thus it was not a differentiating factor in route selection.

Of the eight routes evaluated, four were screened out by CPAI and the remaining routes were analyzed in in more detail. Table 1 summarizes the eight routes evaluated and additional details are provided in the EED.

Table 1. Initial Road Route Alternatives Evaluated

Route	Road Miles[1]	Judy Creek Bridge (ft.)	Crosses Fish Creek Setback[2]	Crosses YBLO Buffer	Advanced for CPAI Analysis	Notes
North 1	37.6 mi	450	Y	Y	Y	Provides the most direct access from GMT2 to CW-01 and an optimal crossing location of Judy Creek with one of the shortest bridges. Includes essential crossing of the Fish Creek Setback (BMP K-1).
North 2	38.9 mi	-	Y	N	N	Similar to but longer mileage than North 1 and North 3. Places 2 miles of road in Fish Creek Setback (BMP K-1). Route not sufficiently distinct from other routes evaluated (North Route 1) but would require additional deviation from BMP K-1. Other similar routes (North Route 1, North Route 3) further minimize or avoid infrastructure in Fish Creek setback.
North 3	36.9 mi	1,400	N	Y	Y	Provides direct access from GMT2, but it would have a longer bridge crossing of Judy Creek than North 1.
Mid 1	35.5 mi	420	N	Y	Y	Provides shortest overall road length and minimizes tundra footprint.
Mid 2	42.3 mi	420	N	Y	N	Not sufficiently distinct from other routes evaluated (Mid Route 1) and would require additional deviation from BMP E-11. Other similar routes would have a smaller total footprint.
South 1	37.0 mi	1,850	N	N	Y	Conforms to BMPs and stipulations to the maximum extent practicable but has the longest bridge crossings of Judy Creek.
South 2	42.3 mi	1,850	N	N	N	Not sufficiently distinct from other routes evaluated (South Route 1). Other similar routes would have a smaller total footprint.
Southwest	37.3 mi	-	N	N	N	Not sufficiently distinct from other routes evaluated (South Route 1) and would require additional deviation from BMP K-2. Other similar routes further minimize infrastructure near deepwater lakes.

[1] Road mileages evaluated with common crossing of Fish Creek to access northern drillsites
[2] Established by BMP K-1; excluding essential crossings
Y: Yes; N; No; -: not evaluated; ft.: feet; BMP: best management practice

In addition to the eight routes discussed above, two Fish Creek crossing locations were also considered to connect drillsites CW-04 and 05 to the CW-02 area: west and central routes (see Figure 1). Table 2 describes the routes considered.

Table 2. Fish Creek Crossing Alternatives Evaluated

Route	Road Miles	Fish Creek Bridge (ft.)	Crosses Fish Creek Setback[1]	Crosses YBLO Buffer	Advanced for further CPAI Analysis	Notes
West	12.9	850	N	N	Y	Avoids known yellow-billed loon setbacks (BMP E-11) and provides the shortest alignment to early drillsite locations.
Central	13.4	650	N	Y	N	Provides shortest Fish Creek bridge but requires more road length, gravel fill, and crosses through yellow-billed loon setback (BMP E-11) near Fish Creek.

[1] Established by BMP K-1; excluding essential crossings
Y: Yes; N; No; -: not evaluated; ft.: feet; BMP: best management practice

Figures 2 through Figure 5 show the four road routes that were advanced during the 2017 screening process.

