US Army Corps
of Engineer
Alaska District

Draft Environmental Impact Statement

Alaska Stand Alone Gas Pipeline

January 2012

Volume 1

Executive Summary and Sections 1.0 through 5.9

United States Army Corps of Engineers
Alaska District

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In cooperation with:

Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)

U.S. Coast Guard (USGS)

U.S. Department of the Interior, Bureau of Land Management (BLM)

U.S. Department of the Interior, National Park Service (NPS)

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (USDOT, PHMSA)

U.S. Environmental Protection Agency (EPA)

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Draft Environmental Impact Statement
Alaska Stand Alone Gas Pipeline

Lead Agency: U.S. Army Corps of Engineers (USACE), Alaska District.

Cooperating Agencies: Bureau of Land Management; U.S. Environmental Protection Agency; National Park Service; Alaska Department of Natural Resources, State Pipeline Coordinator's Office; U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration; and U.S. Coast Guard.

Proposed Action: The proposed action is the construction and operation of a 737-mile-long, 24-inch-diameter pipeline to transport a stable and reliable supply of natural gas and natural gas liquids from Alaska's North Slope to Fairbanks, Anchorage and the Cook Inlet area by 2019.

Location: The proposed pipeline would extend from near Prudhoe Bay, Alaska to Point MacKenzie, Alaska, and would be developed in the general vicinity of the Dalton and Parks Highway Corridors. A lateral pipeline would extend from Dunbar east to Fairbanks.

Abstract: On November 1, 2011, the USACE, Alaska District received the Alaska Gasline Development Corporation's (the Applicant's) complete permit application to construct and operate the proposed Alaska Stand Alone Gas Pipeline Project (Project). The proposed Project includes the construction of structures in navigable waters of the United States (U.S.) and the discharge of dredged and/or fill materials into waters of the U.S., including wetlands. The proposed work requires authorization from the USACE under Section 10 of the Rivers and Harbors Act (RHA) of 1899 and Section 404 of the Clean Water Act (CWA). The Draft Environmental Impact Statement (EIS) will be used to evaluate the Applicant's USACE permit application and compliance with the National Environmental Policy Act (NEPA).

The USACE and the cooperating agencies have prepared this Draft EIS, which identifies and evaluates the potential direct, indirect and cumulative environmental impacts associated with the proposed action and alternatives, including the No Action Alternative. Measures to mitigate adverse impacts are identified and described. The Draft EIS has been prepared to address issues and alternatives raised during the scoping process. The USACE will give full consideration to all public comments received on the Draft EIS. A summary of the public meetings, written comment letters, and responses will be incorporated into the Final EIS, as appropriate.

DEIS Comment Period: The 45-day review and comment period begins on January 20, 2012 and ends on March 5, 2012. Send written comments, postmarked by March 5, 2012, to:
U.S. Army Corps of Engineers CEPOA-RD-N
Alaska District, Regulatory Division
Attention: Mary Romero
Post Office Box 6898
JBER, AK 99506-0898

Send electronic comments, received by March 5, 2012, to: asapcomments@usace.army.mil or via the ASAP EIS website: www.asapeis.com

For Further Information: Contact Mary Romero by e-mail at mary.r.romero@usace.army.mil, or by telephone at 800-478-2712 (toll free within AK) or 907-261-7710.

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Helpful Notes for Reading the Draft Environmental Impact Statement (DEIS)

The following notes are intended to help readers gain an overall perspective of the DEIS and the information it contains. For those readers interested in specific sections of the DEIS, these guidelines will help determine where to find the information you want to review. However, it is important to note that each section builds on the one before it.

Following Federal regulations, this DEIS was designed and written for two main purposes: (1) to provide the U.S. Army Corps of Engineers (USACE) and seven cooperating agencies (listed below) with sufficient information to make informed, reasoned decisions concerning the proposed Alaska Gasline Development Corporation's (AGDC) Alaska Stand Alone Gas Pipeline/ASAP Project; and (2) to inform members of affected communities and interested public of this project so that they may express their opinions to the USACE.

> Cooperating Agencies:
> Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)
> U.S. Coast Guard (USCG)
> U.S. Department of the Interior, Bureau of Land Management (BLM)
> U.S. Department of the Interior, National Park Service (NPS)
> U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (USDOT, PHMSA)
> U.S. Environmental Protection Agency (EPA)

This DEIS consists of the following sections:

References utilized as information sources for development of the EIS are listed at the end of each section (and major subsection under the Environmental Analysis).

A **glossary** with key terms and acronyms is included after the table of contents.

The **Executive Summary** presents an overall description of the proposed action, its purpose and need, and environmental consequences. The purpose of this section is to provide non-technical readers an understanding of the potential environmental, technical, economic, and social consequences of **taking** and of **not taking** action.

Section 1 describes the purpose and need of the ASAP Project. It provides a very brief description of the ASAP Project and then explains four key things about the project: (1) the project purpose and need, (2) the relevant environmental issues, (3) the decisions that the USACE and other federal agencies must make concerning this project, and (4) the relevant laws, regulations, and consultation with which AGDC must comply.

Section 2 provides a detailed description of the applicant's proposed project (the proposed action).

Section 3 provides a description and analysis of connected actions – other related projects not proposed by the applicant that would need to be undertaken for the proposed projected to be operated as planned and stated in Section 2.

Section 4 describes potential alternatives to the proposed action and presents a screening level analysis to identify reasonable alternatives for further detailed analysis and comparison in Section 5.

Section 5 briefly describes the past and current conditions of the relevant resources *(issues)* in the project area that would be measurably affected, establishing a part of the baseline used for the comparison of the predicted effects of all alternatives. Detailed, analytic predictions of the consequences of implementing the proposed action and alternatives are also presented. These predictions include the direct, indirect, short term, long term, irreversible, irretrievable, and cumulative effects of implementing the alternatives.

Section 6 provides a summary of resource impacts for the proposed action and alternatives. A comparative analysis of impacts is also included to assist readers and decision makers in identifying their preferred alternative.

An alphabetical **subject index** is included at the end of the DEIS.

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LIST OF APPENDICES

VOLUME 3:

* Appendices to the Scoping Report are included on the CD attached to Volume 1 of the DEIS and can also be downloaded from the Project website at: http://www.asapeis.com/ScopingMeetings.aspx

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Glossary

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Glossary

AAC	The abbreviation for Alaska Administrative Code.
AAQS	The abbreviation for Ambient Air Quality Standards.
ABVS	The abbreviation for Alaska Bureau of Vital Statistics.
ACEC	The abbreviation for Area of Critical Environmental Concern.
ACMP	The abbreviation for Alaska Coastal Management Program.
acoustics	Is the interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound.
ACS	The abbreviation for American Community Survey.
ACW	The abbreviation for Aircraft Control and Warning.
ADEC	The abbreviation for Alaska Department of Environmental Conservation.
ADF&G	The abbreviation for Alaska Department of Fish and Game.
ADHSS	The abbreviation for Alaska Department of Health and Social Services.
ADNR	The abbreviation for Alaska Department of Natural Resources.
ADOT	The abbreviation for Alaska Department of Transportation.
adverse effect	The impairment of, or damage to, the environment or health of humans, or damage to property, or loss of reasonable enjoyment of life or property.
AEA	The abbreviation for Alaska Energy Authority.
AES	The abbreviation for Arctic Slope Regional Corporation Energy Services.
AFN	The abbreviation for Alaska Federation of Natives.
AFS	The abbreviation for Air Force Station.
AGDC	The abbreviation for the Alaska Gasline Development Corporation.
aggradation	The increase in land elevation due to the deposition of sediment.
AGIA	The abbreviation for Alaska Gas Inducement Act.
AHRS	The abbreviation for Alaska Heritage Resource Survey.
AIAN	The abbreviation for American Indian or Alaska Native.

Glossary (Continued)

alluvial	Pertaining to, or consisting of, alluvium, or material deposited by flowing water.
alluvial fan	Is a fan-shaped deposit formed where a fast flowing stream flattens, slows, and spreads typically at the exit of a canyon onto a flatter plain.
alluvium	Is loose, unconsolidated soil or sediments, which is then eroded, deposited, and reshaped by water in some form in a non-marine setting.
AMHS	The abbreviation for Alaska Marine Highway System.
amphidromous	Fish spcies that spend the summer feeding at sea, and move to freshwater rivers and streams in late summer and fall to spawn and live for the winter.
AMS	The abbreviation for American Meteorological Society.
anadromous	Fish that migrate from salt water to fresh water to spawn and die.
ANCSA	The abbreviation for Alaska Native Claims Settlement Act.
ANGTS	The abbreviation for Alaska Natural Gas Transportation System.
ANHP	The abbreviation for Alaska Natural Heritage Program.
ANILCA	The abbreviation for Alaska National Interest Lands Conservation Act.
anode	An electrode through which electric current flows into a polarized electrical device.
anthropogenic	Materials made or modified by humans.
ANWR	The abbreviation for Arctic National Wildlife Refuge.
APA	The abbreviation for Alaska Power Authority.
APDES	The abbreviation for Alaska Pollutant Discharge Elimination System.
APE	The abbreviation for the Area of Potential Effect.
APP	The abbreviation for Alaska Pipeline Project.
aquatic	Living in or near water or taking place in water.
ARC	The abbreviation for Alaska Regulatory Commission.
Archaic period	Was the second period of human occupation in the Americas, from around 8000 to 2000 BC.
ARCO	The abbreviation for Atlantic Richfield Company.
ARRC	The abbreviation for the Alaska Railroad Corporation.

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Glossary (Continued)

artifact Something made or given shape by man, such as a tool or a work of art.

AS The abbreviation for Alaska Statutes.

ASAP The abbreviation for the Alaska Stand Alone Gas Project.

ASTt The abbreviation for Arctic Small Tool tradition.

ATDP The abbreviation for Alaska Traditional Diet Project.

BA The abbreviation for Biological Assessment.

BACT The abbreviation for Best Available Control Technology.

ballast Water taken on ships and submarines and other submersibles to control buoyancy and stability.

BART The abbreviation for Best Available Retrofit Technology.

baseline Analysis of current situation to identify the starting points for a program or project.

bedrock Solid rock that underlies soil or any other unconsolidated surficial cover.

benthic The ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers.

BGEPA The abbreviation for Bald and Golden Eagle Protection Act.

biodiversity The degree of variation of life forms within a given ecosystem, biome, or an entire planet and is a measure of the health of ecosystems.

biota The total collection of organisms of a geographic region or a time period.

Birnirk period Represents a phase of prehistoric Eskimo culture dating back from 500 to 700 AD.

BLM The abbreviation for Bureau of Land Management.

blowdown The event of over pressurized pipeline becoming depressurized by venting gas to the atmosphere.

BMPs The abbreviation for best management practices.

BOEM The abbreviation for Bureau of Ocean Energy Management

borrow site An area that is excavated to provide material, such as gravel or sand, to be used, where required, by the project.

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BRFSS The abbreviation for Behavioral Risk Factor Surveillance System.

broadband Refers to any sound which has its energy spread over a number of frequencies.

BSEE The abbreviation for Bureau of Safety and Environmental Enforcement.

BTU The abbreviation for British Thermal Unit.

CA The abbreviation for Census Area.

CAA The abbreviation for Clean Air Act.

CAAA The abbreviation for Clean Air Act Amendments.

CAM The abbreviation for Compliance Assurance Monitoring.

carbon dating A radiometric dating method that uses the naturally occurring radioisotope carbon-14 (^{14}C) to estimate the age of carbon-bearing materials up to about 58,000 to 62,000 years.

cathodic protection A technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell.

CCP The abbreviation for Comprehensive Conservation Plan.

CCS The abbreviation for Carbon Capture and Sequestration.

CDP The abbreviation for Census-Designated Place.

CEA The abbreviation for Chugach Electric Association.

Central Gas Facility An existing facility in Prudhoe Bay that receives natural gas from the surrounding oil and gas fields through gathering lines. The Central Gas Facility would send natural gas to the proposed GCF (Gas Conditioning Facility) at MP 0 before transport through the pipeline.

centrifugal compressors Use a rotating disk or impeller in a shaped housing to force the gas to the rim of the impeller, increasing the velocity of the gas.

CERCLA The abbreviation for Comprehensive Environmental Response Compensation and Liability Act.

CEQ The abbreviation for Council on Environmental Quality.

CFR The abbreviation for Code of Federal Regulations.

CGF The abbreviation for Central Gas Facility.

CIRI The abbreviation for Cook Inlet Region, Inc.

cirque An amphitheatre-like valley head, formed at the head of a valley glacier by erosion.

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CIS	The abbreviation for Community Information Summaries.
clay	A soil particle less than 2 µm in diameter.
climate	The prevailing weather conditions of an area. Climate is a measure of the long-term averages, i.e., normals, of key atmospheric variables, such as temperature, precipitation and wind.
climate change	The change in long-term climate.
CO_2	The chemical symbol for carbon dioxide.
collocate	To set or place together, especially side by side.
colluvium	The name for loose bodies of sediment that have been deposited or built up at the bottom of a low-grade slope or against a barrier on that slope, transported by gravity.
Cook Inlet Natural Gas Liquid Extraction Plant	A facility proposed for development at the end of the mainline pipeline at MP 737 near the Upper Cook Inlet which would separate NGLs from the gas stream and inject utility-grade natural gas into the existing ENSTAR pipeline.
compressor station	A facility containing equipment that is used to increase the pressure in the pipeline to keep the flow of natural gas moving at an appropriate rate.
Construction Phase	The phase of a project preceding the Operations Phase, during which project facilities and infrastructure are assembled and installed, and connected and tested to ensure that they operate as designed.
contingency plans	A plan devised for an exceptional risk which is impractical or impossible to avoid.
corrosion	The disintegration of metal due a chemical reaction with its surroundings.
critical habitat	• Specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and • Specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.
CSIS	The abbreviation for Community Subsistence Information System.
CSU	The abbreviation for Conservation System Unit.
CT	The abbreviation for Census Tract.
CTL	The abbreviation for Coal to Liquids.

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cumulative effects The result of all impact-causing activities that affect a resource while the impacts of the proposed action are occurring or remain in effect.

CWA The abbreviation for Clean Water Act.

CWMP The abbreviation for Comprehensive Waste Management Plan. The plan would ensure that hazardous and nonhazardous wastes generated by the proposed Project would be minimized, identified, handled, stored, transported, and disposed of in a safe and environmentally responsible manner.

CZMA The abbreviation for Coastal Zone Management Act.

DB The abbreviation for Denali Borough.

dB The symbol for decibel.

dBA The abbreviation for A-weighted decibel scale.

decommissioning The act of taking a processing plant or facility out of service and isolating equipment, to prepare for routine maintenance work, suspending or abandoning.

degree day A quantitative index demonstrated to reflect demand for energy to heat or cool houses and businesses.

DEW The abbreviation for Distant Early Warning.

DHS&EM The abbreviation for Division of Homeland Security & Emergency Management.

diadromous Fish migrating between fresh and salt water.

dialect A variety of a language that is a characteristic of a particular group.

direct impacts Are caused by the action and occur at the same time and place.

discharge The rate of water flow at a given moment, expressed as volume per unit of time.

DOLWD The abbreviation for Department of Labor & Workforce Development.

DOT&PF The abbreviation for Alaska Department of Transportation and Public Facilities.

DSM/EE The abbreviation for Demand-Side Management and Energy Efficiency.

easement A certain right to use the real property of another without possessing it.

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echolocation	The act of emitting calls out to the environment and listening to the echoes of those calls that return from various objects near them for navigation and foraging.
ecology	The scientific study of the relations that living organisms have with respect to each other and their natural environment.
EFH	The abbreviation for Essential Fish Habitat.
EIA	The abbreviation for Environmental Impact Assessment.
EIS	The abbreviation for Environmental Impact Statement.
ENSTAR	The abbreviation for the ENSTAR Natural Gas Company.
environment	The surroundings of an object, or the Natural environment, all living and non-living things that occur naturally on Earth.
Environmental Impact Assessment	An assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects.
Environmental Impact Statement	A document required by the National Environmental Policy Act (NEPA) for certain actions significantly affecting the quality of the human environment.
environmentally sensitive area	A type of designation for an agricultural area which needs special protection because of its landscape, wildlife or historical value.
eolian	To be borne, deposited, produced, or eroded by the wind.
EPA	The abbreviation for Environmental Protection Agency.
ephemeral stream	A seasonal stream that only flows for part of the year.
epidemic	When new cases of a certain disease, in a given human population, and during a given period, substantially exceed what is expected based on recent experience.
ESA	The abbreviation for Endangered Species Act.
ESCP	The abbreviation for Erosion Sediment Control Plan.
ESU	The abbreviation for Evolutional Significant Units
ethnographic	The branch of anthropology that deals with the scientific description of specific human cultures.
evapotranspiration	The sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.

Glossary (Continued)

export pipeline The export pipeline is not proposed for this Project, but is included as a connected action. The export pipeline would be a buried 6-8 inch diameter pipeline, extending 80 miles long, beginning at the NGELP, and following the existing Beluga natural gas line south of the village of Tyonek to MP 58. It would pass under Cook Inlet to Nikiski and terminate at the NGL Fractionation Facility.

Fairbanks Distribution System Expansion of the local distribution system to transport natural gas from the Fairbanks Lateral terminus to the customers in the Fairbanks area is a reasonably foreseeable future action.

Fairbanks Lateral The proposed development of a 12 inch diameter pipeline extending approximately 35 miles from the mainline gas line at MP 458 to the Fairbanks Terminus.

Fairbanks Route Variation Alternative This alternative would follow the existing TAPS/Dalton Highway alignment from Livengood to Fairbanks and then along the Parks Highway/Alaska Railroad to Dunbar.

fault crossings Crossings proposed for fault rupture zones.

fauna The animal life of any particular region or time.

FEMA The abbreviation for Federal Emergency Management Agency.

FERC The abbreviation for Federal Energy Regulatory Commission.

fiord A long, narrow inlet with steep sides or cliffs, created in a valley carved by glacial activity.

FL Fairbanks Lateral.

flora The plant life occurring in a particular region or time, generally the naturally occurring native plant life.

FLPMA The abbreviation for Federal Land Policy and Management Act.

flume An open artificial water channel, in the form of a gravity chute, that leads water from a diversion dam or weir completely aside a natural flow.

fluvial systems Relating to flowing water.

FNG The abbreviation for Fairbanks Natural Gas.

FNSB The abbreviation for the Fairbanks North Star Borough.

FPC The abbreviation for Fairbanks Pipeline Company.

FPPA The abbreviation for Farmland Protection Policy Act.

FRA The abbreviation for Federal Railway Administration.

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Glossary (Continued)

frost bulb	A frozen zone, typically formed around a chilled pipe, in otherwise unfrozen ground.
frost heave	The raising of a surface caused by ice in the underlying soil. This movement results from alternate thawing and freezing. Frost heaving generates stress on vertical support members of pipelines in the Arctic and, as a result, also on the pipeline.
FTA	The abbreviation for Federal Transit Administration.
fugitive dust	A type of nonpoint source air pollution - small airborne particles that do not originate from a specific point such as a gravel quarry.
Gas Conditioning Facility	An approximately 70-acre facility proposed for installation at MP 0 of the proposed Project that would receive natural gas from an existing central natural gas facility to remove carbon dioxide (CO_2), hydrogen sulfide (H_2S) and other impurities. The natural gas would then be compressed to required delivery pressures, enriched with the addition of NGLs, cooled then transported down the pipeline.
GCF	The abbreviation for Gas Conditioning Facility.
geo-fabric	Permeable fabrics that have the ability to separate, filter, reinforce, protect, or drain.
geotechnical	Geological technical application for construction on or in the ground.
GHG	The abbreviation for Green House Gases.
gill net	A mesh net made of monofilament with a float line and a lead sinking line to snare fish by their gills as they swim through the net.
GIS	The abbreviation for Geographic Information System.
GMP	The abbreviation for General Management Plan.
GMU	The abbreviation for Game Management Units.
groundwater	Subsurface water that is recharged by infiltration and enters streams through seepage and springs.
GVEA	The abbreviation for Golden Valley Electric Association.
H_2S	The chemical symbol for hydrogen sulfide.
habitat	An ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism.
habituate	Make or become accustomed or used to something.
HAP	The abbreviation for Hazardous Air Pollutant.

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haul out	The behavior associated with pinnipeds (true seals, sea lions, fur seals and walruses), temporarily leaving the water between periods of foraging activity to lay or rest at sites on land or ice.
HB	The abbreviation for House Bill.
HCA	The abbreviation for High Consequence Areas.
HDD	The abbreviation for Horizontal Directional Drilling.
HEA	The abbreviation for Homer Electric Association.
HECs	The abbreviation for Health Effects Categories.
heritage resources	Cultural, historic, archaeological and paleontological resources, including pre-contact and post-contact features.
HGM	The abbreviation for Hydrogeomorphic Classification.
HIA	The abbreviation for Health Impact Analysis.
hovercraft	A craft capable of traveling over surfaces while supported by a cushion of slow moving, high-pressure air which is ejected against the surface below and contained within a skirt.
HPSA	The abbreviation for Health Professional Shortage Areas.
HRSA	The abbreviation for Health Resources and Services Administration.
HUC	The abbreviation for Hydrologic Unit Code.
hydrology	The study of the movement, distribution, and quality of water.
hydrostatic testing	A way to test leaks in pressure vessels such as pipelines.
hyporheic zone	A region beneath and alongside a stream bed, where there is mixing of shallow groundwater and surface water.
HWE	The abbreviation for Healthy Worker Effect.
IBA	The abbreviation for Important Bird Areas.
ICBTL	The abbreviation for Integrated Coal Biomass-To-Liquids.
Ice age	The geological period of long-term reduction in the temperature of the Earth's surface and atmosphere, resulting in the presence or expansion of continental ice sheets, polar ice sheets and alpine glaciers.
IGCC	The abbreviation for Integrated Gasification Combined Cycle.
igneous rock	Rocks formed through the cooling and solidification of magma or lava.