Figure 2. North Route 1 Road Alignment

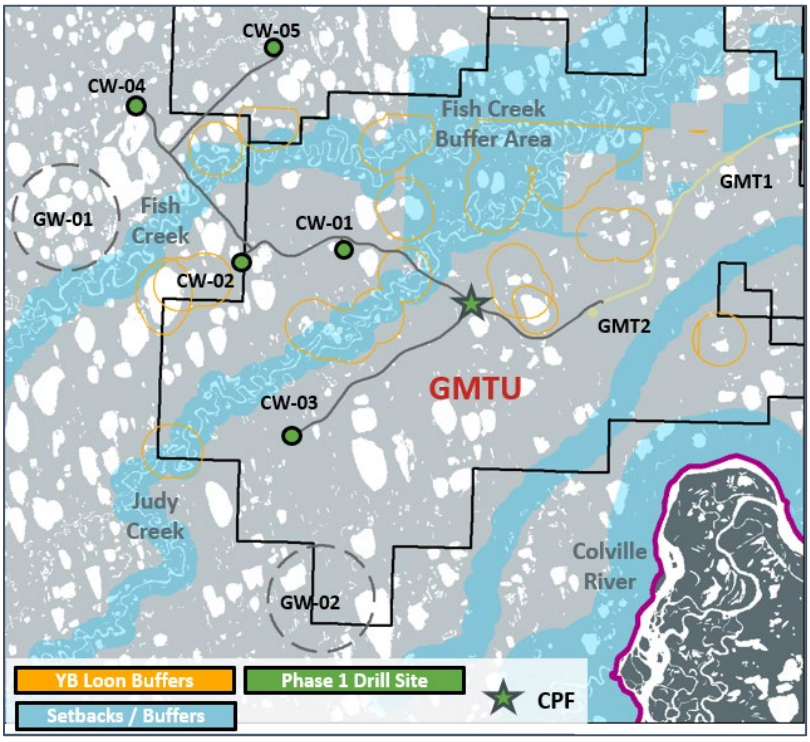


Figure 3. North Route 3 Road Alignment

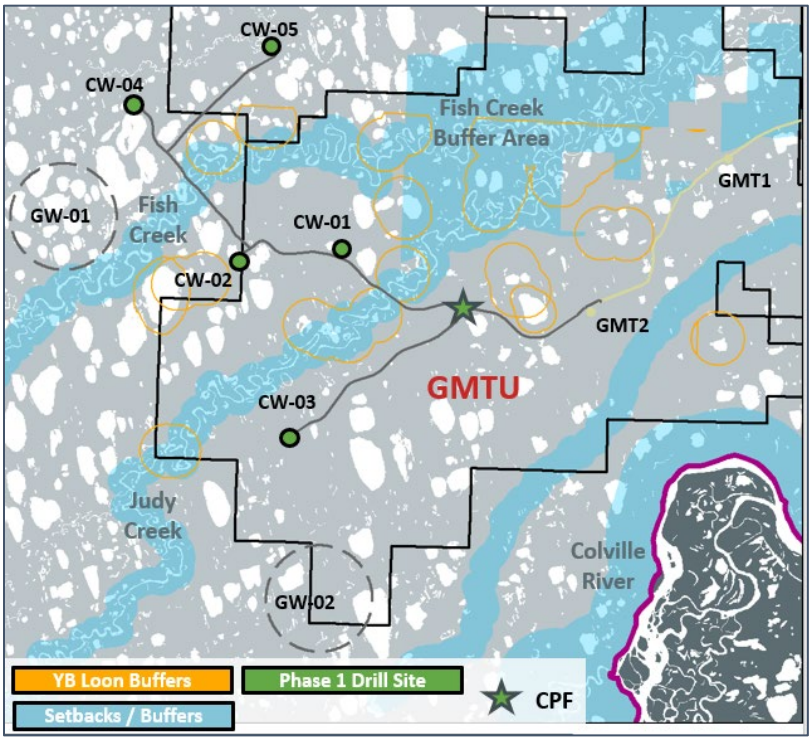


Figure 4. Mid Route 1 Road Alignment

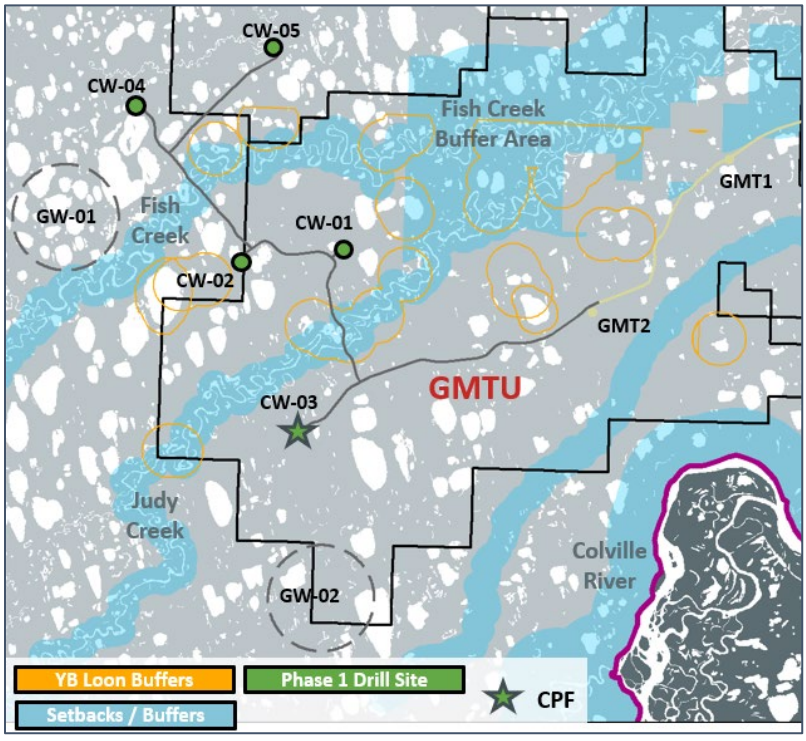
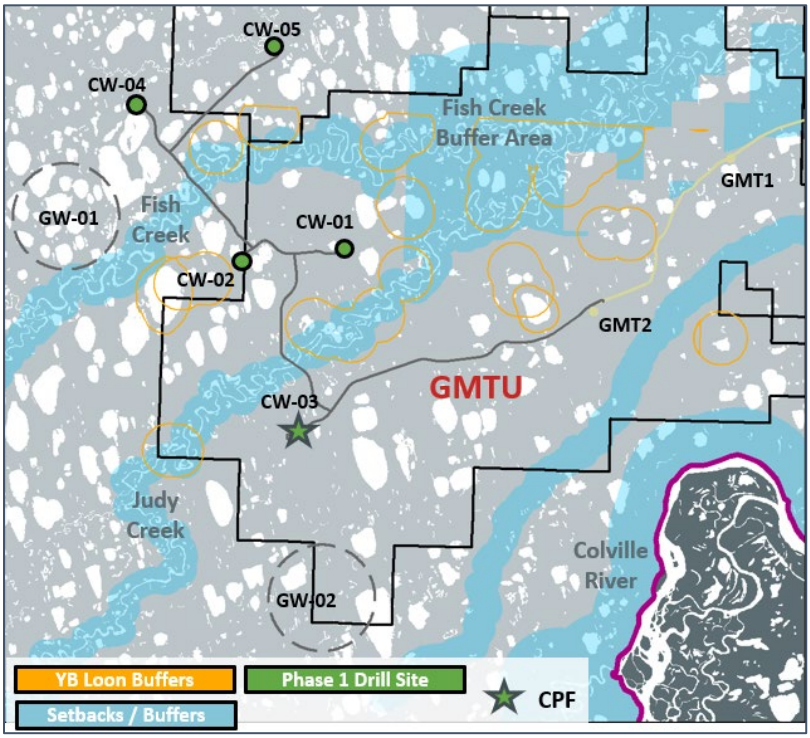


Figure 5. South Route 1 Road Alignment



Drillsite Location Refinement and EED Route Identification

After analyzing subsurface data from the 2018 Willow appraisal drilling season, CPAI refined some drillsite locations to further optimize recovery of the subsurface resource, while minimizing surface disturbance. The updated drillsites were located within the overall geographic area as the original sites, and the road routing evaluation criteria that was used during the previous screening effort was utilized to assess road route options to the new drillsite locations. Project engineers reevaluated the same general alignment corridors, bridge crossing locations, and road segments identified in 2017. During the spring and summer of 2018, LIDAR surveys were conducted throughout the field in order to further refine road routings, stream crossings, and bridge locations. New data from ongoing environmental studies including hydrology, avian surveys, fish surveys, ITU and wetlands mapping, and caribou surveys were also incorporated into route development and evaluation. CPAI shared the initial road alignments with the BLM and other regulatory agencies and received feedback that was also incorporated into road alignment reevaluation.