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Glossary (Continued)

indirect impacts	Are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR § 1508.8) Indirect effects and secondary effects are used interchangeably by FHWA.
INHT	The abbreviation for Iditarod National Historic Trail.
impact	To have an effect on or influence; alter.
impoundment	A body of water, such as a reservoir, made by impounding.
incubation period	The period of time for embryos to reach the alevin stage and emerge from spawning beds.
infrastructure	The set of interconnected structural elements that provide framework supporting an entire structure of development.
interstitial space	An empty space or gap between spaces full of structure or matter.
intertidal	The area that is above water at low tide and under water at high tide.
intrastate	Relating to or existing within the boundaries of a state.
IPCC	The abbreviation for Intergovernmental Panel on Climate Change.
IWC	The abbreviation for International Whaling Commission.
KOP	The abbreviation for Key Observation Points.
leach	To dissolve out by the action of a percolating liquid.
liquefaction	The process by which saturated, unconsolidated sediments are transformed into a substance that acts like a liquid.
LNG	The abbreviation for Liquefied Natural Gas. A clear, colorless, liquid that forms when natural gas is cooled to around -258 degrees Fahrenheit to reduce its volume for storage and shipping. LNG production would not be included in the proposed Project.
loess	An aeolian sediment formed by the accumulation of wind-blown silt.
LPG	The abbreviation for Liquid Petroleum Gas. LPG includes propane and butane.
LWCF	The abbreviation for Land and Water Conservation Fund.
MSFCMA	The abbreviation for Magnuson-Stevens Fishery Conservation and Management Act
MACT	The abbreviation for Maximum Achievable Control Technology.

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Glossary (Continued)

macrohabitat A large scale habitat presenting considerable variation of the environment, containing a variety of ecological niches, and supporting a large number and variety of complex flora and fauna.

mainline block valve A valve that restricts or stops the flow of gas to isolate portions of the pipeline.

mainline gas pipeline The proposed gas pipeline that would extend from Prudhoe Bay at the GCF (MP 0) southbound 737 miles to the Upper Cook Inlet NGELP.

MAOP The abbreviation for maximum allowable operating pressure

masking The perception of one sound is affected by the presence of another sound.

MBTA The abbreviation for Migratory Bird Treaty Act.

MEA The abbreviation for Matanuska Electric Association.

median The numerical value separating the higher half of a sample.

metamorphic rocks The transformation of an existing rock type (protolith), which is subjected to heat and pressure causing profound physical and/or chemical change.

meter station A station that analyzes the quality and quantity of natural gas being transferred through a pipeline.

MHT The abbreviation for Mental Health Trust.

microhabitat The small-scale physical requirements of a particular organism or population.

migration A regular journey or movement made in search of new habitat.

mitigation The elimination, reduction, or control of a project's adverse effects, including restitution for any damage to the environment caused by effects through avoidance, replacement, restoration, compensation or other means.

MLA The abbreviation for Mineral Leasing Act.

ML&P The abbreviation for Municipal Light & Power.

MLV The abbreviation for mainline block valve.

MMBtu/hr The abbreviation for 100 million British thermal units per hour.

MMg The symbol for million gallons.

MMPA The abbreviation for Marine Mammal Protection Act.

MMS The abbreviation for Minerals Management Service.

Glossary (Continued)

MMscfd The abbreviation for million standard cubic feet per day.

module Sections of pre-fabricated material to construct the GCF.

molt A loss of plumage, skin, or hair as a regular feature of an animal's life cycle.

monitoring Periodic inspection to meet the following objectives:

- observe and report on compliance with approval conditions
- confirm effectiveness of approved protection measures
- verify the accuracy of impact predictions
- identify any effects not predicted in the impact assessment

moraine Any glacially formed accumulation of unconsolidated glacial debris (soil and rock) which can occur in currently glaciated and formerly glaciated regions.

morphology The form and structure of an organism or any of its parts.

morphs A visual or behavioral difference between organisms of distinct populations in a species.

MP Milepost

Mat-Su The abbreviation for the Matanuska-Susitna.

MT The abbreviation for metric ton.

MUA The abbreviation for Medically Underserved Area.

MUPs The abbreviation for Medically Underserved Populations.

MW The abbreviation for megawatt.

NAAQS The abbreviation for National Ambient Air Quality Standards.

natural gas A naturally occurring gas mixture consisting primarily of methane.

natural gas liquids Hydrocarbons found in raw natural gas that are separated from the gas as liquids through gas processing. These are valuable byproducts of natural gas processing, which include: ethane, propane, butane, iso-butane and pentane.

navigable Waters that provide a channel for commerce and transportation of people and goods.

NEPA The abbreviation for National Environmental Policy Act.

NESHAPs The abbreviation for National Emission Standards for Hazardous Air Pollutants.

Glossary (Continued)

NGL Fractionation Facility This facility would be a connected action and is not included in the Project as proposed. The NGL Fractionation Facility would include the use of a turbo-expander refrigeration process for NGL extraction and a de-ethanizer stripping column for fractionation of the NGL's. Propane, butane and natural gasoline would be produced.

NGLs The abbreviation for natural gas liquids. NGL's are hydrocarbons found in raw natural gas that are separated from the gas as liquids through gas processing. These are valuable byproducts of natural gas processing, which include: ethane, propane, butane, iso-butane and pentane.

NGL Distribution Plant and marine terminal This facility is a connected action and is not included in the Project as proposed. The NGL Distribution Plant and marine terminal would be associated with the NGL Fractionation Facility located in Nikiski to transport NGL's on VLGC's.

NGLEP The abbreviation for the Cook Inlet Natural Gas Liquid Extraction Plant. This facility is proposed for development at the end of the pipeline at MP 737 near the Upper Cook Inlet. The NGLEP would remove propane, butane, and pentane NGLs. This facility would contain an inlet and liquid separators, molecular sieve, and a storage facility. After processing, the utility-grade natural gas would be compressed and transferred via a metering station into the ENSTAR (MP 39) gas line.

NHD The abbreviation for National Hydrography Dataset.

NHPA The abbreviation for National Historic Preservation Act.

NIOSH The abbreviation for National Institute for Occupational Safety and Health.

NIP The abbreviation for Non-native Invasive Plants.

NLCD The abbreviation for National Land Cover Database.

NMFS The abbreviation for National Marine Fisheries Service.

NOAA The abbreviation for National Oceanic and Atmospheric Administration.

NOI The abbreviation for Notice of Intent.

NO2 The chemical symbol for nitrogen dioxide.

NPRA The abbreviation for National Petroleum Reserve Alaska.

NPS The abbreviation for National Park Service.

NHRP The abbreviation for National Register of Historic Places.

Glossary (Continued)

NS	The abbreviation for North Slope.
NSB	The abbreviation for the North Slope Borough.
NSR	The abbreviation for New Source Review.
NWI	The abbreviation for National Wetlands Inventory.
NWF	The abbreviation for National Wildlife Refuge.
ODPCP	The abbreviation for Oil Discharge Prevention and Contingency Plan.
OHA	The abbreviation for Office of History and Archaeology.
old world	Consists of those parts of the world known to classical antiquity and the European Middle Ages. It comprises Africa, Asia, and Europe (collectively known as Afro-Eurasia), plus surrounding islands.
O&M	The abbreviation for Operation and Maintenance.
OMS	The abbreviation for Operation and Material Sites.
Operations Phase	The phase of a project during which the pipeline and associated facilities are operated.
opportunistic	Taking advantage of opportunities as they arise.
ordinary high water mark	Refers to the highest level of water reached by a body of water that has been maintained for a sufficient period of time to leave evidence on the landscape.
organic matter	The fraction of soil that contains plant and animal residues in various stages of decomposition.
overburden	The material that lies above an area of economic or scientific interest in mining and archaeology; most commonly the rock, soil, and ecosystem that lies above a coal seam or ore body.
overwintering period	The period of time during the winter season when temperatures are cold and food and space is limited for fish, making survival difficult.
PA	The abbreviation for Programmatic Agreement.
PACs	The abbreviation for Potentially Affected Communities.
Paleo-Arctic tradition	The name given by archaeologists to the cultural tradition of the earliest well-documented human occupants of the North American Arctic, which date from the period 8000–5000 BC.
Paleoindians	The first peoples who entered, and subsequently inhabited the American continent during the final glacial episodes of the late Pleistocene period.

Glossary (Continued)

palsas	Low, often oval frost heaves occurring in polar and subpolar climates which contain permanently frozen ice lenses.
palustrine	Includes any inland wetland which lacks flowing water, contains ocean-derived salts in concentrations of less than 0.05%, and is non-tidal.
PCBs	The abbreviation for polychlorinated biphenyls.
pelagic	Water in a sea or lake that is not close to the bottom or near to the shore.
permafrost	Soil that is at or near the freezing (32˚F) point of water for two or more years.
PHMSA	The abbreviation for Pipeline and Hazardous Materials Safety Administration.
photosynthesis	Is the process of converting light energy to chemical energy found in plants and algae and storing it in the bonds of sugar.
PI	The abbreviation for Points of Inflection.
pig	A pig is a mechanical tool used to clean and/or inspect the interior of a pipeline.
pig launcher	A facility on a pipeline for inserting and launching a pig.
pig receiver	A piping arrangement whereby an incoming pig can be diverted into a receiving cylinder isolated and then removed.
pingo	A mound of earth-covered ice found in the Arctic and subarctic that can reach up to 230 ft in height and up to 2,000 ft in diameter.
PJD	The abbreviation for Preliminary Jurisdictional Determination.
PM	The abbreviation for Particulate Matter.
POA	The abbreviation for Port of Anchorage.
polynya	An area of open water surrounded by sea ice.
POS	The abbreviation for the Port of Seward.
prehistory	The span of time before recorded history.
productivity	The quantity of organic matter or its equivalent in dry matter, carbon, or energy content which is accumulated during a given period of time.
Project facilities	Are aboveground facilities required for pipeline operation including: a GCF, compressor stations, straddle and off-take facility, NGELP, meter stations, mainline valves, pig launcher and receivers.

Glossary (Continued)

protohistory	A period between prehistory and history, during which a culture or civilization has not yet developed writing, but other cultures have already noted its existence in their own writings.
PSD	The abbreviation Prevention of Significant Deterioration.
psig	The abbreviation for pounds per square inch gauge.
PSIO	The abbreviation for Petroleum Systems Integrity Office.
PWSs	The abbreviation for Public Water Systems.
RCRA	The abbreviation for Resources Conservation and Recovery Act.
rearing period	The period of time where young fish feed and grow.
reclamation	The process of reclaiming (return to a suitable condition for use) something from loss or from a less useful condition.
rehabilitation	The reparation of ecosystem processes, productivity and services but does not necessarily mean a return to pre-existing biotic conditions.
restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Also, Restoration attempts to return an ecosystem to its historic trajectory.
richness	The number of different species in a given area.
Richardson Highway Route Alternative	The route would extend from Livengood, southeast to Fairbanks adjacent to the TAPS ROW; then parallel the Richardson Highway up the Tanana River Valley to Delta, turn south and follow the Delta River Valley to Isabel Pass and cross the Gulkana River. It would follow the Glenn Highway south west to Caribou Creek, Boulder Creek terminating at the Matanuska River at MP 55 of the ENSTAR Beluga Gasline.
right-of-way	The pipeline easement in which the pipeline will be installed and operated. The pipeline right-of-way width for the project will vary dependant on land ownership.
riparian	Situated or dwelling on the margin of a river or other waterbody.
RIRP	The abbreviation for Regional Integrated Resource Plan.
RMPs	The abbreviation for Resource Management Plans.
rookery	A colony of breeding animals, generally birds.
ROW	The abbreviation for right-of-way.
rut period	The mating season of ruminant animals such as deer, sheep, moose, caribou, and goats.

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Glossary (Continued)

SCADA	The abbreviation for Supervisory Control and Data Acquisition.
SCORC	The abbreviation for Statewide Comprehensive Outdoor Recreation Plan.
SDH	The abbreviation for Social Determinants of Health.
SDWA	The abbreviation for Safe Drinking Water Act.
sedimentary rocks	Are formed by the deposition of material at the Earth's surface and within bodies of water.
sedimentation	The tendency for particles in suspension to settle out of the fluid in which they are entrained, and come to rest against a barrier.
SEIS	The abbreviation for Supplemental Environmental Impact Statement.
semi-subterranean houses	Houses built half below the surface of the ground.
SERC	The abbreviation for State Emergency Response Commission.
SES	The abbreviation for Seward Electrical Association.
sexually dimorphic	A phenotypic difference between males and females of the same species.
SF	The abbreviation for State Forest.
SFHAs	The abbreviation for Special Flood Hazard Areas.
shore fast ice	Sea ice that has frozen along coasts along the shoals, or to the sea floor over shallow parts of the continental shelf, and extends out from land into sea.
SHPO	The abbreviation for State Historic Preservation Office.
SIP	The abbreviation for State Implementation Plan.
SMAP	The abbreviation for Susitna Matanuska Area Plan.
SNC	The abbreviation for Significant Non-Complier.
SOC	The abbreviation for Synthetic Organic Contaminants.
sociocultural	Relating to or involving a combination of social and cultural factors
SP	The abbreviation for State Park.
SPCCP	The abbreviation for Spill Prevention Control and Countermeasure Plan.
SPCO	The abbreviation for State Pipeline Coordinators Office.

Glossary (Continued)

SPCP	The abbreviation for Spill Prevention and Control Plan. The plan would address O&M of vehicles, storage of fuels and other hazardous materials, containment requirements, liquid and solid storage and waste disposal, spill response and cleanup procedures, reporting requirements, and periodic inspection and documentation requirements.
SPL	The abbreviation for Sounds Pressure Level.
spoil	Refuse material removed from excavation.
spring	A place where ground water flows naturally from a rock or soil onto the land surface.
SRA	The abbreviation for State Recreational Area.
SRMAs	The abbreviation for Special Recreation Management Areas.
SRR Plan	The abbreviation for Sedimentation, Rehabilitation and Restoration Plan.
straddle and off-take facility	A facility proposed to be located at the Fairbanks Lateral tie-in at MP 458.1 of the mainline gas line that would remove NGL's from the natural gas to allow utility-grade gas to enter the Fairbanks Lateral. Extracted NGL's would be injected back into the mainline natural gas line.
stock	Subpopulations of a particular species.
subnivean	Refers to a zone that is in or under the snow layer.
substrate	The material that makes up the bottom layer of the stream, such as gravel, sand, or bedrock.
subtidal zone	The zone that is exposed to air at the lowest of low tides and is primarily marine in character.
succession	The series of changes in an ecological community that occur over time after a disturbance.
SWCD	The abbreviation for Soil and Water Conservation District.
SWPPP	The abbreviation for Storm Water Pollution Prevention Plan.
TAGS	The abbreviation for Trans-Alaska Gas System.
TAH	The abbreviation for petroleum hydrocarbon.
taiga	Is also known as the boreal forest, is a biome characterized by coniferous forests.
"take"	The act of hunting, killing, capture, and/or harassment of any marine mammal; or, the attempt at such.

Glossary (Continued)

TAPS	The abbreviation for the Trans Alaska Pipeline System.
TC Alaska	The abbreviation for the TransCanada Alaska Company, LLC.
TCE	The abbreviation for Temporary Construction Easement.
TCPs	The abbreviation for Traditional Cultural Properties.
TEG	The abbreviation for Thermo-Electric-Generator.
temperate	Latitudes on the globe that are above the tropics and below polar circles.
temporal	Relating to time.
TEWS	The abbreviation for Temporary extra Workspaces.
thermokarst	The melting of permafrost by heat transfer from water bodies resulting in a depression.
thermoregulation	The ability of an organism to keep its body temperature within certain boundaries, even when the surrounding temperature is very different.
thoracic	Refers to the chest area.
threshold	The point that must be exceeded to begin producing a given effect or result or to elicit a response.
Thule people	The first true ancestors of Alaska's Inupiat groups.
till	Unsorted glacial sediment.
TMDL	The abbreviation for total maximum daily load.
TPY	The abbreviation for Tons Per Year.
traditional knowledge	Cultural knowledge that is based on direct observation or information passed on orally from other community members, developed from centuries of experience of living off the land.
TLUI	The abbreviation for Traditional Land Use Inventory.
tributary	A stream that flow into another river or stream.
TUC	The abbreviation for Transportation and Utility Corridor.
μm	The symbol for microns.
UNFCCC	The abbreviation for United Nations Framework Convention on Climate Change.
upwelling	Areas where water flows from the stream bed up into the water column.

Glossary (Continued)

USACE	The abbreviation for United States Army Corps of Engineers.
USCG	The abbreviation for United States Coast Guard.
USDA	The abbreviation for United States Department of Agriculture.
USDOD	The abbreviation for United States Department of Defense.
USDOI	The abbreviation for United States Department of the Interior.
USDOT	The abbreviation for United States Department of Transportation.
USEPA	The abbreviation for United States Environmental Protection Agency.
USFWS	The abbreviation for United States Fish and Wildlife Service.
USGS	The abbreviation for United States Geological Survey.
VdB	The abbreviation for vibration decibels.
vegetation community	A distinct grouping of plant species often associated with a particular set of environmental conditions such as terrain, soil, permafrost and water. Also known as plant community.
vertical support members	Aboveground steel support structures used to elevate the pipeline for the first 6 miles of the Project.
VLGC	The abbreviation for Very Large Gas Carrier.
VOC	The abbreviation for Volatile Organic Compound.
VRM	The abbreviation for Visual Resource Management.
VSM	The abbreviation for Vertical Support Members.
waterbody	A body of water that is a significant accumulation of water covering the earth which includes wetlands, streams, rivers, lake or ocean.
water crossing	A location where a pipeline or access road crosses a stream, river or lake.
watershed	A region or area draining into a particular stream or river.
weather	The state of the atmosphere at a place and time considering temperature, cloud cover, humidity, wind and precipitation.
WELTS	The abbreviation for Well Log Track System.
wetland	An area of land whose soil is saturated with water either permanently or seasonally.
WHO	The abbreviation for World Health Organization.
wintering ground	The location where a species inhabits for the winter period.

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Glossary (Continued)

WQS The abbreviation for Water Quality Standards.

INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Alaska District and six cooperating agencies have prepared a Draft Environmental Impact Statement (DEIS) for the proposed Alaska Stand Alone Gas Pipeline (ASAP) Project. The DEIS describes the proposed Project and evaluates the potential direct, indirect and cumulative environmental impacts associated with the proposed action and alternatives, including the No Action Alternative. Measures to mitigate adverse impacts are identified and described. The DEIS has been prepared to address issues and alternatives raised during the scoping process. The USACE will give full consideration to all public comments received on the DEIS. A summary of the public meetings, written comment letters, and responses will be incorporated into the Final EIS, as appropriate.

The EIS process is being conducted to comply with the National Environmental Policy Act (NEPA). The steps of the EIS process are described in Figure ES-1

This Executive Summary of the DEIS provides an overview of the proposed ASAP Project, the purpose of and need for the Project, the public involvement process including areas of concern raised during the scoping process, the alternatives to the proposed Project considered, and the conclusions drawn regarding potential environmental impacts. More detailed information on these aspects is presented in the DEIS (also provided in the attached CD on the back page of Volume 1).

BACKGROUND

The ASAP Project is being planned as an in-state natural gas pipeline designed to provide long-term, stable supplies of natural gas from the North Slope to the Fairbanks, Anchorage and the Cook Inlet area of Alaska.

In March 2010, the Alaska legislature mandated that the State prepare a project plan for an in-state natural gas pipeline. This mandate also established a joint in-state gasline development team to prepare the project plan. The development team is led by the Alaska Housing Finance Corporation, which created a subsidiary corporation called the Alaska Gasline Development Corporation (AGDC). The AGDC was established in July 2010 and became the applicant for the proposed ASAP Project.

PROPOSED ACTION

The AGDC proposes to construct, operate, and maintain approximately 737 miles of new 24-inch-diameter pipeline. A map of the proposed Project area can be viewed in Figure ES-2. The proposed Project would transport up to 500 million standard cubic feet per day (MMscfd) of natural gas and natural gas liquids (NGLs) from North Slope gas fields to markets in the Fairbanks, Anchorage and the Cook Inlet area by 2019. The pipeline would have an operating pressure of 2,500 pounds per square inch. Additionally, a new 12-inch-diameter lateral pipeline would extend approximately 34 miles from Dunbar east to Fairbanks. The general location of the proposed Project facilities is shown in Figure ES-2. The AGDC anticipates that initial Project natural gas flow would be less than 250 MMscfd, but a peak capacity of 500 MMscfd has been proposed to meet anticipated future demands.

The proposed Project would connect with the central gas facility (CGF) near Prudhoe Bay, provide for connection to a Fairbanks natural gas distribution system, and connect to ENSTAR Natural Gas Company's (ENSTAR) pipeline system located in Southcentral Alaska (Anchorage and the Cook Inlet area).

The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. The gas and NGLs would be used to heat homes, business and institutions, to generate electrical power, and for potential industrial uses. Further Information regarding the proposed Project is presented in Section 2.0 of the DEIS.