Route development and evaluation criteria and considerations were similar to those identified during initial route creation and screening but incorporated additional and/or more refined data. Criteria used for route development and evaluation included:

1. Gravel Footprint: Early analysis utilized road mileage as a surrogate for gravel footprint, as it assumed constant road width and depth based on aerial photography. Subsequent analysis used the LIDAR survey data and routings were optimized to avoid significant topographic changes that would increase gravel depth and footprint.
2. Caribou Migration Effects: Care was taken to minimize the potential for corralling effects due to loops or forks in the road.
3. Avoidance of Special Areas: Priority was given to avoidance of the Fish Creek 3-mile buffer (BMP K-1) as well as minimizing roadway length in the Judy Creek and Fish Creek ½-mile buffers upstream of the Fish Creek/Judy Creek confluence (BMP K-1). Additional special area considerations given to the Colville River Special Area and the Teshekpuk Lake Caribou Habitat Special Area (BMP K-5)

4. Stream Crossings: Routes were selected and evaluated with consideration given to the minimization of stream crossing impacts, mainly evaluated by the number of pile groups or pier groups in waterbodies.
5. Yellow-billed Loon Setback: Routes minimized crossing yellow-billed loon setbacks (defined as the area 1-mile from identified nests and 500 meters from the nesting lakes as stipulated in BMP E-11). Some routes may cross buffers where tradeoffs exist between crossing a setback and other potential environmental impacts, such as increased gravel fill. Discussion with BLM personnel in 2018 indicated that a waiver process allows for encroachment into setback, if it avoids causing more substantial impacts elsewhere, and that reducing gravel fill should be prioritized over encroaching within the setback.
6. Waterbodies Setback: Routes maintained waterbodies setback of 500 feet as stipulated in the 2013 IAP (BMP E-2)
7. Deep Water Lakes Setback: Routes maintained deep water lakes setback of ¼ mile as stipulated in the 2013 IAP (BMP K-11)
8. Teshekpuk Lake Caribou Habitat Area: Minimization of footprint in the Teshekpuk Lake Caribou Habitat Area (IAP BMP K-5)
9. General use of higher, drier ground: This is both a good engineering and maintenance practice, as well as use of a general assumption that drier ground was correlated with less highly functioning wetland areas.

Based on this evaluation, two road alignments, generally based on the Mid Route 1 and South Route 1 initial road alignments, were selected for further analysis as part of three alternatives within CPAI's Willow MDP EED.

EED Alternative 1

EED Alternative 1 was based generally on the road alignments evaluated as part of the Mid Route 1 alignment. The overarching goal in developing this road alignment was to minimize wetland impacts by selecting the most direct route from GMTU to proposed Willow facilities. This included the minimization of road length as well as the minimization of road footprint through optimization of topography by locating the road on generally higher, drier ground. It would also minimize wetland impacts by selecting optimal stream crossings to minimize bridge crossing lengths and gravel footprint within floodplains and adjacent wetlands. Alternative 1 would provide the shortest road alignment between drillsites and minimize the length of the Judy Creek bridge (420 feet) but it has the tradeoff of passing through yellow-billed loon nest/nesting lake setbacks near Judy Creek and would have a longer bridge at the Fish Creek crossing (1,100 feet). (Note: please refer to the EED for maps of the EED Alternatives.)

EED Alternative 2

Based on guidance from the BLM, this alternative sought to minimize the number of waivers to the 2013 IAP BMPs but requires tradeoffs of a greater gravel footprint and sub-optimal stream crossings. A major factor in this routing is avoidance of the yellow-billed nest buffers (BMP E-11), which drives additional road length, a longer bridge crossing of Judy Creek stream, the longest road mileage of the routes considered, and substantially more infrastructure in the Teshekpuk Lake Habitat Area (BMP K-5).

EED Alternative 3

This alternative evaluated a development scenario where the Willow area is not connected by gravel road to GMTU. This alternative reduces overall gravel footprint but results in tradeoffs of additional air traffic, freshwater use, subsistence impacts and reduced stakeholder access benefits, and challenges in emergency response (including spill) access. The gravel road alignments from the Willow processing facilities to each drillsite follow the same alignments considered as part of EED Alternative 1.

EED Alternative Evaluation

Table 2 summarizes CPAI's analysis of the road alignments evaluated in the Willow EED (September 2018) based on the evaluation criteria. Based on the overall minimization of gravel fill (and thus minimization of fill in wetlands and other water of the U.S.), minimization of the length of the Judy Creek bridge crossing, and balancing other environmental tradeoffs including compliance with the 2013 IAP BMPs, CPAI selected Alternative 1 as its proposed project for Willow development.

Table 2. Alternative Road Routes Evaluated

Project Component		Alternative 1	Alternative 2	Alternative 3
Gravel Roads		37 miles; 273 acres Eight 0.3-acre turnouts with ramps (2 acres total)	45 miles; 326 acres Nine 0.3-acre turnouts with ramps (3 acres total)	28 miles; 200 acres Six 0.3-acre turnouts with ramps (2 acres total)
Bridges (number)		8	10	7
Bridges (length)	Judy Creek	420 feet	1,850 feet	420 feet
	Judy Creek Kayyaaq	75 feet	Crossing 1: 75 feet; Crossing 2: 75 feet	75 feet
	Fish Creek	1,100 feet	850 feet	1,100 feet
	Kalikpik River	500 feet	550 feet	500 feet
	Willow Creek 2	80 feet	80 feet	NA
	Willow Creek 4	130 feet	130 feet	130 feet
	Willow Creek 4a	90 feet[1]	90 feet[1]	90 feet[1]
	Willow Creek 5	NA	20 feet[1]	NA
	Willow Creek 7	NA	75 feet[1]	NA
	Willow Creek 8	30 feet[1]	NA	30 feet[1]
	Other	Stream and cross drainage culverts as required	Stream and cross drainage culverts as required	Stream and cross drainage culverts as required
Acres in Special Areas	Acres in Colville River Special Area	8 acres	8 acres	NA
	Acres in Teshekpuk Lake Special Area	110 acres	130 acres	103 acres
Compliance with BLM BMPs	Acres in Teshekpuk Lake Caribou Habitat Area (BMP K-5)	19 acres, no deviation anticipated	56 acres, no deviation anticipated	19 acres, no deviation anticipated
	Yellow-billed Loon Nest/Lake Setback Deviations (BMP E-11)[2]	Lake M0151 (nesting lake shoreline setback) Lake M1522 (nesting lake shoreline setback, nest setback) Lake M1523A (nesting lake shoreline setback, nest setback) Lake M1524 (nest setback) Lake M0303 (nest setback)	Lake M0151 (nesting lake shoreline setback)	Lake M1522 (nesting lake shoreline setback, nest setback) Lake M1523A (nesting lake shoreline setback, nest setback) Lake M1524 (nest setback) Lake M0303 (nest setback)
	River Setback Deviations (BMP K-1)	Essential road/pipeline crossing of Judy Creek Essential road/pipeline crossing of Fish Creek	Essential road/pipeline crossing of Judy Creek Essential road/pipeline crossing of Fish Creek	Essential road/pipeline crossing of Judy Creek Essential road/pipeline crossing of Fish Creek
	Deepwater Lake Setback Deviations (BMP K-2)	Lake M0015	Lake M0015	Lake M0015

[1] Bridge versus culvert battery crossing structure to be determined.
[2] 1-mile nest setback and 1,625-foot (500-meter) nesting lake shoreline setback.
Notes: All values are approximate and subject to change; BMP: best management practice.

EIS Alternative Development

A description of the EED Alternatives was submitted to BLM and co-operating agencies in May 2018 and updated in September 2018. CPAI understands that these alternatives were considered by the agencies as part of the EIS alternative development process.

Since submittal of the EED, CPAI has also supported EIS alternative development through technical and engineering support. This has included further refinement and changes to the proposed project based on agency feedback. For example, in October 2018, at the request of BLM and co-operating agencies, CPAI evaluated moving the BT4 drillsite out of the Teshekpuk Lake Caribou Habitat Special Area (K-5) and east of the Kalikpik River. While infrastructure and development are allowed within the K-5 area, the agencies suggested locating the drill site outside of this area if practical. CPAI evaluated this request and was able to accommodate it with an associated negative impact to subsurface resource recovery. The shift of the BT4 drillsite caused another evaluation of the road route between BT2 and BT4 including the elimination of a bridge over the Kalikpik River.