ASAP PROJECT COMPONENTS

Pipelines:

- 737 miles of 24-inch-diameter pipeline extending from near Prudhoe Bay to Point MacKenzie, Alaska
- 34 miles of 12-inchdiameter lateral pipeline extending from Dunbar to Fairbanks, Alaska

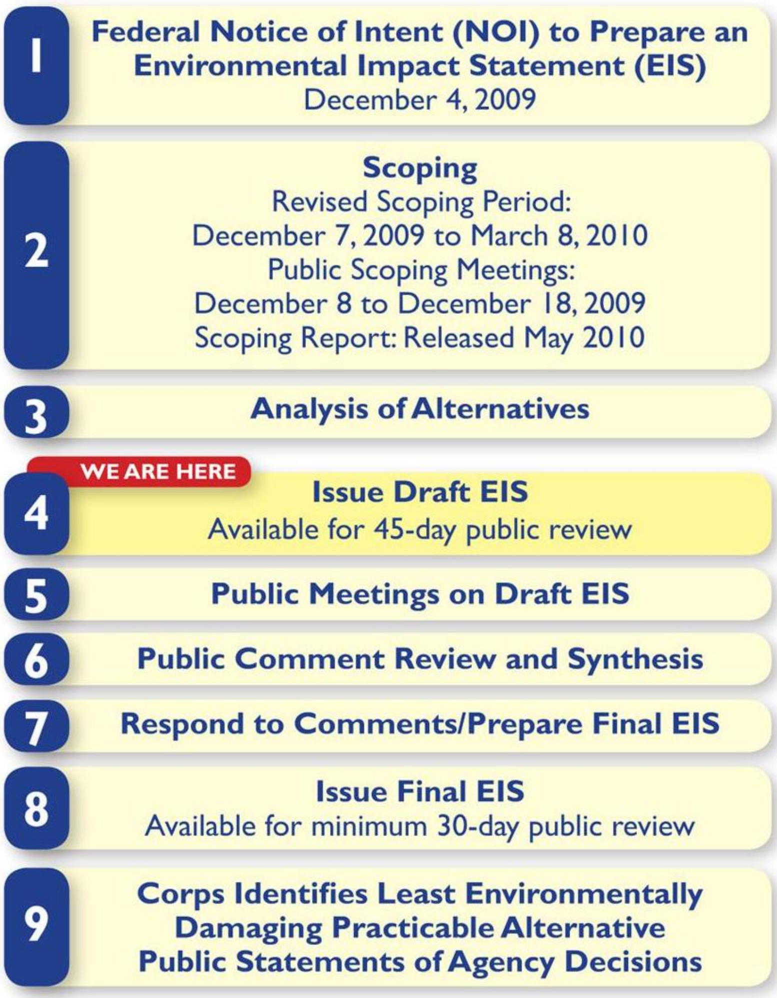
Aboveground Facilities:

- A North Slope gas conditioning facility (GCF)
- A straddle and gas off-take facility near Dunbar
- A Cook Inlet NGL extraction plant (NGLEP) facility
- 1 or 2 compressor stations
- 3 meter stations
- 37 mainline valves at intervals not greater than 20 miles

Support Facilities:

- Operations and maintenance buildings
- Construction camps and pipeline yards; and material sites

Figure ES-1: Steps in the Environmental Impact Statement Process



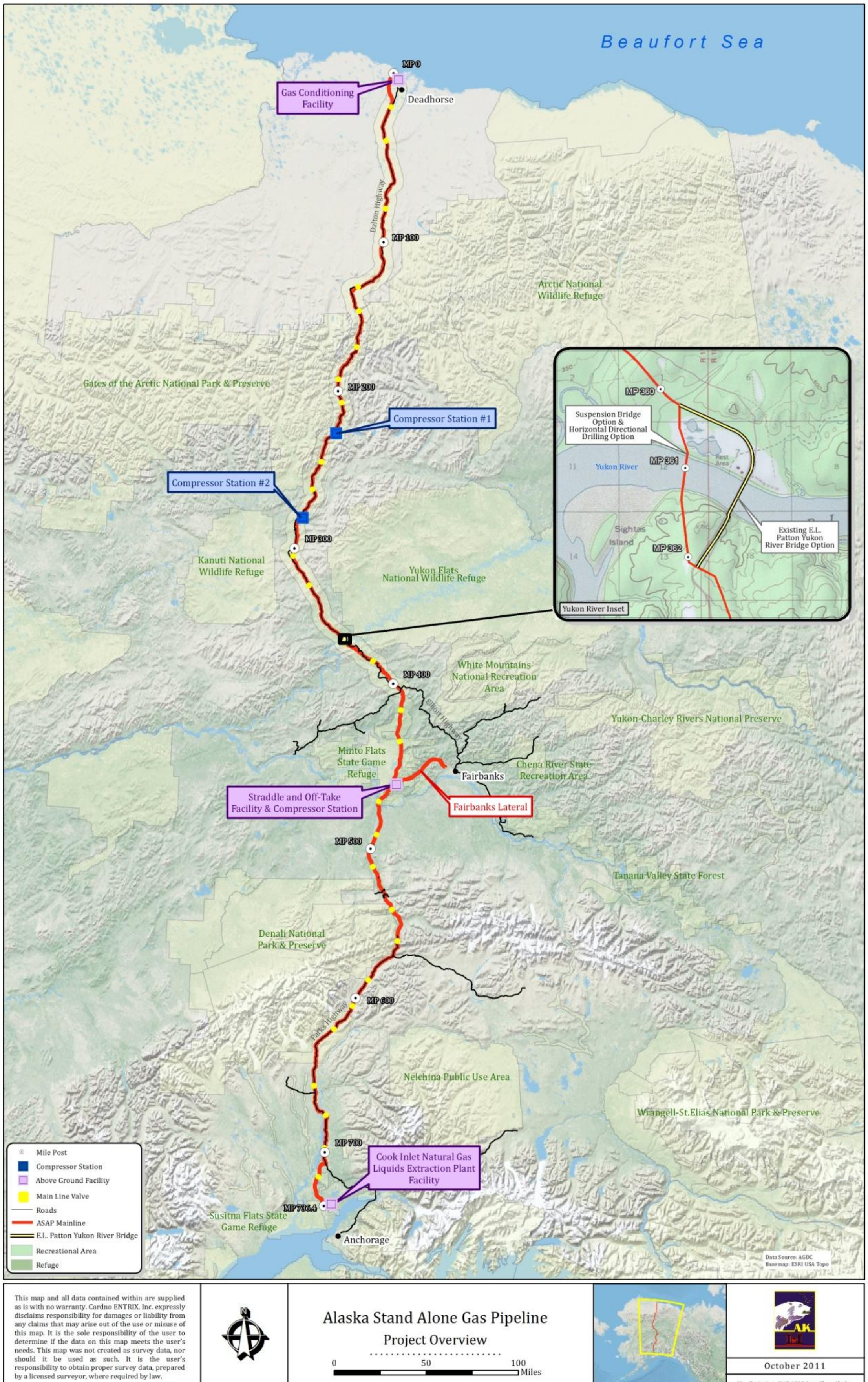
CONNECTED ACTIONS

Several connected actions would be required for the proposed Project to operate as planned. These connected actions are not proposed by the AGDC and would be completed by others:

- Construction and operation of four aboveground pipelines that would connect the Prudhoe Bay CGF to the gas conditioning facility (GCF) for supply of natural gas and NGLs and return of bi-products. The aboveground pipelines would be less than 1 mile in length.
- Processing and distribution of 60 MMscfd of NGLs from the Cook Inlet natural gas liquid extraction plant (NGLEP) facility located at the southern terminus of the mainline could be accomplished by pipeline, fractionation facility, and storage and tanker vehicles. A facility at Nikiski would require installation of an 80-mile-long pipeline to transport NGLs from the Cook Inlet NGLEP facility to Nikiski for fractionation, storage and subsequent in-state and export distribution by ship. Transport of NGLs from Nikiski for in-state use by tanker trucks would also be possible.

Further information regarding connected actions is presented in Section 3.0 of the DEIS.

Figure ES-2: Project Overview Map



PURPOSE AND NEED FOR THE PROPOSED ACTION

The primary purpose of the proposed Project is to provide a long-term, stable supply of up to 500 MMscfd of natural gas and NGLs from existing reserves within North Slope gas fields to markets in the Fairbanks, Anchorage and the Cook Inlet area by 2019. A secondary purpose is to utilize proven gas supplies that are readily available on the North Slope to provide economic benefit to the State of Alaska through royalties and taxes.

As identified by State legislature, a long-term, affordable energy source is needed for Fairbanks and Southcentral Alaska. Residential, community, commercial, and industrial entities would benefit from a reliable supply of natural gas. Existing and future energy users need access to reliable cost-effective energy. The proposed Project would fulfill the following needs:

- Relieve a shortfall of natural gas supply in the Cook Inlet area, which is the primary fuel source for heating and electrical power generation, projected in the near future (2013-2015);
- Provide for conversion from existing heating sources to natural gas in Fairbanks in order to reduce harmful air emissions. This would in turn assist in achieving attainment status. Fairbanks currently is in air pollution non-attainment area status due to particulate matter. Use of oil and wood for heating are major contributors to the problem of air pollution in winter;
- Provide a stable and reliable supply of natural gas and NGLs to meet current and future demand of up to 500 MMscfd;
- Provide a stable and reliable supply of natural gas needed to spur economic development of commercial and industrial enterprises in Fairbanks and the Cook Inlet area; and
- Provide economic benefit to the State of Alaska through royalties and taxes. Approximately 82 percent of Alaska's estimated state revenues for 2010 were from oil taxes, royalties, and fees.

Further Information regarding the purpose and need for the proposed Project is presented in Section 1.0 of the DEIS.

PUBLIC INVOLVEMENT PROCESS

On December 4, 2009, the USACE published the Notice of Intent (NOI) to prepare an EIS in the *Federal Register*. On the same date, the USACE sent a public notice to affected parties regarding the EIS public scoping meetings and how to obtain more information on the Project. The NOI initiated the scoping period, which was originally scheduled to begin December 7, 2009 and close on February 5, 2010. In response to public request, the scoping period was extended to March 8, 2010. This extension was announced through a Public Notice distributed to interested parties on February 5, 2010.

Public Scoping Meeting at the Anchorage Senior Activity Center

Photo: NRG

Public Scoping Meetings

The USACE hosted eight public meetings in the vicinity of the proposed ASAP Project corridor in December 2009. The purpose of these meetings was to disseminate Project information, solicit public input, and identify issues and concerns that the public believed should be addressed in the EIS. The scoping meetings were minimally attended with a few public comments received in some locations. Three scoping meetings did not receive any attendees. Much of the discussion by those in attendance focused on details regarding design, alignment, and the relationship of the proposed Project to other gas pipeline projects.

An agency scoping meeting was held on December 18, 2009 at the Bureau of Land Management (BLM) office in Anchorage. This meeting provided a specific opportunity for agencies to hear the scoping meeting presentation and to ask questions of clarification regarding the Project. The presentation and discussion served as a common foundation for identification of issues and concerns by federal and state agencies with jurisdiction and responsibility for resources potentially affected by the proposed Project.

Comments Received and Issues Identified during Scoping

Seventeen unique comment submissions were received during the scoping period, including four from state or federal agencies, one from local government, one from a state representative, and eleven from non-profit organizations, businesses and the general public. In addition, oral comments were provided and recorded at all meetings, with the exception of the agency meeting in Anchorage and the scoping meetings with no attendance (Glennallen, Delta Junction, and Wasilla). All scoping submissions and comments from members of the public can be seen in their entirety in Appendix E of the Scoping Report (Appendix B of this DEIS).

ALTERNATIVES CONSIDERED

Implementation of NEPA through the EIS process requires consideration of reasonable alternatives to the proposed Project that could minimize impacts to the natural and human environment. Consideration of the No Action Alternative is also required.

Alternatives to the proposed Project are described in detail in Section 4.0 of the DEIS. Several types of potential alternatives to the proposed Project have been considered:

- No Action Alternative – the proposed Project would not be constructed and would not operate;
- Energy Source Alternatives – energy alternatives and energy conservation measures that could reduce or replace the North Slope natural gas and NGLs that would be transported by the proposed Project;
- Natural Gas Transport System Alternatives – other systems that could transport the North Slope natural gas and NGLs that would be transported by the proposed Project;
- Pipeline Route Alternatives – alternative pipeline routes and route segment variations; and
- Aboveground Facility Alternatives – alternative aboveground facility sites.

The potential alternatives that were identified are evaluated for:

- Consistency with the purpose and need for the proposed Project as stated in Section 1.2 of the DEIS;
- Technical and logistical feasibility, and reasonableness; and
- Environmental advantages over the proposed Project.

No Action Alternative

The No Action Alternative is defined as the proposed action not being undertaken. The short-term and long-term environmental impacts identified in this EIS would not occur, as the proposed pipeline and associated aboveground facilities would not be constructed and 500 MMscfd of North Slope natural gas and NGLs would not be transported and made available to Fairbanks, Anchorage, and the Cook Inlet area. As a result of no action, the unrealized benefits would include: a reliable long-term natural gas supply for Fairbanks and Southcentral Alaska; improved air quality in the Fairbanks area; revenues to the State of Alaska from gas sales, taxes and royalties; and jobs related to construction and operation of the proposed Project.

Yet the current annual demand for Cook Inlet natural gas would remain at approximately 200 MMscfd, and future demand would grow to approximately 250 MMscfd by 2030. In Fairbanks, current and future demand of 60 MMscfd would not be met.

Energy conservation programs and new facilities that generate electricity and heat from sources other than natural gas could reduce, but not fully provide for the current and future demand for natural gas as the existing Cook Inlet supply would continue to diminish. As described in Section 1.2.2 of the DEIS, the natural gas shortage is projected to become acute by 2015.

Energy Source Alternatives

The Alaska North Slope gas fields are a proven, stable and reliable source of natural gas and could be developed to provide a supply of natural gas and NGLs for the proposed Project by the scheduled 2019 start of pipeline operations. According to a 2009 report by the Department of Energy, discovered technically recoverable natural gas resources on the North Slope are estimated to be about 35 trillion cubic feet. Energy sources other than North Slope natural gas were examined as potential alternatives to the proposed Project that could reduce or replace the need for natural gas and NGLs that would be transported by the proposed Project. Several alternative energy resources in the Project area are currently being developed or are in the planning and feasibility analysis process.

Studies indicate that energy sources other than North Slope natural gas and NGLs could reduce but not replace the volume of gas or the electrical power-generating capacity of the gas that would be transported by the proposed Project. None of the identified energy alternatives would meet all objectives of the Project purpose and need. Although some projects would provide alternative means for generating electrical power, they would only individually and collectively partially replace the electrical power generating capacity of the gas that would be transported by the proposed Project; they would also not provide the natural gas needed for home and institutional heating and industrial purposes. Energy alternatives, including major new supplies of Cook Inlet natural gas, are unproven or could not be realized by 2019, the planned in-service date for the proposed Project. Additionally, the economic benefits of utilizing an in-state gas source would not be realized by several of the alternatives. Therefore, alternative energy projects are likely to be developed independently of the proposed Project.

Natural Gas Transport System Alternatives

Past experience indicates that pipelines are cost-effective means of transporting large volumes of natural gas over long distances for sustained periods of time. As part of the DEIS assessment, alternatives to the proposed 24-inch-diameter ASAP pipeline were examined that may have the potential to meet the purpose and need of the Project and minimize environmental effects. In comparison to the proposed Project, transportation system alternatives would make use of existing, modified, or proposed natural gas delivery systems to meet the stated objectives of the proposed Project.

Alternative natural gas transportation systems considered and assessed were as follows:

- **A dry gas pipeline**. However, the purpose and need of the proposed Project would not be met because a dry gas line would not provide NGLs at the pipeline terminus.
- **A smaller diameter pipeline with additional compression**. This was examined to evaluate if a reduction in project construction and permanent Right of Way (ROW) footprint and corresponding reduction in impacts to associated environmental resources could be achieved. A benefit of increased compression (maintaining higher operating pressure) is that the required diameter of the pipeline may be decreased. However, the ROW footprint would not be reduced. Crucially, to increase and maintain compression across the length of the over 737-mile-long pipeline, more compressor stations would be required, bringing with them attendant costs and environmental impacts.
- **Spur pipelines from a large North Slope-to-Lower 48 or Valdez Pipeline**. The Alaska Pipeline Project (APP) has been proposed by TransCanada Alaska Company, LLC and ExxonMobil Corporation. The APP would be a 48-inch-diameter natural gas pipeline beginning at a new gas treatment plant to be constructed near existing Prudhoe Bay facilities. Two alternative routes have been proposed for the APP: the Alberta option and the Valdez LNG option. Regardless of the selected pipeline option, a minimum of five off-take connections would be built into the pipeline to allow local natural gas suppliers to obtain product to meet local community needs. These connections could be used to construct spur pipelines to serve the Fairbanks and Southcentral Alaska. The APP is in the planning process although the first gas is currently estimated for mid-2020, well behind the proposed Project timeline. Furthermore, implementation of the APP is uncertain. Therefore, spur pipelines from a North Slope-to-Lower 48 or Valdez Pipeline would not meet the purpose and need of the proposed Project and would not be a reasonable alternative.
- **A pipeline from the North Slope to Fairbanks, and transport by rail car to Southcentral Alaska**. This would involve the Project terminating at a new LNG conversion/production facility near Fairbanks, located near the northern reach of the Alaska Railroad (ARR). After conversion, the LNG would be transported by ARR rail car to new LNG storage and gasification facilities near Anchorage, which would have access to the existing Southcentral Alaska natural gas distribution system. Significantly, this alternative would not be a cost efficient or logistically practicable means of moving large volumes of LNG from Fairbanks to Southcentral Alaska for 30 or more years. Therefore, the pipeline and rail alternative would not be a reasonable alternative.

  Transport by truck/trailer would involve conversion of natural gas to LNG at a new production facility on the North Slope and subsequent transport of LNG by truck/trailer via the Dalton, Elliott, and Parks highways to new LNG storage and gasification facilities in Fairbanks and Southcentral Alaska. Transshipping LNG by truck/trailer has been accomplished by use of 44-

foot-long, 13,000 gallon gross capacity trailers. Each trailer has the capacity to carry LNG that when gasified would amount to approximately 1 MMscf of natural gas. Therefore approximately 500 trailers per day would be required to transport 500 MMscfd. This would require one loaded trailer leaving a North Slope LNG facility approximately every 3 minutes around the clock. Thus, this alternative would not be logistically practical or reasonable.

Pipeline Route Alternatives

Approximately 82 percent of the proposed Project route would be co-located with or would closely parallel existing pipeline or highway ROW. Co-location is desirable as a means of concentrating development within established corridors and minimizing environmental impacts. A major route alternative is defined as a generally longer segment of ROW that would follow a route different from the proposed pipeline. Major route alternatives and route variations that would be co-located with other established corridors were examined as potential alternatives to the proposed Project route. Major route alternatives and route variations identified and analyzed in the DEIS are depicted in Figure ES-3.

Major Route Alternatives: Because only one established corridor exists in the Project area, only one reasonable major route alternative would be possible. A Richardson Highway route alternative would be co-located with an established highway corridor and provide for transport of natural gas to Fairbanks and Southcentral Alaska. A Parks Highway route alternative and a Richardson Highway route alternative were examined and compared in the 2009 Stand Alone Pipeline Alternatives Analysis conducted by the State of Alaska. The 753-mile-long Parks Highway Route considered in the analysis was subsequently refined to the 737-mile-long proposed Project route. The State of Alaska found that constructing a pipeline along the Richardson Highway Route would cost approximately 10 percent more than along the Parks Highway Route. The Richardson Highway Route Alternative would be longer by 92 miles (845 miles long vs. 753 miles) and would cross a greater number of streams, and two mountain ranges. As a result of the increased length, the Richardson Highway Route Alternative would impact 23 percent more wetland features (730 features vs. 593 features), 35 percent more wetland habitat (1,735 wetland acres vs. 1,288 acres), and a greater number of wetland acres of each wetland type than the Parks Highway Route Alternative that was studied in the Alternatives Analysis conducted by the State of Alaska. Under the Richardson Highway Route Alternative, the lateral pipeline from south of Eielson Air Force Base to Fairbanks would be 3 miles shorter than the Fairbanks Lateral associated with the proposed Project (32 miles long vs. 35 miles).

The route of the proposed Project is a refinement of the Parks Highway Route that was the subject of the Alternatives Analysis conducted by the State of Alaska in 2009. For the proposed Project, the Parks Highway Route was refined and shortened by an additional 16 miles, indicating further reduction in overall impacts. Based upon this analysis, the Richardson Highway Route Alternative does not appear to include features that would result in fewer environmental impacts when compared to the Parks Highway Route. Therefore, the Richardson Highway Route Alternative would not in fact present environmental advantages over the Project as proposed.

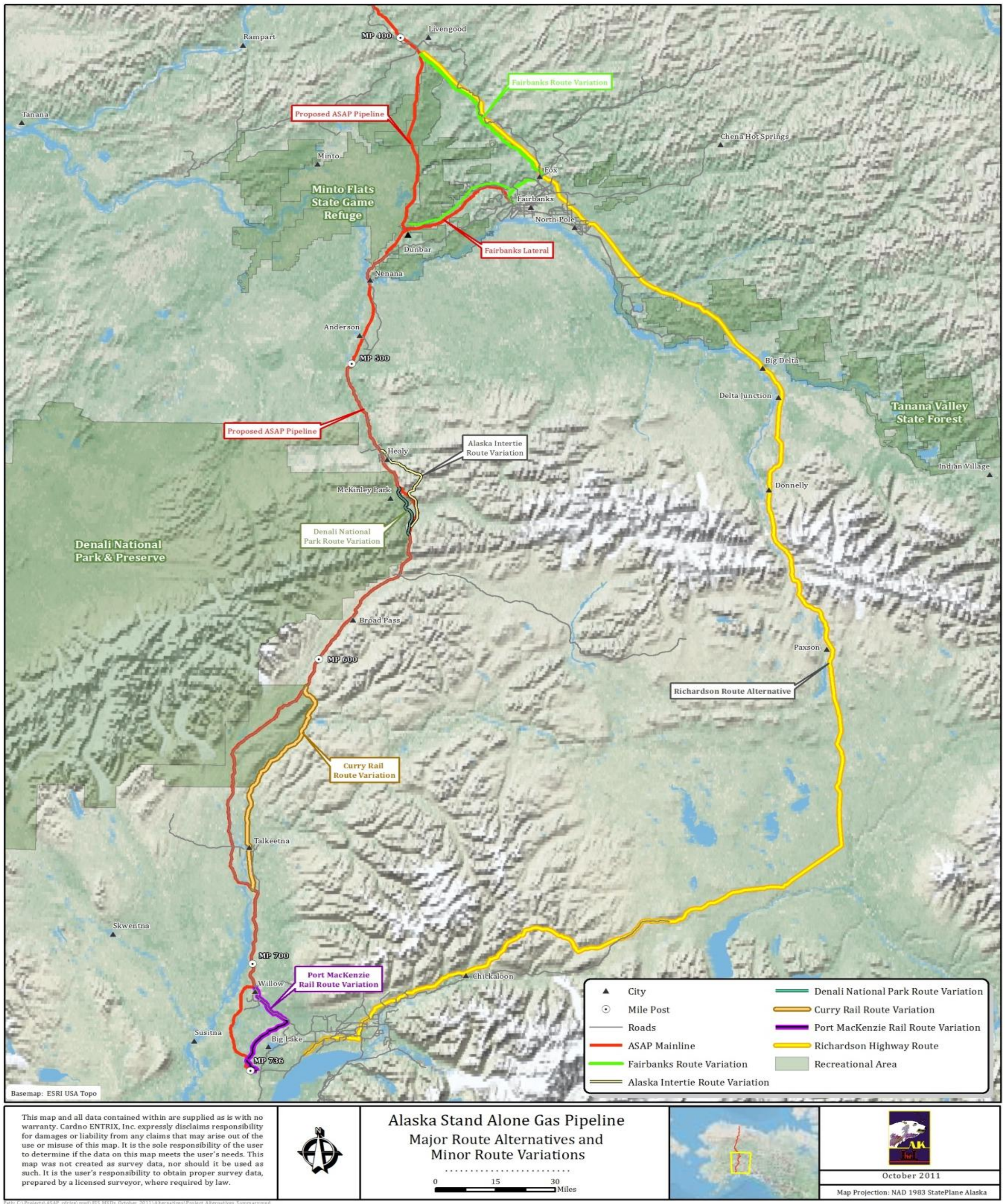
Route Variations: Route variations differ from major route alternatives in that they are identified to resolve or reduce construction impacts to localized, specific resources such as cultural resources sites, wetlands, streams, recreational lands, residences, or terrain conditions. Several route variations were screened but only the Denali National Park and Preserve (NPP) Route Variation is considered a reasonable alternative.