CPAI also continued to advance engineering for the proposed project this spring to further avoid and minimize impacts. The most recent revision to the proposed project (March 2019) optimized the road alignments by incorporating the latest topographic data, gathered in the summer of 2018. Changes to the road alignments were made to avoid wetlands that are permanently inundated (H class water regime) or located within 500 feet of fish bearing waters. These changes were made in locations where design constraints would not be compromised. Updates have also been made to estimates of bridge lengths with specific focus on the Fish Creek crossing, reducing the bridge length from the June 2018 concept of 1,100 feet down to the current concept of approximately 500 feet.

Conclusions

From eight original route routes considered, CPAI screened out five using the criteria described above, and then advanced three for inclusion in the EED. CPAI understands that BLM is including CPAI's proposed project and two alternatives in the draft EIS that is in preparation, and that the three EIS alternatives share similar road alignments. While CPAI anticipates further refinements to road alignment may occur as engineering and the NEPA and permitting processes progress, the substantial analysis already completed demonstrate that the road alignments carried forward in the EIS meet the requirements of the 404(b)(1) Guidelines which requires a LEDPA project. As the routes evaluated by CPAI demonstrate, other road alignments, which are not included in the EIS, are unlikely to meet LEDPA requirements because they would result in greater fill to wetlands and would have a greater impact to the environment compared to the alternatives which are included in the EIS.

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Willow Master Development Plan

Appendix I.3
Dust Control Plan

August 2020

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Willow Dust Control Plan

Scope

This Standard Operating Procedure (SOP) applies to ConocoPhillips Alaska, Inc. (CPA) and contractor personnel at Willow.

Regulatory Requirement

Fugitive dust consists of particulate matter (PM). The U.S. Environmental Protection Agency and the Alaska Department of Environmental Conservation (ADEC) define fugitive dust as "particulate matter that is generated or emitted from open air operations (emissions that do not pass through a stack or a vent)." The most common forms of PM are known as PM10 (particulate matter with a diameter of 10 microns or less) and PM2.5 (particulate matter with a diameter of 2.5 microns or less).

Alaska's current regulations that address fugitive dust include:

- 18 AAC 50.045(d)[1]: A person who causes or permits bulk materials to be handled, transported, or stored, or who engages in an industrial activity or construction project, shall take reasonable precautions to prevent particulate matter from being emitted into the ambient air.
- 18 AAC 50.110[1]: No person may permit any emission which is injurious to human health or welfare, animal or plant life, or property, or which would unreasonably interfere with the enjoyment of life or property.

Currently, ADEC applies its regulatory authority under 18 AAC 50.045(d)[1] to request fugitive dust sources apply “reasonable precautions” to reduce emissions.

Fugitive Dust Sources

Fugitive dust could be generated directly from road and pad construction, facility construction, and during operations and maintenance. The following construction activities are typical examples of activities that have the potential for generating fugitive dust:

- Movement of vehicles and motorized equipment
- Bulldozing and grading
- Excavation and filling
- Blasting
- Material movement, including loading and unloading
- Hauling of loose materials
- Use of parking, staging, and storage areas

[1] 18 AAC 50 as amended though January 8, 2020.

It is the responsibility of the Project entity's Construction Contractor(s) and the Project entity's Field Environmental Coordinators to ensure all sources of dust generation are identified.

Purpose

The purpose of this Standard Operating Procedure is to ensure compliance with ADEC air quality regulations, summarized above, and applicable project permitting stipulations, such as from the Bureau of Land Management, the U. S. Army Corps of Engineers, or the North Slope Borough. (Future update after permits are issued: permit numbers to be added as references, from any permits containing relevant fugitive dust stipulations).

Engineering & Administrative Controls

The Willow road and pad construction is typical of North Slope design and installation, consisting of a minimum of 5 foot of gravel fill above tundra level with 2:1 side slopes. The roads are designed with dust control in mind, and the specifications call for well graded sandy-gravel with low fines content in order to minimize both dust (during dry and/or hot conditions) as well as mud during the shoulder seasons and especially wet summer weather.