The Denali NPP Route Variation would be approximately 15.3 miles long, and would be within Denali NPP for approximately 7 miles, but would stay in the Parks Highway ROW. None of the Denali NPP lands that would be crossed are designated wilderness areas.

Currently, federal laws would not allow construction of this route variation within Denali NPP. Federal legislation that would allow the route variation has been introduced by the Alaska delegation, and is currently being considered by the U.S. Congress. If such legislation is passed into law, the National Park Service (NPS) would have authority to issue a ROW permit for a pipeline route which would result in the fewest impacts or be the least environmentally damaging practicable alternative (LEDPA). For this reason, the description of the Denali NPP Route Variation includes the provision that the AGDC would work with the NPS to adjust and refine the proposed route variation through Denali NPP to assure that the route or mode would be the LEDPA.

The Denali NPP Route Variation would be of similar length and would be co-located with the Parks Highway. Should Federal legislation allow within the time constraints of the Project, the Denali National Park Route Variation is a reasonable alternative that could minimize visual impacts in the area of Denali NPP.

Figure ES-3: Major Route Alternatives and Minor Route Variations



Aboveground Facility Site Alternatives

Aboveground facilities that would be components of the proposed Project include: a North Slope GCF; a Fairbanks gas straddle and off-take facility; one or two compressor stations; a NGL extraction facility; access roads; valves; pigging facilities; maintenance facilities; and pipe yards and camps. The general locations of these facilities are constrained by proximity, technical and logistical issues related to Project construction and operations. Considering these constraints, the AGDC applied other siting criteria to determine the specific locations of the proposed aboveground facilities. These included: topography; waters, wetlands and habitats; visual resources; cultural resources; and people and communities. Based on the siting process, it is reasonable to assume that environmental impacts could be more effectively reduced by the implementation of site specific mitigation measures rather than by alternative facility sites. Mitigation measures have been identified in Section 5 of the DEIS (Environmental Analysis). Accordingly, specific alternative aboveground facility sites have not been identified.

Pipeline Facility Construction

Photo: Courtesy of Michael Baker, Inc.

ENVIRONMENTAL ANALYSIS

The environmental analysis of the proposed Project describes the affected environment, direct, indirect and cumulative impacts that would result from construction and operations, and mitigation measures that could reduce impacts to each affected resource. The environmental analysis is organized by physical, biological and human environmental resources in Sections 5.1 through 5.20 of the DEIS.

Soils and Geology

The following geomorphic processes and features would be encountered in the proposed Project area: mass wasting (gravity-driven actions such as avalanches, rock falls, slides, and slumps, as well as solifluction in cold regions); permafrost degradation/ aggradation and frost action; and seismicity. Geomorphic processes such as these must be considered in pipeline engineering, design, siting and construction due to the fact that these processes have the potential to impact pipeline stability and operations.

Permafrost and Soil Considerations: Permafrost can occur in both soils and bedrock, and is encountered in all nine ecoregions traversed by the proposed Project.

Winter construction activities are planned as a method to decrease the impact on permafrost soils in the warmer months. Temporary ice roads and ice pads would be constructed to stage, construct and transport the work force, equipment and materials along the proposed route. The depth of frozen soil would be closely inspected to prevent a breakthrough below the vegetation. When low-pressure vehicles are used, winter travel does not appear to adversely affect soil or permafrost.

As designed, the pipeline would operate at below freezing temperatures in predominately permafrost terrains to protect the thermal stability of the surrounding ground. Similarly, the pipeline would operate at above freezing temperatures in predominately thawed settings so as not to create frost bulbs around the pipe that could lead to frost heave displacement of the pipeline or adverse hydraulic impacts on drainages crossed by the pipeline. Pipeline design would use engineering controls such as insulation and strategic use of non-frost-susceptible fill to control the thermal signature of the pipeline in discontinuous permafrost.

In areas bermed because of pipe installation, 6-inches minimum of bedding thickness would be required when working in areas of frost susceptible soils. Pipe insulation would be utilized to prevent unacceptable heave or maintain frozen soils based on geothermal analysis.

Brooks Range

Photo: U.S. Fish & Wildlife Service

Seismic Zones and Fault Considerations: South of the Yukon River, the proposed Project would cross two seismic zones that trend northeast in the Ray Mountains: the Minto Flats and Fairbanks seismic zones. The Intermontane region includes the Kobuk Ridges and Valleys, Ray Mountains, Yukon-Tanana Uplands, and the Tanana-Kuskokwim Lowlands ecoregions and has experienced 23 earthquakes greater than magnitude 5, within 50 miles of the Project area. The Alaska Range Transition, with 88 earthquakes greater than magnitude 5, within 50 miles of the Project area, has seen the most seismic activity since 1960, and includes the Alaska Range and Cook Inlet Basin ecoregions.

The following design approaches are currently being considered for areas of high seismic activity and/or fault zones:

- Placing the pipeline on aboveground sliding supports;
- Placing the pipeline in an aboveground berm constructed of low-strength soil;
- Placing the pipeline in an oversized ditch surrounded by low-strength crushable material or loose granular fill.

Paleontology: Fossils occur throughout Alaska and range from single-celled organisms to large vertebrates, including Mesozoic dinosaurs, marine reptiles, and Pleistocene megafauna. Paleontological evidence in Alaska varies, and with respect to the Project area, can be characterized broadly. Fossilized plants of marine and terrestrial origin, as well as invertebrate and vertebrate animal specimens, have been found in the area of the proposed Project.

Alaska's Historic Preservation Act protects paleontological resources that may be encountered along the ROW. If any known or previously undiscovered paleontological resources are encountered during construction or operation related activities, the Alaska State Historic Preservation Officer and an archeologist would be contacted to determine appropriate methods for planning.

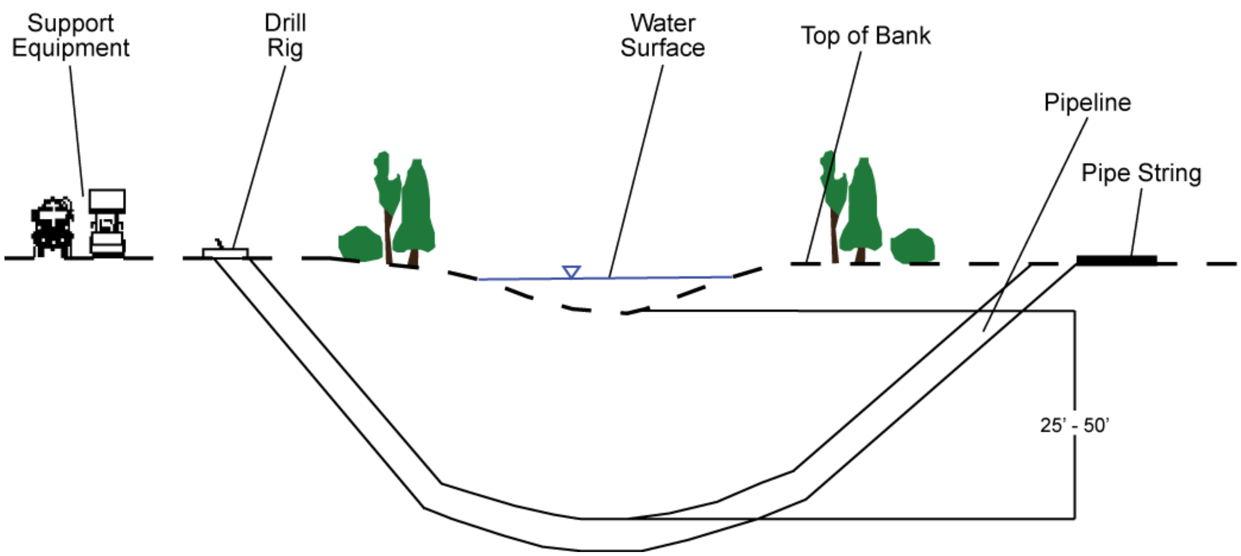
Water Resources

Water resources are defined by three sub regions for the proposed Project: Arctic, Interior-Yukon, and Southcentral. The total drainage area of all the watersheds in the proposed Project area is 47,983.26 square miles.

Surface Water: Surface water bodies found throughout the Project area include numerous streams, rivers, ponds, and lakes. Water uses for the proposed Project include water from permitted lakes and reservoirs for ice roads and pad construction and for temporary work camps. Impacts to water resources would include temporary altered water quality from water withdrawals including decreased oxygen concentrations, increased organic matter, turbidity and changes to pH. Proper ice road development would not adversely affect surrounding water resources. Ice bridges may form and persist across rivers and streams where ice roads were developed. Ice bridges would melt slower than surrounding ice and snow, which could cause flooding during spring break-up and result in increased sedimentation loads which would be temporary and localized.

The ROW would cross approximately 495 waterways and drainages. Construction activities for the ROW would include clearing vegetation, grading over the centerline, and excavating a trench for pipeline installation across streams. Three stream crossing methods would be used: open-cut, open-cut isolation, and horizontal directional drilling (HDD) methods. The HDD method is detailed in Figure ES-4. Up to four existing bridges would be used throughout the Project ROW and one new pipeline suspension bridge could be constructed across the Yukon River. The open-cut method would be the most common stream crossing method used, and would potentially impact instream features by temporarily reducing water quality downstream due to increased sedimentation and turbidity from excavating within the streambed and streambanks. Permanent impacts could include changes to the stream profile and structure (bed and hyporheic zone) at crossing locations, and loss of forested riparian vegetation from construction activities and subsequent maintenance of the ROW. Impacts would be minimized by performing the majority of open-cut trench crossings in the winter, and minimizing duration of in-stream construction in the summer. Streambanks would be revegetated and stabilized with native seed for non-forested vegetation establishment. Streambed scour is not expected to occur due to burial of the pipeline five feet below the surface of streambeds. The chilled pipeline could cause ice damming in the streambed if the pipeline temperature is colder than the stream ambient temperature. Impacts from Project construction at stream crossing locations would primarily be temporary and local.

Figure ES-4: Cross Section of Horizontal Directional Drilling Method



Groundwater: Groundwater is found throughout most of Alaska, but is limited in the northern area of the proposed Project due to continuous permafrost. Groundwater is primarily derived from glaciers, rivers and streams, and the depth of the water table can be as shallow as a few feet to as deep as 400 feet below the surface of the ground. Groundwater is the primary source of Alaska's public drinking water systems and is suitable for agricultural, aquaculture, commercial and industrial uses with moderate to minimal treatment. Arsenic has been found to occur in groundwater within the Project footprint. Contaminated sites also occur within the Project area along the existing ROW of the Parks Highway. Groundwater uses would primarily occur at permanent aboveground facilities and the Project would not be expected to adversely impact existing groundwater availability or quality.

Floodplains: Floodplains provide important ecological and hydrological functions and would be avoided to the extent most practicable for development of the Project. Floodplains would be recontoured to preconstruction state as much as possible, and revegetated with native plant seeds for vegetation establishment. Impacts from Project development would not be expected to adversely impact floodplains.

Vegetation Resources

The proposed Project would cross a diverse array of vegetation communities extending from the Arctic Coastal Plain to the Cook Inlet Basin in Southcentral Alaska. Nine ecoregions would be crossed by the proposed Project. Approximately 4,063 acres of land would be retained as permanent easement and grant ROWs and would be maintained to a non-forested vegetation cover.

Construction activities could cause temporary erosion and sedimentation impacts from vegetation removal along the construction ROW. Grading and topsoil stripping would likely destroy the plant root stock, which would delay vegetation recovery substantially. Non-native and invasive plant establishment and dust deposition could alter vegetation composition. Areas that are constructed in the winter on ice pads would have considerably less impact due to grading not occurring in those areas. Impacts to vegetation would be reduced substantially from associating the Project

ROW with existing ROWs and existing infrastructure. Disturbed areas for construction activities would be recontoured to preexisting conditions and reseeded with native plant seed, and sedimentation structures would be installed as needed in erosion prone areas. Operations of the proposed Project would include mowing the vegetation to a non-forested state. Forested vegetation would be removed permanently within the permanent and grant ROW; however, other vegetation types would recover over time. Project operations should not create additional impacts to vegetation communities beyond the potential for non-native and invasive plants to establish. Additional mitigation measures have been identified to address erosion control, sedimentation, rehabilitation and non-native plant invasion impacts.

Wetland Resources

Wetland resources are found throughout the Project corridor from the Beaufort Sea Coastal Plain southbound to the Cook Inlet Basin. Wetland classes transected by the proposed Project corridor are grouped into four major classifications using the National Wetlands Identification classification system. These include forested wetlands, scrub/shrub, emergent and other wetlands. Quantities and types of wetland resources were identified from results of a multiyear preliminary jurisdictional determination and field investigations verifying wetlands and uplands at field target locations throughout the length of the proposed pipeline ROW.

Yukon Flats

Photo: David Spencer

The proposed Project would affect approximately 5,387 acres of wetlands throughout its length. Three main methods would be employed when constructing in wetlands: open cut with matting, open cut without matting and open cut push/pull. Where possible, grading would occur directly over the center line (trench line) of the pipeline to minimize disturbance to wetlands. The vegetative mat would also be separated from the subsoil to improve rehabilitation success of the vegetative cover.

Wetlands would be contoured to preconstruction state as closely as possible and seeded with native plant species. To reduce impacts to soils, water quality, vegetation and wildlife use, wetland construction would occur during the winter months whenever possible. Impacts would include temporary and permanent disturbance to vegetation from construction activities. If original soil strata are maintained during backfill, subsurface soil, topsoil, and surface hydrology would likely be temporarily impacted. The potential for non-native and invasive plant species to establish could occur; however, this would be mitigated through a robust Non-native Invasive Plant Control Plan developed in collaboration with appropriate state and federal agencies. Erosion control structures would be placed where needed in areas prone to this process.

Operation of the Project would impact vegetation by mowing to maintain the permanent ROW in a non-forested vegetation state. Forest vegetation would be permanently lost, but other wetlands types would persist over the ROW. Project impacts would be reduced substantially by co-locating the ROW with existing utility corridors.

Wildlife Resources

Wildlife resources that could occur within or near the proposed Project area include big game, small game, waterfowl and game bird species, and other common nongame species. The proposed Project ROW crosses seven Game Management Units from the Arctic coast near the Beaufort Sea to the Cook Inlet in Southcentral Alaska. Moose and caribou are the primary big game animals within the Project area, with numerous species of waterfowl and land birds utilizing the area in the summer for breeding, nesting, molting, and rearing young.

The primary impacts to wildlife from construction of the ROW would include temporary construction-related disturbances and permanent operations and maintenance-related disturbances to habitat. Noise produced from construction activities could also affect wildlife adjacent to the ROW. Other impacts could include increased mortality from vehicle and train collisions with wildlife due to additional activity related to Project construction. Whenever possible, construction activities would be timed to occur outside of sensitive time periods for wildlife. Habitat loss would impact tree nesting birds (eagles, owls, hawks) that utilize forested vegetation within the ROW. Forest vegetation would reestablish over time outside the permanent ROW, although it would take years to decades to reach maturity, resulting in long-term forest habitat impacts.

Forests would not be allowed to reestablish over the permanent ROW. Therefore, the loss of forested habitats would be a permanent impact. Fragmentation of wildlife habitat would result from Project development and establishment of the maintained permanent ROW. Operational impacts to wildlife would be negligible in the Project area with the exception of increased road use and development that could increase vehicle collisions with wildlife. The Project would be co-located with existing ROWs as much as practicable to reduce additional impacts to wildlife from Project development.

Caribou

Photo: Bauer, Erwin & Peggy

Fisheries Resources

The proposed Project area extends from a point near Prudhoe Bay in the North Slope Borough south to the Matanuska-Susitna Borough near the Cook Inlet crossing through three major hydrologic regions: the Arctic Slope region, Interior Alaska region, and Southcentral Alaska region. Three main types of fish are found in the waters transected by the Project area, namely anadromous, resident and amphidromous fish species. The proposed Project would cross 516 streams throughout these regions. Eighty-two of the stream crossings have been confirmed to provide habitat for anadromous fish. Many of the streams that would be crossed have not been have not been studied for fish species presence.

Water withdrawn from permitted lakes and reservoirs would be used for ice road construction and for temporary work camps. Impacts to fish include: stress or mortality from low dissolved oxygen concentrations; altered fish behavior, distribution and growth resulting from water fluctuations; and reduced invertebrate productivity. Ice roads constructed across streams can cause ice bridges which can dam surface flow altering fish passage and habitat use. However, ice slotting would be implemented after construction in areas at these ice road crossings before spring break-up to prevent flooding or damming.

Installation of the buried pipeline across fish-bearing streams during construction is likely to have the greatest potential effect to fishery resources in the Project area. Stream crossings would be constructed using one of four methods: open-cut, open-cut isolation, trenchless technology using HDD, or bridge crossings. The degree of construction-related impacts to fish would depend on the type of crossing method used, the timing of construction, duration of in-stream activity, life stage and type of fish present and the mitigation measures implemented. Open-cut methods would likely cause the greatest temporary impacts to fisheries resources due to excavation within the streambed. Stream locations that are known to not have overwintering fish would be constructed in the winter, reducing impacts to fish.

Potential temporary impacts to fishery resources that would occur during construction include in-stream habitat alteration (changes to substrate composition, water depth, flow, sedimentation and turbidity), and channel profile. Permanent impacts would include riparian vegetation loss and stream morphology alteration to the hyporheic zone. Each subsurface stream crossing would be permitted and constructed in a manner and during a time period that would avoid or minimize potential impacts to fish. In-stream pipeline construction within each waterway crossing is anticipated to be completed in one to three days. The proposed Project includes the construction of one potential pipeline suspension bridge across the Yukon River as an option. No other pipeline bridge construction is proposed.

Fisheries impacts from Project operations are not expected to occur beyond maintaining riparian areas of the permanent ROW in a non-forested vegetation state and the potential for a chilled pipeline to affect instream conditions. The loss of riparian vegetation on stream banks may contribute to increased erosion and instability resulting in reduced fish habitat and water quality. A chilled buried pipeline could alter the environment for fisheries resources affecting fish behavior, survival and productivity. Additional impacts would occur to fisheries resources from access road development. New access roads would require bridges or culverts to cross streams, which could result in long-term alteration of fish habitat. Long term impacts would include a loss of riparian vegetation at stream crossings, and sedimentation from road use. Dust and gravel would be deposited in the stream channel on either side of crossing. Run-off could potentially transport contaminants from the road affecting water quality in the stream. To mitigate potential impacts to fish and their habitats, additional erosion control plans, sedimentation and rehabilitation plans would be developed and approved by agency staff with associated permits for construction activities.

Yukon River Suspension Bridge Simulation

Photo: The AGDC

Marine Mammals

Eight species of marine mammals that are not listed under the Endangered Species Act (ESA) could potentially occur near or within the proposed Project area. These include gray whale, beluga whale, killer whale, harbor seal, minke whale, harbor porpoise, Dall's porpoise and Pacific white-sided dolphin.

The Port of Seward (POS) would receive the majority of the shipments for equipment and pipeline material needed for Project construction. The Port of Anchorage (POA) may be utilized to supplement shipments to the POS; however, that has not been determined. West Dock Port is located in the Beaufort Sea, which would receive shipments for materials to construct the pipeline and facilities at the northern end of the Project footprint.

Vessel activity would be the only Project-related activity that would occur in the marine environment. Project-related vessel activity would occur prior to or during the construction phase. Disturbance to marine mammals from vessel activity could be in the form of vessel noise, vessel movement, or a potential collision with a marine mammal. Noise produced from the additional vessel activity along existing transportation routes would be considered relatively minimal, temporary, and localized. Vessel activity proposed for the Project would not significantly increase the volume of marine traffic in the Project area or along existing transportation routes. Current information indicates that vessel collisions with whales are not a significant source of injury or mortality. Marine mammals could be displaced temporarily if they were located in the vicinity of vessel activity. However, they would likely be habituated to regular vessel noise and movement. Also, masking could occur temporarily to species that communicate at low frequency sounds similar to vessel noise produced, although this would be a rare occurrence. Finally, routine vessel operations could result in small fuel leaks and lubricants that are toxic to marine mammals. Still, this would be unlikely to adversely impact marine mammals due to the relatively minimal vessel activity expected for the Project. As a result, marine mammals are not expected to be adversely impacted by vessel activity from the proposed Project.

Killer Whale Pod

Photo: Hosking

Threatened and Endangered Species

Species listed under the ESA as endangered, threatened, proposed for listing, and candidates for listing that could occur in the Project area include 10 marine mammals, one terrestrial mammal, and four bird species. Critical habitat for three ESA-listed species occurs within or near the Project area, namely the Cook Inlet beluga whale, polar bear and sea otter. Endangered species include the bowhead whale, Cook Inlet beluga whale, fin whale, humpback whale, Steller sea lion, Wood bison and Eskimo Curlew. Threatened species include the polar bear, Spectacled and Steller's eiders, and sea otter. Species proposed for listing as threatened are the bearded seal and ringed seal.

Vessel activity would be required to deliver materials and supplies to the POS, West Dock and potentially the POA. These are the only Project activities expected in the marine environment, and would occur over a 2-year construction period. Potential impacts include disturbance to seals, sea otters and whales from vessel noise and movement. Temporary displacement of natural behavior could occur in the vicinity of vessels. However, natural behavior would be expected to resume quickly. Masking effects from vessel noise also could occur temporarily, making it difficult for marine mammals to communicate in their environment. Vessel activity is common at these port locations and shipping lanes, and marine mammals would likely be habituated. The potential for an oil spill could occur if a vessel went aground; a spill however, would be unlikely. Impacts from vessel activity for Project construction would be unlikely to adversely affect ESA and candidate species.

The polar bear and its critical habitat are likely to be adversely affected during Project construction. Although no terrestrial bear dens have been located within this area in the past, the proposed Project area does contain suitable macrohabitat characteristics. Construction and operation of the GCF and the portions of the pipeline on the North Slope may cause disturbance to a few polar bears. No polar bear dens are likely to be disturbed during construction or operation of the GCF or the pipeline. Compliance with regulations pertaining to polar bears for North Slope oil and gas operations would minimize potential impacts to the polar bear and its critical habitat.

The spectacled eider could be adversely affected by construction and operations of the proposed Project due to the potential loss of nesting and breeding habitat. Additional impacts to spectacled eiders could include collisions with structures, increasing mortality, noise disturbance and increased predation on nests. The timing of construction activities during winter and coordination with the U.S. Fish and Wildlife Service (USFWS) regarding lighting of vessels and structures would minimize impacts to spectacled eiders substantially as they use the area only in the summer. Steller's eiders are not likely to be adversely affected from the proposed Project activities because their breeding areas are primarily west of the proposed Project area. Similar impacts to spectacled eiders could occur to nesting Yellow-billed loons due to the overlap of nesting areas with Project development. However, the Project would be unlikely to adversely affect Yellow-billed loons.

Land Use

The Project ROW would impact lands owned by the federal government and managed by the BLM, Department of Defense (DoD), NPS, and USFWS. The State of Alaska, University of Alaska, AHTNA, Inc. and the Toghotthele Corporation have selected federally-owned lands within the Project ROW for their future ownership. The State of Alaska owns the greatest number of parcels within the proposed ROW. Lands owned by the State of Alaska are managed by the Alaska Department of Natural Resources (ADNR). With the exception of the Denali NPP and 6(f) lands, all other lands have applicable land use plans or documents that provide for utility crossings. As a result, the proposed Project would be compatible with these plans. The proposed Project ROW would cross railroads, utilities (including the Trans-Alaska Pipeline System [TAPS]), trails, driveways, and local and arterial roads. Potential effects include disruption to traffic flow and utility service. Effects to agricultural lands would be minimal, with only 0.1 percent of the construction area affected by the proposed Project ROW utilized for agriculture. The Project has the potential to affect developed land by exposing residences or commercial/industrial buildings located near the Project ROW and aboveground facilities to dust and noise primarily during Project construction.

Temporary effects could occur to established trails (R.S. 2477 trails and 17(b) easements) during Project construction and maintenance. These effects should be minimized by ensuring the connectivity of the trails and easements at all times. This could be achieved by connecting the trails or easements via a bypass, or by placing wooden ramps over ditches temporarily created during pipeline construction and maintenance.

Coldfoot, Alaska Airstrip (community along proposed pipeline route)

Photo: Courtesy of Michael Baker, Inc.

Recreation

Although the proposed pipeline alignment was designed to avoid to the greatest extent practicable recreation areas, the mainline pipeline would either cross or be located near (i.e., within less than 1 mile) a number of key recreation features. These include the East Fork Chulitna River Campground, Denali State Park, Montana Creek State Recreation Area, Arctic National Wildlife Refuge, Denali NPP, Nancy Lakes State Recreation Area, Tanana Valley State Forest, Susitna Flats State Game Refuge, Minto Flats State Game Refuge, Willow Creek State Recreation Area, and the Little Susitna Recreation River. In addition, both public and private lands along the mainline route but outside designated recreation areas are commonly subject to dispersed recreation activities.

Project operations including the mowing and maintenance of vegetation resources along the ROW would likely not affect recreation activities or the quality of recreation opportunities in proximity to the pipeline route. However, while the pipeline would be located underground, there would be restrictions to access in some areas along the proposed ROW, accomplished by the use of large boulders, berms, and/or fencing. Consequently, there could be an adverse impact on general recreation access along the pipeline corridor over the long term, although all existing public access points would be retained. While no new public vehicular access routes are required for Project operations, there could be opportunities to include multi-use paths in the Project design to address issues raised during public scoping; this would be a recreation benefit to the region. As a self-contained underground facility, there also would be no effects from pipeline operations that would compromise the recreational quality of the region. Overall, there would be minor long-term adverse effects on tourism or recreation once construction is completed.

Visual Resources

Short-term visual impacts associated with construction would occur from clearing and removal of existing vegetation in the ROW, exposure of bare soils, earthwork, trenching, and machinery and pipe storage. Long-term impacts during operations would be associated with the following: maintenance of access along the ROW; various landform changes including earthwork and rock formation alteration; pipeline markers; and new aboveground structures located along the route such as compressor stations, mainline valves, pig launchers/receivers, and a straddle and off-take facility. Short-term visual impacts would be greater during construction and until re-vegetation occurs than during operations and maintenance.

Visual impacts from construction of the Denali NPP Route Variation are expected to be in the short-term moderate to high due to the sensitivity of viewers, particularly during the visitor season from May to mid-September. Construction of the pipeline would be visible from the Parks Highway, eastern Park lands, and tourist facilities near the Park entrance, and an above-ground segment of the pipeline would be located near the Park entrance on the pedestrian/bicycle bridge over the Nenana River. During operations, the majority of the pipeline route would be located underground within the Parks Highway travel corridor, in which disturbed ground would appear similar to existing conditions following re-vegetation, resulting in low long-term impacts. The segment of the pipeline at the northern Nenana River crossing would be beneath the pedestrian/bicycle bridge and would only be visible to travelers on the Nenana River, not those on the Parks Highway or on the pedestrian/bicycle bridge.

Typical Pipeline Worker Camp

Photo: Courtesy of Michael Baker, Inc.

Socioeconomics

The proposed Project could create up to 9,500 temporary jobs in Alaska over the 2016–2019 period, while the highest number of workers to be on site at any given time during this period is 6,400 temporary employees. Permanent employment would total between 50 and 75 jobs each year over the life of the Project. Non-resident construction workers would temporarily increase the population in the Project area, which may be particularly noticeable in low population areas of the Yukon Koyukuk Census Area, Denali and North Slope boroughs. Given the remoteness of the areas traversed by the proposed Project, it is anticipated that most of the construction workers would live in work camps and mobilize and demobilize to these camps primarily using air transportation. It is estimated that the GCF and Prudhoe Bay Operations and Maintenance (O&M) facility would employ a total of 10 people that would be housed in Prudhoe Bay on a rotation basis. Ten additional Wasilla O&M facility employees would be required. The AGDC has not yet determined the personnel requirements for the compressor stations or straddle and off-take facility.

Environmental Justice

It is expected that minority and low-income communities would be positively affected by the Project through the creation of jobs, as well as income- and tax-effects. Some adverse quality of life effects are anticipated on communities adjacent to the Project during the construction phase due to increased traffic and noise, but those adverse effects would be expected to be minor to moderate, of a temporary nature, and not concentrated in low income or minority areas. Overall, environmental justice effects on low-income and minority populations that would result from the proposed Project would be negligible or minor.

Cultural Resources

The pipeline ROW would encounter 37 Alaska Heritage Resource Survey sites and 705 sites are within 1 mile of the ROW. Direct effects to cultural resources within the ROW from ongoing or proposed activities could include physical destruction of or damage to all or part of the resource, removal of the resource from its original location, change of the character of the resource's use or of physical features within the resource's setting that contribute to its historic significance, change in access to traditional use sites by traditional users, or loss of cultural identity with a resource. Indirect effects could be characterized within a 1-mile radius of the ROW and include: vibration, noise, or atmospheric elements; neglect of a property that causes its deterioration; transfer, lease, or sale out of Federal ownership without proper restrictions; vulnerability to erosion; and increased access to and proximity of Project components to culturally sensitive areas.

Subsistence

Subsistence use impacts common to the proposed Project would include direct and indirect effects on subsistence use areas, user access, resource availability, and competition in those areas. The magnitude of impacts to subsistence would vary, however. Communities that are located along the proposed ROW or whose use areas are bisected by the Project would likely experience greater impacts vs. those communities located further away or which only have a small portion of their use areas intersected by the Project. Construction related activities resulting from the development of the proposed Project would have both direct and indirect effects on subsistence resources, use areas, and subsistence users in terms of availability, access, and competition, as well as hunter responses and effects on culturally significant activities. Where increased employment and workforce development are concerned, subsistence users might have less time available for subsistence activities due to employment commitments and might travel less to traditional places. Furthermore, a decline in the consumption of traditional foods would result in increased cost for obtaining substitute foods. Employment would however provide the benefit of increased income which residents can in turn use to purchase equipment and supplies needed to participate in subsistence activities.

Public Health

Several public health impacts could occur during both the 2.5-year construction and 30+-year operations phases. Impacts could occur to water and sanitation, health infrastructure and delivery, food, nutrition and subsistence, and social determinants of health. Other negative impacts could entail accidents/injuries, an unhealthy degree of exposure to hazardous materials, outbreak of infectious diseases (perhaps transmitted by pipeline construction workers), and an increase in non-communicable and chronic diseases. Using the rating system described in the State of Alaska Health Impact Assessment Toolkit (http://www.epi.alaska.gov/hia/), nearly all of the potential impacts would be described as "low". The possibility of fatal and nonfatal injuries to members of the general public from incremental road and railroad traffic associated with pipeline construction and operation are scored "medium" using the established rating scheme. Although the health effects could be severe for those impacted by injury associated with the proposed Project, quantitative estimates of the number of persons likely to be injured are quite low. Adverse impacts on social determinants of health could arise from anxieties/concerns related to possible loss or lowering of lifestyle quality and fears about accidents/fires/explosions that could occur as a result of leaks from the pipeline during the operations phase.

Assuming that a gas distribution network in Fairbanks would be established, the largest potential health impact attributable to the Project would occur during the operations phase. Natural gas emits fewer pounds of pollutants, particularly fine particulates, than wood or other fossil fuels that are currently being utilized for heating (e.g., coal and oil). Substitution of natural gas for other fuels presently used for heating would reduce fine particulate emissions in Fairbanks substantially, particularly in winter months when heaters are used extensively and air inversions are frequent. Existing concentrations of fine particulates, even at levels below air quality standards, have been proven to result in increased morbidity and mortality. Fairbanks is presently a non-attainment area for fine particulates. Thus, the potential public health benefits of readily available natural gas for heating in Fairbanks would be substantial. Natural gas supplied by the pipeline is estimated to be less expensive than other fuels, so there would be positive economic benefits as well. The analysis presented in the DEIS did not address the possibility of substitution of natural gas for gasoline or diesel motor fuel, which if realized would add to the stated benefits.

Various mitigation measures are included in State ROW lease stipulations and the Project plan of development would minimize effects on public health. Additionally, an active health outreach program for pipeline construction workers, including free vaccinations for influenza and hepatitis A and B, is recommended.

Air Quality

Air quality effects associated with construction of the proposed Project would include emissions from fossil-fuel powered construction equipment, fugitive dust, and open burning. The proposed Project would be constructed in four construction spreads or completed lengths. Simultaneous activity would occur on all four spreads. Total worst-case emissions that would occur from construction and operations are estimated at 1,059,100 tpy for CO2, 21,740 tpy for NOx, 8,008 for CO, 2,304 for VOC, and 165,075 tpy for PM-10. Emissions from the pipeline would be non-existent. Preliminary emission estimates for the GCF would trigger the requirement for a PSD permit for NOx, CO, VOC, PM-10, PM-2.5, and GHGs. For the compressor stations and straddle off-take facility, preliminary estimates would trigger the requirement for a PSD permit for NOx.

Noise

Construction noise levels would fluctuate depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near ambient levels. In addition, construction-related sound levels experienced by a noise sensitive receptor in the vicinity of construction activity would vary by distance. Ground-borne vibration would also occur in the immediate vicinity of construction activities, particularly if rock drilling, pile driving, or blasting is required. Noise levels from the industrial equipment at the proposed gas conditioning facility and compressor stations would be approximately 85 to 95 dBA at 50 feet.

Navigation Resources

The proposed pipeline would be underground at stream crossings except for four bridge crossings. Three bridge crossings would use existing bridges and one new pipeline bridge could be built across the Yukon River as an option. Stream crossings employing open cut methods would be completed in one to three days and would be expected to result in short-term disturbances to navigability. No impacts to navigation would be expected from operation and maintenance of the proposed Project. The pipeline would meet or exceed DOT standards (49 CFR 192.327) and would be buried below the ground surface at the depth required for safe crossing of waterbodies or installed on bridges designed and constructed in compliance with Federal and state regulations, standards, and specifications for crossings of navigable waterways.

Reliability and Safety

The U.S. Department of Transportation (USDOT) pipeline standards published in 49 CFR 190 to 199 specifically address natural gas pipeline safety issues and are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The pipeline and aboveground facilities associated with the proposed Project must be designed, constructed, operated, and maintained in accordance with USDOT pipeline standards.

Furthermore, the State ROW lease for the proposed Project not only grants the AGDC a gas pipeline corridor for construction of the proposed Project, but also contains a comprehensive sequence of stipulations that will direct all aspects of the pipeline design, construction, and operation in conjunction with applicable USDOT pipeline regulations.

The Pipeline Safety Improvement Act of 2002 requires operators to develop and follow a written integrity management program that addresses the risks on each transmission pipeline segment which applies to all high consequence areas (HCA). The Federal Pipeline Safety Improvement Act of 2002 requires operators to develop and follow a written integrity management program that addresses the risks on each transmission pipeline segment. Specifically, the law establishes an integrity management program which applies to all HCA – locations where a gas pipeline accident could do considerable harm to people and their property. The proposed Project contains 15 miles of identified HCAs.

In addition, USDOT regulations require that each pipeline operator establishes an emergency plan that includes procedures to: minimize hazards in a natural gas pipeline emergency; establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency; and coordinate mutual assistance.

The AGDC would also develop a safety plan and an O&M) plan that would outline safety measures to be implemented during normal and abnormal Project operation. The AGDC would conduct a public education program that would include information on the "One-Call" program (which provides preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts), hazards associated with the unintended release of natural gas, unintended release indicators, and reporting procedures.

The number of significant incidents over the more than 300,000 miles of natural gas transmission lines that exists nationwide indicates the risk is low for an incident at any given location. The operation of the proposed Project would represent only a slight increase in risk to the nearby public.

Design, construction and operations elements that would be integrated into the Project would provide a level of security from terrorism threats. These elements would include buried construction of the pipeline, locked security fencing surrounding aboveground facilities, regular air and ground inspection of the pipeline route, and regular visitation to aboveground facilities by operations and maintenance crews.

Additionally, all practicable steps would be taken to protect the pipeline from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads. During the design phase, the AGDC would address specific details such as pipe wall thicknesses as well as grade and design factors for road crossings, river crossings, bridge crossings, railroad crossings, TAPS crossings, populated areas, and major geologic fault locations. The integrity of this design approach is ensured through the Project quality assurance plans and operational safety and integrity management plans.

In the event of a pipeline rupture, the leak detection system would close the pipeline isolation valves and the escaping gas would contain the equivalent of approximately 1,745 barrels (bbls) of propane and 164 bbls of butane 80 percent / pentane 20 percent. Any release would be almost entirely NGL vapor. Winter temperatures could cause the butane and pentane components to initially remain in a liquid state. However, if any liquids formed, much of the volume would quickly evaporate due to the volatile nature of NGLs. The consequences of an accidental spill of NGLs as a result of a pipeline rupture could include fire and/or explosion of NGL vapors. Potential spill impacts are likely to be short-term and low magnitude due to the volatility of NGL components. However, a small portion of the NGLs may not easily vaporize but may instead remain to potentially migrate through the soils and enter the groundwater if spill cleanup procedures were not implemented.

Trench Placement with Sideboom Installation

Photo: Courtesy of Michael Baker, Inc.

Cumulative Effects

The analysis of cumulative effects considers the potential impacts of the proposed Project and connected actions combined with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the ASAP Project area. This assessment includes consideration of the existing pipelines, electrical transmission lines, and roadways, as well as other linear projects that are under construction, planned, proposed, or reasonably foreseeable in the vicinity of the proposed route. The analysis also includes existing and likely energy development projects.

Existing and Proposed Projects

Existing and proposed oil and gas and energy generation projects include the existing TAPS constructed in 1977, the proposed Point Thomson Gas Pipeline – an exploration, production and pipeline system on the North Slope, and the proposed APP – a natural gas pipeline that would extend from the North Slope to northern Alberta, Canada or to Valdez, Alaska.

Existing and proposed North Slope facilities include the Prudhoe Bay GCF, and the possible construction of a facility to produce LNG for delivery to Fairbanks by truck.

The proposed Project would provide utility-grade natural gas to the existing ENSTAR pipeline distribution system, replacing or supplementing natural gas supplies currently obtained from Cook Inlet gas fields. The ENSTAR distribution system is approximately 3,650 miles long and serves 350,000 direct customers.

The Project would be located in close proximity to an extensive transportation and utility system. Highways are continually being repaired, replaced, or upgraded, and these projects are also considered in Section 5.20. Improvements to existing public roads would not be required in association with the proposed ASAP Project. As a result of the anticipated increase in use, airports that would be used to support construction of the ASAP Project may require upgrades to improve runways, lighting, communications, or navigational aids. The Project would not require improvements to the ARR or to exiting port and dock facilities.

In addition, existing high voltage transmission lines would be periodically upgraded and additional parallel lines constructed to enhance the long-term reliability of the entire electrical system.

Finally, Fort Wainwright, Joint Base Elmendorf-Richardson, and Clear Air Force Base are currently proposing to perform infrastructure improvements and base upkeep activities that could coincide with construction of the Project.

Regarding energy, renewable energy generation projects and new discoveries of economic natural gas resources in the Cook Inlet area could have a cumulative effect on energy supply in the region. Future renewable energy projects include wind power (e.g., the Eva Creek Wind Farm near Healy, the Fire Island Wind Farm at Anchorage, and a wind farm at Nikiski) and hydropower (e.g., Susitna, Chakachamna, and Glacier Fork projects). In addition, if operable, the Healy Clean Coal Project could contribute electrical energy to the utilities connected to the Railbelt transmission system. Renewable energy projects as well as energy conservation measures would likely occur in the future regardless of the ASAP Project.

A long-term, stable supply of natural gas provided to Fairbanks by the proposed ASAP Project would likely result in development of a Fairbanks natural gas distribution system. This would include local distribution pipelines and possibly new facilities that would compress natural gas for distribution by storage tanks. Conversion or retrofit of power generation and heating facilities to allow for burning of natural gas could also take place. Also reasonably forseeable are future commercial and industrial projects that could utilize the 130 MMscfd of natural gas that the proposed ASAP Project would provide.

The proposed Accelergy/Tyonek Coal to Liquids (CTL) project would produce aviation fuel, gasoline, and diesel for military and industrial use, and would generate electricity with waste heat. A 12-inch-diameter 58-mile long buried steel pipeline from the end of the Beluga Pipeline to the Tyonek area would be required in order to transport natural gas from the ASAP Project to Tyonek for use in the CTL process.

Another potential use scenario for use of the 130 MMscfd of natural gas that the proposed ASAP Project would provide is conveying natural gas from the southern terminus of the Project to Nikiski for conversion to LNG and subsequent export by ship. Other potential future industrial gas users include the Donlin Creek Mine project, which plans to draw an additional 25 MMscfd of natural gas from unspecified sources at Cook Inlet by 2017, and a natural gas to liquids facility in the Cook Inlet area that would produce synthetic diesel and gasoline fuels from natural gas.

Cumulative Effects to Resources

Soils and Geology

ASAP Project-related effects to soils and geology would be mitigated with measures identified during the Project's final design phase such as the implementation of construction BMPs..The effects from connected actions and other reasonably foreseeable projects would also be identified to reduce cumulative effects. Except for competition for scarce gravel resources, the potential for substantial negative cumulative effects is low. There could be a potential cumulative effect to paleontological resources, but standard permit provisions should avoid damage to these resources associated with the Project, connected actions, and other reasonably foreseeable actions.

Water Resources and Wetlands

Cumulative effects to waterbodies would be small due to the existing processes for issuing temporary use permits for construction and for water rights needed for permanent facilities.

Approximately 4,575 acres of wetlands would be impacted by the proposed ASAP Project between the North Slope and the Cook Inlet area. An additional unquantified disturbance for the conceptual development and operation of a pipeline, fractionating facility, tank farm and marine terminal at Nikiski would be disturbed during construction of this connected action. Except for wetlands within the footprint of permanent facilities, most disturbed wetlands would be expected to retain their functions after construction is completed. New disturbances to wetlands from maintenance of highways, TAPS, and ARR would not be expected. Construction of the APP between the North Slope and MP 405 could double the cumulative effect to wetlands.

Biological Resources

Negative long-term cumulative effects on vegetation or wildlife habitats would be minimal due to the largely temporary site-specific nature of the direct and indirect effects of the proposed Project on vegetation and wildlife and fish habitats.

If activities associated with reasonably foreseeable projects were to occur during a similar time period as the proposed Project, there may be a cumulative mortality of aquatic- and terrestrial- species individuals, but overall, a negative cumulative population-level effect would be minimal.

Increased vessel traffic could cause a cumulative effect of marine activity. Most of this impact would affect aquatic and marine resources – including mammals – due to marine activities during construction and operation of the Project and connected action combined with other reasonably foreseeable actions. However, cumulative negative effects to federal- or state- listed species would not be expected.

Land Use

Reasonably foreseeable future projects that would be constructed within existing transportation and utility corridors generally would be consistent with existing land use planning and would therefore be assumed to have minimal effects on land use.

Anchorage, Alaska (city near the terminus of the proposed pipeline route)

Photo: Courtesy of Alaska Division of Community and Regional Affairs

For example, there would be a short-term negative cumulative effect on recreational opportunity and activity in the Project area due to both construction activity and increased competition for recreation resources from construction workers assigned to the reasonably foreseeable projects associated with the proposed Project.

New roads and the cleared ROW through forested areas could increase unauthorized off-road vehicle use and result in ground disturbance, damage to vegetation, and greater potential for soil erosion. However, overall roadway improvement and maintenance projects are not expected to result in an adverse effect even when combined with the proposed Project. It is unlikely but possible that coinciding construction or maintenance schedules could prevent traffic flow on the Parks or Dalton Highways.

Visual Resources

Since it would be located within an existing transportation and utility corridor, the overall cumulative effect of the Project on the visual resources in the Project area when combined with TAPS, APP, highways, and ARR would be minimal.

Socioeconomics

Potential beneficial effects as result of the proposed Project and connected actions could be expanded when coupled with reasonably foreseeable future actions. These benefits include jobs, tax revenues, and a long-term stable supply of natural gas for electrical generation, home heating and industrial activities. As the mix of energy sources in the Railbelt and rural Alaska alters, there could be incremental change in the overall cost of energy. Because of the small size of the Alaska population, in-state demand is correspondingly small. This also leaves only a small base to cover the initial investment and operating costs for each new energy source. The addition of new non-oil and gas energy sources to the Railbelt area would increase the quantity of natural gas available for in-state industrial use and for export.

Potential adverse effects to quality of life from noise, traffic delay, and increased competition from construction workers are expected to be short-term in duration.

Cultural and Historic Resources

Because of co-location with existing disturbed ROWs for substantial distances along the proposed Project ROW, as well as avoidance of potentially eligible properties wherever possible, the incremental contribution to cumulative effects from the proposed Project to cultural resources in the Project area would be expected to be minimal.