Willow utilizes both the Western North Slope (WNS) standard 32 foot wide (shoulder to shoulder) roads within the core field area, as well as 24 foot wide (shoulder to shoulder) roads at the outlying drill sites. Speed limits on the 32 foot wide roads are generally 35 mph. Due to safety concerns, speeds are reduced to 25 mph on the 24 foot wide roads. Speed limits are enforced by Security personnel. The table below displays road width and speed limits by segment.

Road Segment	Width (feet, driving surface)	Speed Limit (mph)
GMT2 to WOC	32	35
WOC to WCF	32	35
WOC to BT1	32	35
BT1 to BT2	32	35
BT2 to BT4	24	25
WCF to BT3	24	25
BT3 to BT5	24	25

Procedures

Large-scale dust control will be accomplished using on-site water trucks or other suitable equipment. Planned dust control equipment at Willow currently consists of two 325 bbl capacity water trucks, operating 24 hours per day under normal operations. However, if the need arises, vacuum trucks operating in other services can be utilized temporarily as dust control trucks. Dust

control activities will be monitored and scheduled by Western North Slope (WNS) Roads and Pads personnel. Activities will be conducted in a manner to comply with applicable permit stipulations. The following procedures will be utilized during dust control activities:

1. Conduct annual training for dust control regarding permit stipulations application, procedures, and techniques, identification of dust control areas, and location of permitted water sources.

    a. All Roads & Pads operators will be provided annual training that includes:

        i. Importance of proper dust control (air permit fugitive emissions stipulations, USACE permit stipulations, vegetation impacts, etc.)

        ii. Permit stipulations pertaining to water sources (fish screens, volume tracking, ADEC dewatering log, etc.)

        iii. Identification of areas needing dust control (road and pad surface conditions, lighter colored areas developing, discoloration of snow, visible dust in road, etc.)

        iv. Priority areas for dust control (active drilling locations and airstrips)

        v. Location of permitted water sources (impoundments, lakes and secondary containments)

        vi. Proper watering techniques (prevent erosion, ensure dust is controlled, etc.)

2. Reduce dust control activities when precipitation (rain, snow, frost, dew, fog, etc.) provides adequate coverage.

3. Apply proper amount of water at appropriate rates of application to avoid the creation of localized erosion due to water runoff.

4. Collect water for dust control from permitted raw water sources (e.g., lakes, impoundments).

5. Routinely inspect and evaluate facilities regarding dust control.

6. The following list recommends a watering frequency based on the number of expected vehicle trips;

    - Main Roads (32 foot width) – Once per day or as needed.

    - Secondary Roads (24 foot width) – Every 3 days or as needed. Watering frequency will increase to daily while there is an active drilling rig on the associated pad.

- WOC and WCF – Once per day or as needed.
- Drill Sites with rig activity – Every day or as needed.
- Drill Sites without rig activity – Every three days or as needed.
- Willow Airstrip – Twice daily or as needed.

7. Changes to watering frequency will be based on observations from Roads and Pads personnel, including gravel surface conditions, visible dust, or recent deposits on nearby snow or vegetation. Additional watering determinations are made at the discretion of the Roads and Pads Foreman and/or Operations personnel.

Inspection, Monitoring and Recordkeeping

Roads and Pads personnel will perform regular inspection and evaluation of facilities regarding dust control, and inspections will include surrounding areas to determine if visible dust accumulation are present on adjacent vegetation.

- Dust control activities and their effectiveness will be documented by recording to following information in a log book by the watering truck operator. Logs will include the following:
  - Date, time, and location (road segment)
  - Wind conditions (windy, calm)
  - Road surface conditions (dry, damp, wet).
  - Purpose: Watering for scheduled maintenance or based on road/pad conditions.

The watering logs will be available for review by interested local agency representatives upon request. Logs will be retained for a minimum of five years. Additional records of any deviations from the dust plan, along with the reasons for the deviation and corrective actions taken, will also be retained for at least five years.