Subsistence

In conjunction with other reasonably foreseeable and future projects within subsistence areas, the proposed Project would result in cumulative temporary and permanent disruption of subsistence activities. Associated with this impact would be the potential decrease in available harvest resulting from temporary disturbance to wildlife, fisheries, and their habitat. The scale of this disruption would depend on the scale of the other projects.

Public Health

Measured against all cumulative health effects from state and federal programs, other oil and gas activities, and other industrial developments, the incremental impacts of the proposed Project on public health would not likely be large. Put another way, whether or not the proposed Project goes forward would not materially affect the cumulative impacts of all other state, federal, and industrial developments. Furthermore, Residents of Fairbanks would benefit in health terms as a result of improved air quality resulting from the proposed Project and a Fairbanks gas distribution system. These benefits were described in the summary of Public Health effects for the proposed Project, and are described in detail in Section 5.15 of the DEIS.

Air Resources

Even with mitigation, the proposed Project would generate GHG emissions and incrementally contribute to climate change. However, when proposed Project emissions are viewed in combination with global emissions levels that are contributing to the existing cumulative impact on global climate change, the incremental contribution of GHG emissions would be collectively small.

Noise

Due to the short term nature of proposed Project construction and the absence of sensitive noise receptors near work areas, only short-term and transitory cumulative noise effects on humans and wildlife would occur.

Navigation

Disruption of existing vessel traffic at the POS or at West Dock would be unlikely. There would be a long-term increase in vessel traffic in Cook Inlet associated with NGL processing and distribution, and LNG export from Nikiski. When combined with current Cook Inlet vessel traffic and future port improvement activities, fishing, and marine scientific research, Project navigation activity could result in a cumulative increase in vessel congestion and modification to traffic patterns.

Reliability and Safety

There would be potential cumulative effects to safety and reliability with the convergence of the proposed Project, TAPS, highway use and maintenance, and the ARR. It would be expected that final design for the proposed Project would include written agreements that the proposed construction activities, operating conditions, and maintenance requirements would not cause undue risk to existing transportation and utility systems. Accordingly, no negative cumulative effects to TAPS, highways, or the ARR would be expected.

1.0 PURPOSE AND NEED

The Alaska District, U.S. Army Corps of Engineers (USACE) and six cooperating agencies — the Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA), National Park Service (NPS), Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO), U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), and the U.S. Coast Guard (USCG) — initiated the NEPA process through the development of the Alaska Stand Alone Gas Pipeline (ASAP) Draft Environmental Impact Statement (Draft EIS). This Draft EIS examines the Alaska Gasline Development Corporation's (AGDC, the applicant) need to transport a stable and reliable supply of natural gas and natural gas liquids from near Deadhorse on Alaska's North Slope to Cook Inlet, with the proposed action being to develop a 24-inch diameter, 737-mile long, high pressure natural gas pipeline, defined henceforth as the "Project" (Figure 1.0-1). This Draft EIS examines the potential impacts of construction and operation of the proposed pipeline, and evaluates a range of alternatives, consistent with applicable law, by which to accomplish the purpose and need of the proposed action while avoiding or minimizing adverse impacts.

The proposed pipeline would be developed in the general vicinity of the Dalton and Parks Highway Corridors. A 12-inch diameter lateral pipeline would extend about 35 miles from Dunbar east to Fairbanks. The proposed Project's aboveground facilities would include: a North Slope gas conditioning facility (GCF); one or two compressor stations (CS); a straddle and off-take facility near Dunbar; a Cook Inlet natural gas liquids extraction plant facility; and mainline valves and pig launcher/receivers. Support facilities would include: operations and maintenance buildings; construction camps and pipeline yards; and material sites. The proposed Project is more fully described in Section 2. In addition to the pipeline proposed by the AGDC, several alternatives analyze development options for segments of the pipeline route.

The USACE and cooperating agencies join in this effort in order to allow the Draft EIS and subsequent Final EIS to provide the basis for respective agency actions and permit evaluations on the proposed Project.

1.1 PROJECT OVERVIEW

The AGDC proposes the construction and operation of a pipeline to transport natural gas and natural gas liquids (NGLs) from the North Slope of Alaska near Prudhoe Bay to Fairbanks, Anchorage and the Cook Inlet area. The pipeline would transport natural gas and NGLs from existing reserves within Prudhoe Bay gas fields on the North Slope of Alaska for delivery to in-state markets in Fairbanks, and Southcentral Alaska (Anchorage and the Cook Inlet area). Discovered technically recoverable natural gas resources on the Alaska North Slope are estimated to be about 35 trillion cubic feet (TCF) (DOE 2009). The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. The gas and NGLs would be used to: heat homes, business and institutions; generate electrical power; and for potential industrial uses. NGLs in excess of in-state demand could be transported to other parts of the United States and international export markets via marine transport from existing facilities at Nikiski. However, the export of NGLs is not proposed by the AGDC as a component of the proposed action.

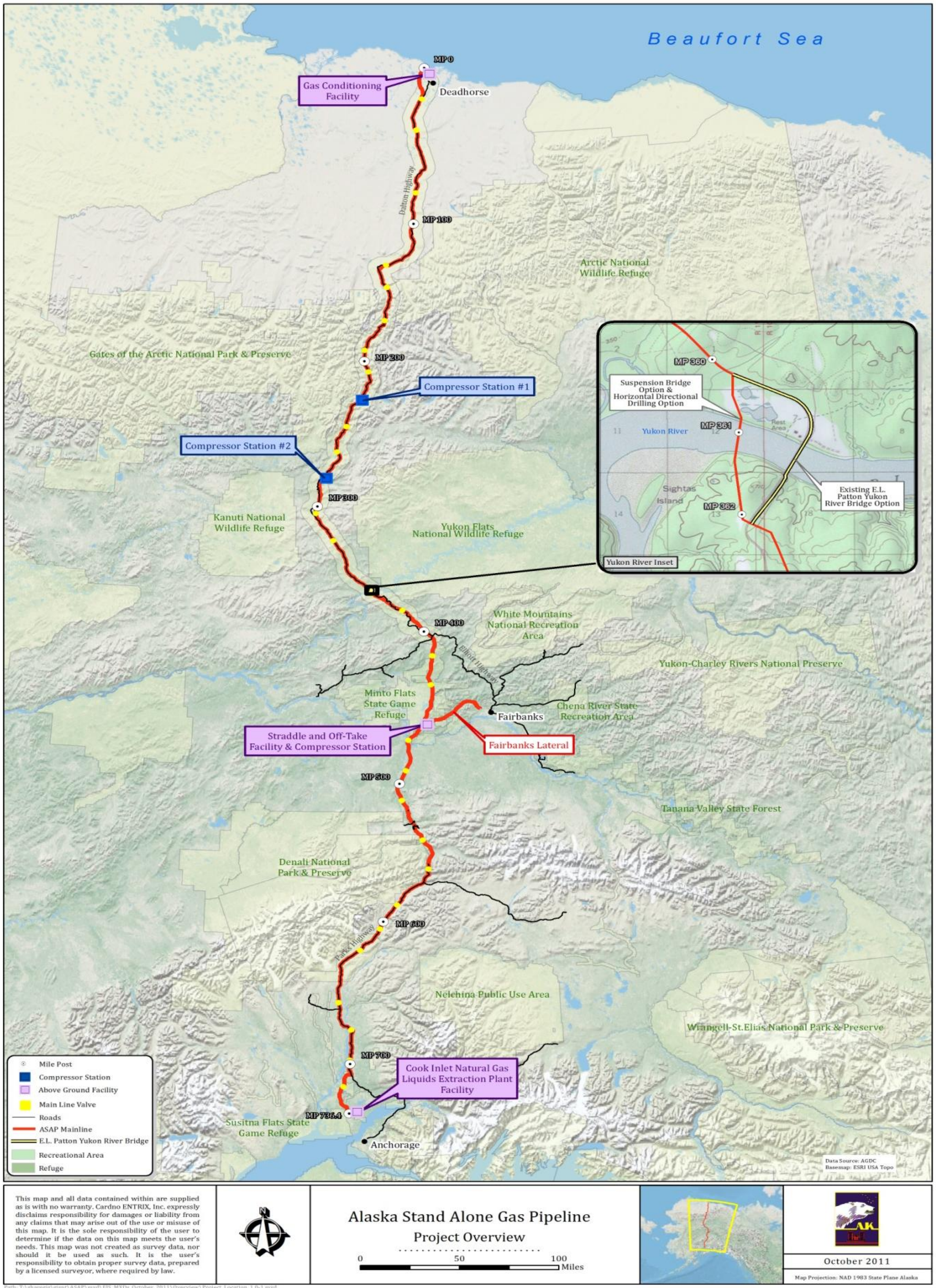


FIGURE 1.1-1 Project Overview

1.2 PROJECT PURPOSE AND NEED FOR THE PROPOSED ACTION

1.2.1 Applicant's Stated Purpose

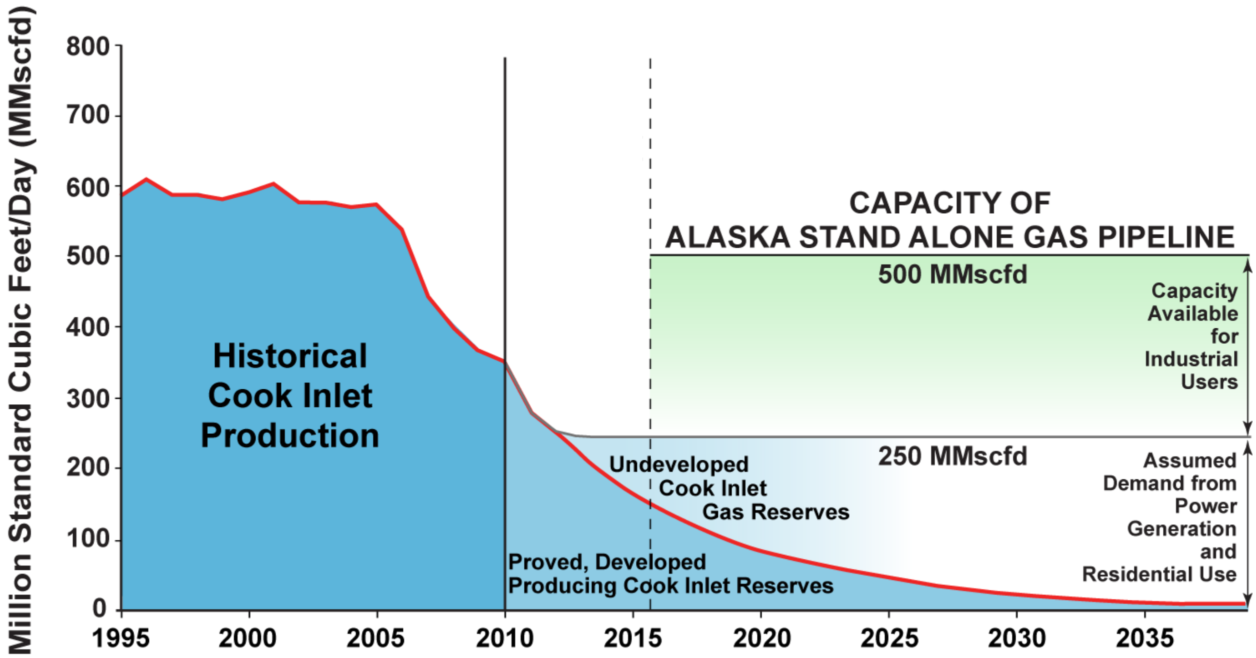
The proposed action is the construction and operation of the proposed Project from the North Slope to the Cook Inlet Area in Southcentral Alaska. The primary purpose of the Project is to provide a long-term, stable supply of up to 500 MMscfd of natural gas and NGLs from existing reserves within North Slope gas fields to markets in the Fairbanks and Cook Inlet areas by 2019. A secondary purpose is to utilize proven gas supplies that are readily available on the North Slope to provide economic benefit to the State of Alaska through royalties and taxes.

1.2.2 Applicant's Stated Need

In 2010, Alaska Statute (AS) 38.34 was passed by the Alaska Legislature. Section 38.34.040 provides for the establishment of an intrastate natural gas pipeline system. The Project is an intrastate project independent of the proposed interstate natural gas pipeline project. TransCanada Alaska Company, LLC (TC Alaska) and ExxonMobil Corporation are studying the feasibility of exporting Alaska's North Slope natural gas via the Alaska Pipeline Project, a proposed large-diameter pipeline. As their studies and export plan continue, the near-term need for additional natural gas supplies to supplement Cook Inlet reserves and to serve developed and developing markets within Alaska remains.

The Cook Inlet gas fields have served the residential and commercial needs of Southcentral Alaska for decades supplying natural gas for heating and electrical power generation (93 percent of generated electricity uses natural gas) (AGDC 2010). The existing Cook Inlet gas fields are currently supplying approximately 200 MMscfd of natural gas to the region for power generation and residential use (AGDC 2010). The fields have also supplied large industrial operations like the liquefied natural gas (LNG) export plant at Nikiski[1] and the Agrium fertilizer facility in Kenai. These existing fields cannot sustain the area's needs without some form of supply expansion. Major new supplies of Cook Inlet natural gas remain unproven. The projected drop in production is illustrated in Figure 1.2-1.

[1] The Kenai plant shipped about 21 billion cubic feet of LNG in 2009, off a peak of 64 billion cubic feet (Anchorage Daily News 2011a). The plant is currently in winterization mode but is scheduled to resume exports in 2012 (Anchorage Daily News 2011b).



Note: Project startup is currently projected for 2019.
Source: AGDC 2010.

FIGURE 1.2-1 Projected Drop in Production at Cook Island Gas Fields

Fairbanks has no long-term source of fuel other than oil. Currently, LNG is trucked in limited supplies to Fairbanks from Cook Inlet suppliers for a small local distribution system[2]. A long-term, affordable energy source is needed for Fairbanks and the interior. Community, commercial, and industrial development in Interior Alaska could be facilitated with a reliable supply of natural gas. Existing and future energy users need access to reliable cost-effective energy.

The proposed Project would fulfill the following needs:

- Relieve a shortfall of natural gas supply in the Cook Inlet area, which is the primary fuel source for heating and electrical power generation, projected in the near future (2013-2015).
- Provide for converting from existing heating sources to natural gas in Fairbanks to reduce harmful air emissions and assist in achieving attainment status. Fairbanks currently is in air pollution non-attainment area status due to particulate matter. Use of oil and wood for heating are major contributors to this problem in winter.
- Provide a stable and reliable supply of natural gas and NGLs to meet current and future demand of up to 500 MMscfd as follows:

[2] Fairbanks Natural Gas, LLC has been providing liquefied natural gas to Fairbanks since 1998. LNG from Cook Inlet is transported to Fairbanks by tanker trucks, stored, gasified and distributed to approximately 1,100 residential and commercial customers (fngas.com). The current source of gas for Fairbanks is the diminishing Cook Inlet gas field.

- 200 MMscfd – Cook Inlet area current demand
- 50 MMscfd – Additional Cook Inlet area future demand - 2030
- 60 MMscfd – Fairbanks current and future demand - 2030
- 60 MMscfd – NGLs to be extracted at the Cook Inlet NGL Extraction Plant Facility for future commercial and industrial use
- 130 MMscfd – Future commercial and industrial use

- Provide a stable and reliable supply of natural gas needed to spur economic development of commercial and industrial enterprises in Fairbanks and the Cook Inlet area.
- Provide economic benefit to the State of Alaska through royalties and taxes. Approximately 82 percent of Alaska's estimated state revenues for 2010 were from oil taxes, royalties, and fees (Reuters 2009).

The proposed pipeline route was selected by the AGDC to minimize total pipeline length and reduce the amount of challenging terrain and geologic design areas, thereby reducing construction impacts. As proposed, approximately 82 percent of the proposed pipeline route is co-located within or closely parallels existing pipeline or highway rights-of-way (ROW) (AGDC 2011).

1.2.3 USACE Project Purpose

As the identified Lead Agency and under the requirements of the National Environmental Policy Act (NEPA) of 1969 as amended (42 USC 4321 et seq.) and the Council on Environmental Quality (CEQ) Regulations for implementing the NEPA (40 CFR 1500-1508), it is the USACE's responsibility to prepare the EIS and define the purpose and need. The USACE policy is to define the basic project purpose and the overall project purpose. The definition of basic project purpose is used to determine water dependency [40 CFR 230.10(a)(3)], and the definition of overall project purpose drives the search for alternatives and is used to evaluate their practicability under the Section 404(b)(1) Guidelines.

1.2.3.1 Basic Project Purpose and Water Dependency

The basic project purpose is the transport of natural gas and NGLs, this is not a water dependent activity. The proposed project is partially sited in a special aquatic site, jurisdictional wetlands; therefore pursuant to 40 CFR 230.10(a)(3), practicable alternatives not involving special aquatic sites[3] are presumed to be available and less environmentally damaging.

The Clean Water Act, Section 404(b)(1) guidelines state, "Where the activity associated with a discharge which is proposed for a special aquatic site (as defined in subpart E) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special

[3] "Special aquatic sites" as found in 40 CFR Part 230, Subpart E include wetlands, sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, riffle and pool complexes.

aquatic sites are presumed to be available, unless clearly demonstrated otherwise."Overall Project Purpose

The overall project purpose is more specific to the applicant's project than the basic project purpose. The overall project purpose is used for evaluating practicable alternatives under the Section 404(b)(1) Guidelines and must be specific enough to define the applicant's needs, but not so restrictive as to preclude all discussion of alternatives. Defining the overall project purpose is the responsibility of the USACE, however, the applicant's needs must be considered in the context of the desired geographic area of the development, and the type of project being proposed. The applicants overall project purpose is to transport 500 MMscfd of natural gas and natural gas liquids from the North Slope of Alaska to Fairbanks, Anchorage and the Cook Inlet area of Alaska by 2019.

1.2.4 Agency Participation

This EIS is intended to fulfill the needs and obligations set forth by the NEPA and other relevant laws, regulations, and policies of the USACE (lead agency) and of the BLM, EPA, NPS, ADNR SPCO, PHMSA, and USCG (cooperating agencies).

1.2.4.1 Lead Agency – U.S. Army Corps of Engineers

As the lead agency, the USACE is responsible for the development of the EIS, as well as necessary permits within its jurisdiction. The USACE has the authority to issue or deny permits for placement of dredged or fill material in the waters of the United States, including wetlands, and for structures in, on, over, or under navigable waters of the United States. Consequently, the USACE's authority extends, and its decisions following completion of the EIS will extend, to the entire proposed Project, regardless of land ownership.

- The NEPA sets policy and provides the means by which the federal government, including both the USACE and the federal cooperating agencies, examines major federal actions that may have significant effects on the environment, such as the authorization of a gas pipeline ROW contemplated in this EIS (42 USC § 4231 et seq.).
- Under Section 404 of the Clean Water Act (CWA) (33 USC § 1251 et seq.), the USACE regulates the discharge of dredged or fill material in waters of the United States, including wetlands.
- Under Section 10 of the Rivers and Harbors Act (33 USC 403), the USACE requires prior approval for any work performed in, on, over, or under navigable waters of the United States, or which affects the course, locations, condition or capacity of such waters.

1.2.4.2 Cooperating Agencies

The BLM, EPA, NPS, ADNR SCPO, PHMSA, and the USCG are participating as cooperating agencies in the NEPA review process and development of the EIS.

Bureau of Land Management (BLM)

The BLM is responsible for land-use authorizations on federal lands. The authority for management of the land and resource development options presented in the EIS comes from several statutes, including the NEPA, the Federal Land Policy and Management Act (FLPMA), the Mineral Leasing Act (MLA), Title VIII and IX of the Alaska National Interest Lands Conservation Act (ANILCA), and the National Trails System Act.

- Under the FLPMA, the Secretary of the Interior has broad authority to regulate the use, occupancy, and development of public lands and to take whatever action is required to prevent unnecessary or undue degradation of public lands (43 USC § 1732). In accordance with the FLPMA, the BLM manages its Alaska lands and their uses to ensure healthy and productive ecosystems.
- Under Section 28, as amended in Section 185(f), of the MLA of 1920, the BLM has the authority to issue Right-of-Way Grants and Temporary Use Permits for all affected federal lands; those actions would be accomplished in accordance with 43 CFR Parts 2800 and 2880, and subsequent 2800 and 2880 Manuals. The AGDC would need to obtain a Right-of-Way Grant and a Temporary Use Permit from the BLM for crossing BLM-managed lands. The AGDC has submitted a STANDARD FORM 299, Application for Transportation and Utility Systems and Facilities on Federal Lands.
- Title VIII of ANILCA establishes procedures for federal agencies to evaluate impacts on subsistence uses and needs and means to reduce or eliminate such impacts (16 USC § 3120).
- Title IX of ANILCA establishes procedures for federal agencies to grant rights-of-way on lands selected by, or granted or conveyed to the State of Alaska under Section 6 of the Alaska Statehood Act (16 USC 410hh-3233, 43 USC 1602-1784).
- Pursuant to the National Trails Systems Act of 1968 (16 USC 1241-1251), the BLM is the statutorily-designated federal administrator for the Iditarod National Historic Trail (INHT), and is the federal point-of-contact for INHT matters.

The BLM's proposed action would be to provide the Alaska Gasline Development Corporation with legal access across federal lands for the construction and operation of a natural gas pipeline to bring gas from the North Slope to Southcentral Alaska. The need for the proposed action is established by the BLM's responsibility under the Mineral Leasing Act to respond to a request for a right-of-way grant for legal access across federal lands submitted by the AGDC to construct and operate a 24-inch high-pressure natural gas pipeline.

U.S. Environmental Protection Agency (EPA)

The EPA authority to regulate the proposed pipeline project is contained in the CWA (33 USC § 1251 et seq.), Clean Air Act (CAA) (42 USC § 7401 et seq.), and the Safe Drinking Water Act (SDWA) (42 USC § 300). Like the authority of the USACE, the EPA's authority extends, and its decisions following completion of the EIS will extend, to the entire Project, regardless of who owns the land.

- Under Section 402 of the CWA (33 USC § 1251 et seq.), the EPA oversees the Alaska Department of Conservation's (ADEC's) administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction[4]. Point-source discharges that require a (APDES) permit include, but are not limited to, sanitary and domestic wastewater, dewatering of gravel pits and construction areas, and hydrostatic test water, storm water discharges, etc. (40 CFR 122).
- Under Section 404 of the CWA (33 USC § 1251 et seq.), the EPA reviews and comments on the USACE Section 404 permit applications for compliance with the Section 404(b)(1) guidelines and other statutes and authorities within its jurisdiction (40 CFR 230).
- Under Sections 165 and 502 of the CAA (42 USC § 7401 et seq.), the State of Alaska is delegated authority to issue air quality permits for facilities operating within state jurisdiction for the Title V operating permit (40 CFR 70) and the Prevention of Significant Deterioration (PSD) permit (40 CFR 52.21) to address air pollution emissions. The EPA maintains oversight authority of the state's program.
- Under Section 309 of the CAA (42 USC §7401 et seq.), the EPA has the responsibility to review and comment on, in writing, the EIS for compliance with the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500–1508).
- Under Sections 3001 through 3019 of the Resource Conservation and Recovery Act (RCRA) (42 USC 3251 et seq.), the EPA establishes criteria governing the management of hazardous waste. Any hazardous waste generated at a facility associated with the proposed Project is subject to the hazardous waste regulations administered by the EPA.
- Under the Oil Pollution Prevention regulations (40 CFR Part 112), the EPA requires facilities that store, use, and manage petroleum products to develop a Spill Prevention, Control and Countermeasure (SPCC) Plan and a Facility Response Plan (FRP). The EPA has the responsibility to review these plans.

[4] On October 31, 2008, the EPA formally approved the state's National Pollutant Discharge Elimination System (NPDES) Program application. The State's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting and compliance and enforcement programs is being transferred to the ADEC over 4 years. Oil and gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.

National Park Service (NPS)

The NPS is responsible for management of lands within Denali National Park and Preserve for the purpose of this EIS. Several specific federal regulations would apply to the proposed action:

- Title XI of the ANILCA would apply to the Denali National Park Route Variation Alternative that involves use of lands within Denali National Park and Preserve Conservation System Unit (CSU). Transportation systems that are proposed to cross a CSU created or expanded by ANILCA require an act of Congress if such transportation system would cross any congressionally-designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska.
- The NPS Organic Act would apply to the Denali National Park Route Variation Alternative that involves use of lands within Denali National Park and Preserve. The Organic Act gives the NPS the authority to grant permits and regulate the use of public lands and to take whatever action is required to prevent unnecessary or undue degradation of these lands.
- The NPS has oversight responsibility for certain state and local recreational resources pursuant to section 6(f)(3) of the Land and Water Conservation Fund (LWCF) Act (Public Law 88-198) and its implementing regulations at 36 CFR Part 59. Section 6(f)(3) would apply to segments of the pipeline constructed within Denali State Park. Section 6(f)(3) prohibits the conversion of property acquired or developed with LWCF grants to a non-recreational purpose without the approval of the NPS and replacement lands of equal value, location and usefulness. In Alaska the section 6(f)(3) program is administered by the Alaska Division of Parks and Outdoor Recreation (ADPOR).

Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)

The ADNR manages development on its lands in the project corridor on which the proposed pipeline ROW is located. A State of Alaska Title 38 Right-of-Way Permit is required for use of State lands. The State of Alaska is responsible for regulating activities and developments on federal, State, and private lands that may affect air or water quality or resident species of fish and wildlife. The State of Alaska also is responsible for providing for subsistence use of fish and wildlife. The EIS studies development options that will help the State of Alaska meet its responsibilities under various state statutes including AS Title 16 (Fish and Game), Title 31 (Oil and Gas), Title 38 (Public Land), Title 41 (Public Resources), and Title 46 (Water, Air, Energy, and Environmental Conservation). Consequently, following completion of the EIS, the State will make some decisions on the entire proposal, while it will make other decisions that rest with the role of manager of state owned lands. The AGDC submitted a Right-of-Way Leasing Act AS 38.35.050 Application for Pipeline Right-of-Way Lease on March 21, 2011. The State of Alaska issued Right-of-Way Lease ADL 418977 to the AGDC on July 25, 2011.

U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA)

The PHMSA is responsible for regulating and ensuring the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines. The USDOT is mandated to provide pipeline safety under Title 49, USC Chapter 601. The PHMSA administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. The USDOT pipeline standards are published in 49 CFR 190 to 199. Part 192 specifically addresses natural gas pipeline safety issues, Part 193 addresses LNG facilities, and Part 195 addresses NGL pipelines. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety.

U.S. Coast Guard (USCG)

The USCG is responsible for any structures erected across navigable waters of the United States. The USCG has authority under the Rivers and Harbors Act of 1899 to approve construction of any bridge including causeways, approaches, fenders and other appurtenances, across navigable waters to ensure safe navigability of waterways. The USCG exercises its authority to prevent unauthorized obstruction or alteration of the nation's navigable waters (33 USC 403). Within the Plan Area, the USCG decisions will address any potential obstruction, including bridges, of navigable rivers and their tributaries.

1.2.4.3 Commenting Agencies

Federal, state and local agencies that are not designated cooperating agencies and have an interest in the proposed pipeline project are considered commenting agencies. An agency scoping meeting was conducted on December 18, 2009 to share information and discuss issues related to the Project. Commenting agencies that participated in the agency scoping process include the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries; NMFS), U.S. Fish and Wildlife Service (USFWS) Alaska Department of Fish and Game (ADF&G), Alaska Department of Environmental Conservation, and the Matanuska-Susitna (Mat-Su) Borough. Additional meetings for commenting agencies will be conducted as the EIS process proceeds.

1.3 TRIBAL CONSULTATION AND COORDINATION

Pursuant to Executive Order 13175 of November 6, 2000, federal agencies are charged with engaging in regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and are responsible for strengthening the government-to-government relationship between the United States and Indian tribes. The USACE follows the United States Department of Defense American Indian and Alaska Native Policy guidance for developing and maintaining government-to-government relationships with federally recognized tribes. This section outlines the USACE's approach to conducting coordination and consultation with tribes for the proposed Project EIS development process.

As the lead agency for this EIS, the USACE is responsible for government-to-government consultation and coordination with federally recognized tribes that may be impacted by this proposed Project. The USACE invited 41 potentially affected federally recognized tribes to participate in the proposed Project EIS NEPA process through coordination and consultation. The tribes considered to be potentially affected by the proposed Project by virtue of their location along the proposed pipeline corridor are:

- Alatna Village
- Allakaket Village
- Village of Anaktuvak Pass
- Arctic Village Council
- Inupiat Community of the Arctic Slope (ICAS) [Indian Reorganization Act (IRA)]
- Native Village of Barrow Inupiat Traditional Government
- Beaver Village Council
- Birch Creek Tribal Council
- Native Village of Cantwell
- Circle Native Community (IRA)
- Cheesh-Na Tribal Council
- Chickaloon Native Village
- Chitina Traditional Indian Village Council
- Village of Dot Lake
- Native Village of Eagle (IRA)
- Native Village of Eklutna
- Evansville Village
- Native Village of Gakona
- Gulkana Village
- Gwitchyaa Gwichin Tribal Government Native Village of Fort Yukon (IRA)
- Healy Lake Village
- Kaktovik Village

- Kenaitze Indian Tribe (IRA)
- Native Village of Kluti-Kaah
- Knik Village
- Manley Hot Springs Village
- Mentasta Lake Tribal Council
- Native Village of Minto (IRA)
- Nenana Native Association
- Ninilchik Traditional Council
- Northway Village
- Native Village of Nuiqsut
- Rampart Village
- Native Village of Stevens (IRA)
- Tanacross Village Council
- Native Village of Tanana (IRA)
- Native Village of Tazlina
- Native Village of Tetlin (IRA)
- Native Village of Tyonek (IRA)
- Native Village of Venetie Tribal Government (IRA)
- Venetie Village Council

It is the USACE's goal to consult early and often with federally recognized tribes that may be impacted by our activities. The following milestones and opportunities for meaningful participation by tribal governments have been provided thus far during the EIS process:

Notification and invitation to consult letter sent (October 19, 2009): An initial notification and invitation to consult letter was sent to the 41 tribes listed above on October 19, 2009. The letter briefly described the Project, offered government-to-government consultation, and invited tribes to a teleconference on November 6, 2009. The letter included a consultation questionnaire for the tribes to return to the USACE indicating their level of interest and expected engagement in the proposed Project EIS. Telephone calls were made to the tribes to ensure that the letters were received and to confirm attendance at the teleconference. Several tribes requested e-mail and fax follow-ups with the letter attached.

Teleconference for tribes (November 6, 2009): The USACE provided the tribes with a toll free teleconference number to join in the first informational discussion regarding the proposed Project and EIS development on November 6, 2009.

Chickaloon meeting (March 16, 2010): On Tuesday, March 16, 2010, USACE representatives travelled to Sutton for a meeting with representatives of the Chickaloon Traditional Council. The Tribal Council had invited the USACE to meet with them to discuss the development of the EIS.

Phone calls to tribes (November 2010): Phone calls were made to the 41 tribes identified above to update their contact information, including current leadership points-of-contact and e-mail addresses.

Invitation to teleconference (November 19, 2010): On November 19, 2010, the USACE e-mailed invitations to the 41 tribes listed above for a second teleconference to be held on December 8, 2010. Some invitations were faxed to those tribes that did not provide an e-mail address. A reminder was sent via e-mail and fax on December 6, 2010.

Teleconference for tribes (December 8, 2010): The USACE provided tribes with a toll free teleconference number to join in the second informational teleconference for tribes to discuss the proposed Project and EIS development on December 8, 2010. A summary of the meeting was sent to the 41 tribes (including those that were not able to attend) via e-mail and fax on December 8, 2010.

Invitation to teleconference (April 12, 2011): On April 12, 2011, the USACE e-mailed invitations to the 41 tribes listed above for the third teleconference to be held on April 28, 2011. Some invitations were faxed to those tribes that did not provide an e-mail address. A reminder was sent via e-mail and fax on April 27, 2011.

Teleconference for tribes (April 28, 2011): The USACE provided the tribes with a toll free teleconference number to join in the third informational discussion regarding the updated Project proposal based on the March 2011 revised Plan of Development (POD) on April 28, 2011. A summary of the meeting was sent to the 41 tribes (including those that were not able to attend) via e-mail and fax on May 6, 2011.

Invitation to teleconference (November 3, 2011): An e-mail invitation was sent to the tribes for a teleconference on November 21, 2011

Teleconference for tribes (November 21, 2011): The USACE provided an update to the project was given including the portions of the project that have been eliminated; Mary Romero was introduced as the new USACE project manager. Tribes were asked how they would like to receive their copy of the Draft EIS and notified of an upcoming teleconference for commenting in early February as well as a follow up teleconference in late March to discuss final comments.

Letter to the Tribes (December 16, 2011): The letter shared the minutes from the teleconference, provided the schedule and call in numbers for the next two teleconferences in February and March; provided a questionnaire to those tribes that were not party to the conference to ask them how they wish to receive a Draft EIS.

1.4 PUBLIC COMMENT PROCESS

1.4.1 Scoping Including Significant Issues Identified

1.4.1.1 Scoping Notice

On December 4, 2009, the USACE published the Notice of Intent (NOI) to prepare an EIS in the *Federal Register*. On the same date, the USACE sent a public notice to affected parties regarding the EIS public scoping meetings and how to obtain more information on the Project. The NOI initiated the scoping period, which was originally scheduled to begin December 7, 2009, and close on February 5, 2010. In response to a request from a project stakeholder, the scoping period was extended to March 8, 2010. This extension was announced through a Public Notice distributed to the original stakeholder mailing list on February 5, 2010. Copies of the NOI and the Public Notice are included in Appendix A of the Scoping Report (Appendix B of this Draft EIS).

Newspaper announcements for the scoping meetings were advertised in the *Copper River Record* on December 3, 2009; the *Delta Wind* online edition on December 7, 2009; the *Fairbanks Daily News Miner* on December 9-10, 2009; the *Anchorage Daily News* on December 14, 2009; the *Mat-Su Valley Frontiersman* on December 10 and 15, 2009; and the *Arctic Sounder* on December 17, 2009. A public service announcement was e-mailed on December 1, 2009, to the KXGA radio station. Online announcements were posted on the Delta News Web calendar on December 2, 2009, and the KSKA Anchorage Public Radio datebook calendar on December 10, 2009.

Scoping period deadline reminders were advertised in newspaper announcements in the *Mat-Su Valley Frontiersman* on January 17, 19, and 22, 2010; the *Copper River Record*, *Delta Wind*, and the *Arctic Sounder* on January 21, 2010; and the *Fairbanks Daily News Miner* on January 22-28, 2010. An online reminder announcement with a link to the Project website was posted on the *Anchorage Daily News* homepage on January 18-24, 2010, and Peg Tileston's *What's Up* on January 22, 2010.

An extension of the scoping period was advertised in newspaper announcements in the *Copper River Record*, *Delta Wind*, and the *Arctic Sounder* on February 18, 2010; and the *Mat-Su Valley Frontiersman* on February 19, 21, and 23, 2010. Online extension announcements with a link to the Project website were posted on the *Anchorage Daily News* and *Fairbanks Daily News Miner* homepages on February 19-26, 2010. Copies of the scoping notices are included in Appendix B of the Scoping Report (Appendix B of this Draft EIS).

1.4.1.2 Public Scoping Meetings

The USACE hosted eight public meetings (see Table 1.4-1) in December 2009. The purpose of these meetings was to disseminate Project information, solicit public input, and identify issues and concerns that the public believed should be addressed in the EIS. The scoping meetings were minimally attended with a few public comments received in some locations. Three scoping meetings did not receive any attendees. Much of the discussion by those in attendance focused on details regarding design, alignment, and the relationship of the proposed Project to other gas pipeline projects.

TABLE 1.4-1 Scoping Meetings, Locations, Dates, and Times

Date	Time	Location	Venue	Venue Address
December 8, 2009	5-8 PM	Glennallen	Tazlina Village Hall	MP 110.5 Richardson Highway, Glennallen
December 9, 2009	5-8 PM	Delta Junction	Delta Junction Community Center	2287 Deborah Street, Delta Junction
December 10, 2009	11 AM – 1 PM	Nenana	Nenana Civic Center	723 North A Street, Nenana
December 10, 2009	5-8 PM	Fairbanks	Pioneer Hall at Pioneer Park	2300 Airport Way, Fairbanks
December 11, 2009	11 AM – 1 PM	Denali National Park/McKinley Village	McKinley Park Community Center	MP 230 Parks Highway, McKinley Park
December 14, 2009	5-8 PM	Anchorage	Anchorage Senior Activity Center	1300 East 19th Avenue, Anchorage
December 15, 2009	5-8 PM	Wasilla	Curtis D Menard Memorial Sports Center	1001 South Mack Drive, Wasilla
December 16, 2009	2-6 PM	Barrow	Inupiat Heritage Center	5421 North Star Street, Barrow

Each meeting included an open house, a brief formal presentation, and a public question and comment period. The same Project information was presented at all public meetings. A court reporter recorded transcripts of each of the public scoping meetings with attendees. These transcripts are included in Appendix F of the Scoping Report (Appendix B of this Draft EIS).

An agency scoping meeting was held on December 18, 2009, at 1:00 p.m. at the BLM Office in Anchorage. This meeting provided a specific opportunity for agencies to hear the scoping meeting presentation and to ask questions of clarification regarding the proposed Project. The presentation and discussion served as a common foundation for identification of issues and concerns by federal and state agencies with jurisdiction and responsibility for resources potentially affected by the proposed Project. The agencies were asked to provide their scoping comments in writing. Comment submissions are included in Appendix D of the Scoping Report (Appendix B of this Draft EIS).

1.4.1.3 Comments Received and Issues Identified during Scoping

Seventeen unique comment submissions were received during the scoping period, including four from state or federal agencies, one from local government, one State Representative and eleven from non-profit organizations, businesses and the general public. In addition, oral comments were provided and recorded at all meetings, with the exception of the agency meeting in Anchorage and the scoping meetings with no attendance (Glennallen, Delta Junction, and Wasilla). All scoping submissions and comments from members of the public can be seen in their entirety in Appendix E of the Scoping Report (Appendix B of this Draft EIS).

Table 1.4-2 summarizes the most common issues raised during the scoping period along with the section in this EIS that addresses the concern.

TABLE 1.4-2 Comments Received on Environmental Issues during the Public Scoping Process for the Proposed Project

Issue	Comment	Section where Comment / Issue Addressed in EIS
Public Involvement	Comments were received regarding communication and outreach to communities and with other projects. One commenter suggested a citizen's advisory group for the Project. Comments were received regarding other in-state and inter-state pipeline projects.	1.7
Alternatives	One commenter requested an oil line in addition to the proposed gas line from Gubik. Another commenter requested Gubik region gas to be a source option for the proposed gas line. One commenter suggested the East Curry Route Alternative, not included in the project documents, which would bypass the Parks Highway.	4.0
Wildlife and Fisheries	Comments were received identifying impacts to wildlife and fisheries habitat.	5.5 and 5.6
Land Use/Recreation	Comments identified competing land uses along the proposed route. One commenter submitted 225 signatures on a petition to include multi-use paths in the Project design.	5.9 and 5.11
Socioeconomic	Commenters suggested the EIS include a cost/benefit analysis of the Project, local use of natural gas, health impact analysis and environmental justice.	5.13
Cumulative Impacts	Comments were received regarding cumulative impacts, fish and wildlife habitat impacts, future development of minerals and petroleum products.	5.20

1.4.2 Additional Public Outreach

Due to the length of time since the end of the scoping period, change in the applicant, and refinements in the Project description, the USACE posted a newsletter on March 23, 2011, on the Project website[5]. The newsletter was also distributed through the stakeholder mailing list. The newsletter provided a summary of the scoping meetings, a timeline of the NEPA process, details on the Project history, and a description of the next steps regarding the analysis of alternatives. Two additional newsletters will be distributed during later stages of the NEPA process.

1.5 PERMITS, APPROVALS, COMPLIANCE WITH EXECUTIVE ORDERS AND REGULATORY REQUIREMENTS

This EIS is intended to fulfill the needs and obligations set forth by the NEPA and other relevant laws, regulations, and policies of the lead and cooperating agencies, as described in Section 1.2.4 above. Several other federal, state, and local government agencies have authorities that apply to the proposed action. These include the following federal agencies: U.S. Fish and Wildlife Service (USWFS), and NOAA Fisheries. State agencies with authority applicable to the proposed action include the ADEC, ADF&G, Alaska Department of Transportation and Public

[5] A copy of the newsletter can be viewed on the project website, at http://asapeis.com/Newsletter.aspx.

Facilities (ADOT&PF), and the Alaska Railroad Corporation (ARRC). Local authorities include the North Slope Borough (NSB), Fairbanks North Star Borough (FNSB), Denali Borough, Mat-Su Borough, and the City of Nenana. Table 1.5-1 summarizes authorities that apply to the proposed action.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Federal		
Federal Laws and Executive Orders Common To Multiple Federal Agencies		
Alaska National Interest Lands Conservation Act (ANILCA) 16 USC 410hh-3233 43 USC 1602-1784 43 CFR 36	Title XI: SF 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands. Transportation systems that are proposed to cross a conservation system unit (CSU) created or expanded by ANILCA require an act of Congress if such a transportation system would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a right of way for the particular type of transportation system proposed, such as a natural gas pipeline across National Park Service units in Alaska. Section 906(k) requires state concurrence on selected lands prior to granting ROW. Title VIII: Section 810 – Federal agencies must evaluate and provide a proposed finding of effects of proposed development on subsistence.	Minimize impacts to CSUs through the approval or disapproval of transportation and utility system applications across public lands in Alaska. Provide the opportunity for rural Alaska residents to continue to engage in a subsistence way of life.
American Indian Religious Freedom Act of 1978 42 USC 1996	Federal agencies must consider protection of sites considered sacred to Native Americans.	Reaffirm Native Americans' right to religious freedom, "including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites."
Executive Order 11514 – Protection and Enhancement of Environmental Quality	The EPA reviews and evaluates the Draft and Final EIS for compliance with Council on Environmental Quality (CEQ) guidelines.	This Executive Order details the responsibilities of federal agencies and the CEQ in directing their policies, plans, and programs to meet national environmental goals.
Executive Order 11988 – Floodplain Management	Federal agencies must establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for actions undertaken in a floodplain. Impacts to floodplains are to be avoided to the extent practicable.	Protect floodplains and manage risk from flooding.
Executive Order 11990 – Protection of Wetlands	Federal agencies must avoid short- and long-term adverse impacts to wetlands whenever a practicable alternative exists.	Protect wetlands.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Federal agencies must develop environmental justice (EJ) strategies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (including Native American tribes).	Protect the health and environment of minority and low-income populations.
Executive Order 13007 – Indian Sacred Sites	Federal agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.	Protect and accommodate access to Native American sites.
Executive Order 13112 – Invasive Species	Federal agencies are to prevent the introduction of invasive species, control those that are introduced, and provide for the restoration of native species.	Prevent the introduction of invasive species and provide for their control.
Executive Order 13175 – Consultation and Coordination with Indian Tribal Governments	Federal agencies must establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, strengthen the government-to-government relationships with Indian tribes, and reduce the imposition of unfunded mandates upon Indian tribes.	Encourage communication and active cooperation between the federal government and Native American tribal governments.
Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds	Federal agencies must avoid or minimize the impacts of their actions on migratory birds and take active steps to protect birds and their habitat.	Protect migratory bird habitat and populations.
Executive Order 13212 – Actions to Expedite Energy-Related Projects	Federal agencies must take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.	Increase production and transmission of energy in a safe and environmentally sound manner.
National Environmental Policy Act (NEPA) 42 USC 4321	The NEPA of 1969 requires all federal agencies to prepare a detailed statement of the environmental effects of proposed federal actions that may significantly affect the quality of the human environment.	Protect the environment through procedures that ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken.
National Historic Preservation Act (NHPA) of 1966 16 USC 470 et seq.	Federal agencies are responsible for ensuring protection of historical, cultural, and archaeological sites and resources in the USACE's permit areas.	Ensure consideration of the values of historic properties in carrying out federal activities. Make efforts to identify and mitigate impacts to significant historic properties.
Native American Graves Protection and Repatriation Act 25 USC 3001	Discovery or disturbance of any human remains in the Project area must be accounted for and protected and/or properly returned to the tribe of origin.	Protect Native American sacred and grave sites.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
	Bureau of Land Management (BLM)	
Alaska Native Claims Settlement Act (ANCSA) 14 USC 33 1601-1629g	The BLM is responsible for consultation with Native Corporations on selected lands prior to granting a ROW, and for transfer of federal lands to Native corporations and villages.	The ANCSA established Alaska Native land entitlements.
Federal Land Policy and Management Act (FLPMA) 43 USC § 1732, and 43 CFR 2800	The BLM has the authority to grant permits and regulate the use, occupancy, and development of the public lands and to take whatever action is required to prevent unnecessary or undue degradation of the public lands.	Provide for multiple uses of public lands while protecting them from unnecessary or undue degradation.
National Trails Systems Act of 1968 16 USC 1241-1251	The BLM is the statutorily-designated federal administrator for the INHT, and is the federal point-of-contact for INHT matters.	Requires the BLM to identify segments and sites for inclusion in National Historic Trail System; coordinate protection and/or improvement of Trail System, and liaison between land managers, private trail organizations, and trail managers by providing an information network.
Rights of Way, under the Mineral Leasing Act 43 CFR 2880 Mineral Leasing Act of 1920	The BLM has the authority to approve a Federal Pipeline Grant of ROW and associated Temporary Use Permits (TUP) across federal lands.	Provide for mineral development on public lands while protecting them from unnecessary or undue degradation.
Wilderness Act of 1964 16 U.S.C. 1131 et seq.		Establishes definition of wilderness and is used in identifying lands with wilderness characteristics.
	U.S. Army Corps of Engineers (USACE)	
Clean Water Act (CWA) of 1972 33 USC 1344	The USACE issues a Section 404 permit for discharge of dredged and fill material into U.S. waters, including wetlands.	Minimize impacts to waters of the United States (including wetlands) by regulating the discharge of dredged and/or fill material.
Rivers and Harbors Act of 1899 33 USC 403	The USACE issues Section 9 and Section 10 permits for structures or work in, or affecting, navigable waters of the U.S.	Prevent unauthorized obstruction or alteration (dam, dike, or other structure) of any navigable waters of the United States.
	U.S. Environmental Protection Agency (EPA)	
Clean Air Act of 1967, Amended 1977 (CAA) 42 USC 7401 et seq.	As oversight the EPA conducts a review and evaluation of the Draft and Final Environmental Impact Statement (EIS) as authorized by Section 309 of the CAA.	Protect and enhance the quality of the nation's air resources by controlling emissions of EPA-designated air pollutants by stationary and mobile sources. The EPA maintains oversight of the Alaska Department of Environmental Conservation's (ADEC's) implementation of the federal Prevention of Significant Deterioration (PSD) program through its state implementation plan.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
CWA of 1972, Amended 1977 33 USC 1251 et seq.	The National Pollutant Discharge Elimination System (NPDES) Permit program is administered under Section 402, Federal Water Pollution Control Act of 1972, as amended (CWA) for discharges of pollutants, including oil and gas, from a point source into waters of the United States. Through program delegation, the EPA oversees the ADEC's administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction. Authority for Oil and Gas facilities will be delegated on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility. Section 402 – NPDES Water Discharge Permit. The ADEC previously issued coverage under AKG-33-0000 for hydrostatic testing and discharges of excavation, dewatering, and stormwater from temporary camps, or an individual permit covering these discharges could be issued. AKG-33-0000 is currently expired but has been proposed for reissuance. Section 311 – The EPA provides a Federal On-Scene Coordinator responsible for direction and monitoring of spills. The EPA also issues spill prevention, control, and countermeasure (SPCC) plan and facility response plan (FRP) approvals for storage of more than 1,320 gallons in aggregate in aboveground tanks with capacity of 55 gallons or more. Section 404 – The EPA reviews and comments on permit applications for compliance with Section 404(b)(1) guidelines and other statutes and authorities within their jurisdiction.	The purpose of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. It prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 402 establishes guidelines for effluent discharges from point-sources to the waters of the United States and for the NPDES permitting program. Section 311 establishes procedures, methods and equipment, and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines. The purpose of Section 404 is to minimize impacts to waters of the United States (including wetlands) by regulating the discharge of dredged and/or fill material.
Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act 42 USC 9601	The EPA implements facility reporting requirements to state and federal agencies for releases of hazardous substances in excess of specified amounts.	Protect public health and the environment from risks posed by uncontrolled hazardous waste sites.
Resource Conservation and Recovery Act of 1976 (RCRA) 42 USC 6901	The EPA develops and implements regulatory programs to manage hazardous waste from generation until ultimate disposal, including issuing an identification number for any entity that generates hazardous wastes.	The protection of human health and environment from the potential hazards of waste disposal, conservation of energy and natural resources, waste reduction, and environmentally sound waste management.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Toxic Substances Control Act 15 USC 2601	The EPA develops and implements regulatory requirements for the testing of new and existing chemical substances and regulates the treatment, storage, and disposal of certain toxic substances.	The protection of human health and the environment from hazardous chemicals.
U.S. Coast Guard (USCG)		
Rivers and Harbors Act of 1899 33 USC 403	The USCG approves construction of a bridge across navigable waters to ensure safe navigability of waterways.	Prevent unauthorized obstruction or alteration (dam, dike, or other structure) of any navigable waters of the United States.
U.S. Department of Transportation, Hazardous Materials Safety Administration (USDOT, PHMSA)		
Pipeline Safety Regulations Title 49 CFR Parts 190-199 Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006 Public Law 109-468 The Pipeline Safety Statute 49 USC 60101-60301	Pipeline transportation and pipeline facilities must meet the minimum safety standards as regulated and enforced by the USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA).	To enable the USDOT PHMSA to achieve and maintain pipeline safety. To provide for enhanced safety and environmental protection in pipeline transportation, and to provide for enhanced reliability in the transportation of the Nation's energy products by pipeline. To provide adequate protection against risks to life and property posed by pipeline transportation and pipeline facilities by improving the regulatory and enforcement authority of the Secretary of Transportation.
Hazardous Materials Transportation Act 49 USC 1801-1819	Hazardous materials must be transported according to USDOT regulations.	The Secretary of Transportation must protect the nation adequately against risks to life and property that are inherent in the transportation of hazardous materials.
U.S. Fish and Wildlife Service (USFWS)		
Fish and Wildlife Coordination Act (FWCA) 16 USC 661 et seq. FWCA of 1980 16 USC 2901	The USFWS provides consultation on effects to fish and wildlife resources. The USFWS consults with the state agency responsible for fish and wildlife resources to conserve or improve wildlife resources.	Ensure that fish and wildlife resources receive equal consideration to other project features. Conserve and promote conservation of non-game fish and wildlife species and their habitats.
Bald and Golden Eagle Protection Act 16 USC 668	The USFWS permits relocation of bald and golden eagle nests that interfere with resource development or recovery operations.	Protect bald eagle populations.
Marine Mammal Protection Act (MMPA) 16 USC 1361-1407	The USFWS issues a Letter of Authorization for incidental takes of marine mammals including polar bear and walrus.	Ensure that marine mammal populations are maintained at, or in some cases restored to, healthy population levels.
Migratory Bird Treaty Act (MBTA) 16 USC 703	The USFWS implements provisions of the Migratory Bird Protection Act.	Protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Endangered Species Act of 1973 (ESA) 16 USC 1531	The USFWS provides consultation on effects to threatened or endangered species, and to designated critical habitat, and issues incidental take authorizations.	Protect wildlife, fish, and plant species in danger of becoming extinct, and conserve the ecosystems on which endangered and threatened species depend.
National Oceanic and Atmospheric Administration (NOAA) Fisheries		
FWCA 16 USC 661 et seq.	The NOAA Fisheries (NMFS) provides consultation regarding effects on fish and wildlife resources.	Ensure that fish and wildlife resources receive equal consideration to other project features.
Magnuson-Stevens Fishery Management and Conservation Act 16 USC 1801-1883	The NOAA Fisheries provides consultation on the effects on Essential Fish Habitat. Essential Fish Habitat includes habitats necessary to a species for spawning, breeding, feeding, or growth to maturity.	Protect fish habitats and populations.
MMPA 16 USC 1361-1407	The NOAA Fisheries provides consultation regarding effects on marine mammals. The NOAA Fisheries issues Incidental Harassment Authorization under the Marine Mammal Protection Act (MMPA) for incidental takes of certain protected marine mammals (ringed seals, bowhead whales, etc.).	Ensure that marine mammal populations are maintained at, or in some cases restored to, healthy population levels.
The ESA of 1973 16 USC 1531	The NOAA Fisheries provides consultation on effects to threatened or endangered species, and to designated critical habitat, and issues incidental take authorizations.	Protect certain species of marine mammals and fish in danger of becoming extinct, and conservation of the ecosystems on which endangered and threatened species depend.
National Park Service (NPS)		
National Park Service Organic Act 39 Stat. 535, 16 U.S.C. 1 et seq., as amended	The NPS has the authority to grant permits and regulate the use of public lands and to take whatever action is required to prevent unnecessary or undue degradation of these lands.	Promote and regulate the use of the national parks, monuments, and reservations for the purpose of conserving the scenery, natural and historic objects, and wildlife and to provide for the enjoyment of these lands in a manner that will leave them unimpaired for the enjoyment of future generations.
Section 6(f) of the Land and Water Conservation Fund (LWCF) 16 U.S.C 4601 et seq.	Prohibits the conversion of property acquired or developed with LWCF grants to a non-recreational purpose without the approval of the NPS.	Assures that replacement lands of equal value, location and usefulness are provided as conditions to approval of conversion of lands acquired with LWCF funds.
U.S. Department of the Treasury		
Treasury Department Order No. 120-1	The U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms requires that applicants obtain a Permit to Purchase Explosives for Blasting prior to the purchase, storage, and use of explosives for conducting blasting activities.	Regulates blasting activities to ensure public safety.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
State		
Alaska Department of Environmental Conservation (ADEC)		
CAA of 1967, Amended 1977 42 USC 7401 et seq. (CAA) Air Quality Control 18 AAC 50 et seq.	The ADEC issues Air Quality Control permits to construct and to operate. The ADEC issues Title V Operating permits and prevention of significant deterioration (PSD) permits for air pollutant emissions under the CAA Amendments (Title V).	Identify, prevent, abate, and control air pollution in a manner that meets the purposes of AS 46.03, AS 46.14, and 42 U.S.C. 7401 - 7671q (CAA).
CWA of 1972, Amended 1977 33 USC 1251 et seq.	Section 401 – Requires the ADEC to certify that federal permits meet standards set by the Water Quality Standards program. The ADEC reviews and approves Storm Water Discharge Pollution Prevention Plans.	Establishes guidelines for effluent discharges from non-point sources to the waters of the United States and the NPDES permitting program.
CWA of 1972, Amended 1977 33 USC 1251 Wastewater Disposal 18 AAC 72 Alaska Pollutant Discharge Elimination System 18 AAC 83 Water Quality Standards 18 AAC 70 Drinking Water Standards 18 AAC 72	The ADEC provides approval for domestic wastewater collection, treatment, and disposal plans for domestic wastewaters. The ADEC requires a permit for disposal of domestic and non-domestic wastewater. The ADEC is fully authorized to administer the EPA's NPDES program through the Alaska Pollutant Discharge Elimination System (APDES). Existing regulations at 18 AAC 15 and 18 AAC 72 were amended to comply with the Clean Water Act. The ADEC provides approval for treatment and disposal plans for industrial wastewaters.	Regulation of discharges to protect water quality. On October 31, 2008, the EPA formally approved the state's NPDES Program application. The state's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting and compliance and enforcement programs is being transferred to the ADEC over four years. Oil and Gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to the DEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
RCRA of 1976 42 USC 6901 18 AAC 60.430. – AS 46.03.005, 010 Permit Application 18 AAC 60.210-.215	The ADEC reviews and approves solid waste processing and temporary storage facilities plans for handling and temporary storage of solid waste on state lands. The ADEC reviews permits for solid waste landfills on state lands.	The protection of human health and environment from the potential hazards of waste disposal, conservation of energy and natural resources, waste reduction, and environmentally sound waste management.
Permit and Registration Requirements 18 AAC 31.020	The ADEC may issue permits for persons seeking to operate a food establishment.	Protect public health through the regulation of food establishments.
System Classification and Plan Approval 18 AAC 80.200	The ADEC may issue approval of drinking water plans.	Protect public health through regulating the provision of drinking water.
Open Burning 18 AAC 50.065	The ADEC enforces air quality requirements for open burning, and requires a permit for controlled open burning of forest land, vegetative cover, fisheries, or wildlife habitat in excess of 40 acres annually.	Protect public health through the regulation of open burning.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Oil and Hazardous Substances Pollution Control Regulations 18 AAC 75	The ADEC requires installations or facilities having an effective aboveground or belowground storage capacity of 10,000 barrels (420,000 gallons) of non-crude oil to prepare an Oil Discharge Prevention and Contingency Plan.	Protect public health through regulation of the storage of non-crude oil.
	Alaska Department of Fish and Game (ADF&G)	
The Fish and Wildlife Conservation Act of 1980 16 USC 2901 The Fish and Wildlife Conservation Act of 1980 16 USC 661 et seq.	The ADF&G consults with the USFWS about fish and wildlife resources to conserve or improve wildlife resources. The ADF&G provides comments and recommendations to federal agencies pursuant to the FWCA.	Conserve and promote conservation of non-game fish and wildlife species and their habitats. Ensure that fish and wildlife resources receive equal consideration to other project features.
Anadromous Fish Act AS 16.05.871 Fishway Act AS 16.05.841	An individual or governmental agency notifies and obtains authorization from the ADF&G for activities that could use, divert, obstruct, pollute, or change natural flow of specified anadromous fish streams.	Protect the integrity of the various rivers, lakes, and streams or parts of them that are important for the spawning, rearing, or migration of anadromous fish.
Activities Requiring a Special Area Permit 5 AAC 95.420	A special area permit must be obtained from the ADF&G for activities (except for lawful hunting, trapping, fishing, viewing, and photography) occurring in state game refuges, state recreation areas, across designated wild and scenic rivers, or through state parks.	Prevent significant effects to vegetation, drainage, water quality, soil stability, fish, wildlife, or their habitats.
License, Permit, and Tag Fees; Surcharge; Miscellaneous Permits to Take Fish and Game AS 16.05.340	The ADF&G may issue a permit to collect fish and game, subject to limitations and provisions that are appropriate, for a scientific, propagative, or educational purpose.	To permit and regulate the collection of fish and game.
Permit for Scientific, Educational, Propagative, or Public Safety Purposes 5 AAC 92.033	The ADF&G may issue a permit for the taking, possessing, importing, or exporting of game for scientific, educational, propagative, or public safety purposes.	
	Alaska Department of Natural Resources (ADNR)	
Alaska Historic Preservation Act AS 41.35.010 to .240 NHPA of 1966 16 U.S.C 470 et seq. 36 CFR 800 Sections 106 and 110 The Archeological Resources Protection Act of 1979 16 USC 470	Section 106 of the NHPA requires consultation with the Alaska State Historic Preservation Office (SHPO) and, when there are effects on cultural resources listed on or eligible for inclusion in the National Register of Historic Places (NRHP), with the President's Advisory Council on Historic Preservation. The SHPO issues a Field Archaeology Permit for archaeological fieldwork on state lands. The SHPO would also be consulted by the USACE. The ADNR Office of History and Archeology (OHA) issues a Cultural Resources Concurrence for developments that may affect historic or archaeological sites.	Protect cultural and archaeological resources to ensure consideration of the values of historic properties in carrying out federal activities and to make efforts to identify and mitigate impacts to significant historic properties. The Archeological Resources Protection Act secures the protection of archaeological resources and sites on public and Native American lands and encourages the exchange of information between involved individuals and entities.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Public Land Act Material Sales AS 38.05.110 Permits AS 38.05.850 Mining Sites Reclamation Plan Approvals AS 27.19	The ADNR issues a Material Sales Contract for mining and purchase of gravel from state lands. The ADNR issues Right-of-Way (ROW) and Land Use permits for use of state land, ice road construction on state land, and state waters. The ADNR approves mining reclamation plans on state, federal, municipal, and private land and water.	Manage use of Alaska's land and water resources.
Right of Way (ROW) Leasing Act AS 38.35.020	The ADNR Joint Pipeline office issues pipeline ROW leases for pipeline construction and operation across state lands. The ADNR Commissioner signs the leases and the State Pipeline Coordinator manages the leases.	Manage use of Alaska's land and water resources.
Water Use AS 46.15	The ADNR Division of Land, Mining and Water Management issues a Temporary Water Use Authorization for water use necessary for construction and operations. The ADNR issues a Water Rights Permit for appropriation of a significant amount of water on other than a temporary basis.	Manage use of Alaska's land and water resources.
Duties and Powers of Department of Natural Resources, Limitations AS 41.21.020 Section 6(f) of the Land and Water Conservation Fund (LWCF) 16 U.S.C 4601 et seq.	The ADNR has the responsibility for outdoor recreation planning and administering the LWCF program within Alaska.	Assures that replacement lands of equal value, location and usefulness are provided as conditions to approval of conversion of lands acquired with LWCF funds.
Alaska Department of Transportation and Public Facilities (ADOT&PF)		
Chapter 25 Operations, Wheeled Vehicles: Oversize and Overweight Vehicles 17 AAC 25.300	The ADOT&PF issues permits for oversize or overweight vehicles.	To protect Alaska's highway investments by regulating the transport of oversize and overweight loads on Alaska highways.
Chapter 25 Operations, Wheeled Vehicles: Transportation of Hazardous Materials, Hazardous Substances, or Hazardous Waste 17 AAC 25.200	The ADOT&PF regulates the transportation of hazardous materials, hazardous substances, or hazardous waste by vehicles.	To ensure compliance at the State level with the Hazardous Materials Transportation Act (49 USC 1801-1819); to protect the State adequately against risks to life and property that are inherent in the transportation of hazardous materials.
Utility Permits 17 AAC 15.011	The ADOT&PF issues permits authorizing the applicant to construct or install utility facilities within a department right-of-way.	Protect the public interest by ensuring that utility facilities do not adversely affect the design, construction, maintenance, safety, or operation of highways within the State.

TABLE 1.5-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Alaska Railroad Corporation (ARRC)		
Alaska Railroad Corporation Act of 1984 AS 42.40.10 et seq.	The ARRC requires developers to obtain a permit from the ARRC prior to use of ARRC-owned lands.	The Act created the ARRC as a self-sustaining, State-owned corporation. ARRC has the authority to support its operations by generating revenue from freight, passenger and real estate services.
Alaska Division of Homeland Security & Emergency Management (DHS&EM)		
Hazardous Chemicals, Materials, and Wastes AS 29.35.500	The State Emergency Response Commission (SERC) enforces reporting and planning requirements for facilities that handle, store, and/or manufacture hazardous materials.	To implement the Superfund Amendments and Reauthorization Act at the state and local levels in order to support emergency response planning and community right-to-know relative to hazardous materials.
Local		
North Slope Borough (NSB)		
NSB Land Management Regulations (NSBMC §§ 19.10.010 – 19.70.060)	The NSB requires compliance with its zoning and permitting ordinances and issues permits for development, uses, and activities on land within the NSB.	The NSB regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of NSB residents and to ensure compliance with environmental policies of local concern.
Fairbanks North Star Borough (FNSB)		
FNSB Title 18 Zoning Code (§§18.02-18.58)	The FNSB requires compliance with its zoning code. The borough requires that an approved zoning permit be acquired prior to any excavation, construction, relocation, or installation for a new land use.	The FNSB regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of FNSB residents and to ensure compliance with environmental policies of local concern.
Denali Borough		
DB Title 9 Land Use Code (§§9.05.10 - 9.25)	The Denali Borough requires compliance with its Land Use Code, which includes the Comprehensive Land Use Plan, zoning code, and gas exploration and development ordinance (Chapter 9.25.010).	The Denali Borough regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of Denali Borough residents and to ensure compliance with environmental policies of local concern.
Matanuska-Susitna (Mat-Su) Borough		
MSB Title 17 Zoning (§§17.01-17.125)	The Mat-Su Borough requires compliance with its zoning code. All land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit.	The Mat-Su Borough regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of Mat-Su Borough residents and to ensure compliance with environmental policies of local concern.
City of Nenana		
Land Use Permit	Development within the City requires mayoral approval of a Land Use Permit.	The City of Nenana maintains oversight over development within the City.

1.6 REFERENCES

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2.0 PROJECT DESCRIPTION

2.1 PROPOSED FACILITIES AND LAND REQUIREMENTS

2.1.1 Pipeline Facilities

The AGDC proposes to construct, operate, and maintain approximately 737 miles of new 24-inch-diameter intrastate natural gas transmission pipeline, approximately 34 miles of new 12-inch-diameter pipeline lateral, one or two standalone compressor stations (CS), a gas conditioning facility (GCF), a straddle and off-take facility, the Cook Inlet Natural Gas Liquid Extraction Plant (NGLEP) Facility, three meter stations, 37 mainline valves, five pig[1] launcher and/or receiver facilities, and other permanent facilities. The proposed Project would extend from a point near Prudhoe Bay in the North Slope Borough (NSB) south to the Matanuska-Susitna (Mat-Su) Borough near Cook Inlet. The general location of the proposed Project facilities is shown in Figure 1.0-1. The Fairbanks Lateral would diverge from the proposed mainline and extend through Yukon-Koyukuk Census Area (YKCA) and Fairbanks North Star Borough (FNSB). The proposed Project would connect with Central Gas Facility near Prudhoe Bay, to the Fairbanks natural gas distribution system, and to ENSTAR Natural Gas Company's (ENSTAR) pipeline system. Additional information regarding the transportation of gas between the Prudhoe Bay Central Gas Facility and the proposed pipeline can be found in Section 3, Connected Actions.

The AGDC anticipates that initial Project natural gas flow would be less than 250 MMscfd, but a peak capacity of 500 MMscfd has been proposed to meet anticipated future demands. The design capacity of the Fairbanks Lateral would be approximately 60 MMscfd.

In this EIS, the locations of specific features along the proposed mainline pipeline route, such as Project facilities and environmental resources, are identified by milepost (MP). Similarly, the locations of specific features along the proposed Fairbanks Lateral route are identified by MP Fairbanks Lateral (FL). Further, the analysis contained in Section 5 of this EIS is presented for each of four proposed Project segments. Table 2.1-1 provides the location, MP, borough, and length information for the pipeline facilities associated with each of the proposed Project segments.

2.1.2 Aboveground Facilities

The AGDC proposes to construct and operate a GCF, at least one stand alone natural gas-fired compressor station, a straddle and off-take facility, the Cook Inlet NGLEP Facility, meter stations, mainline valves (MLVs), and pig launcher/pig receiver facilities. MLVs would be located at intervals not greater than 20 miles. Approximately 37 MLVs will be necessary to accommodate this spacing requirement. However, the specific locations of MLVs will be

[1] A pig is a mechanical tool used to clean and/or inspect the interior of a pipeline.

determined during the pipeline design process. Table 2.1-2 contains the locations for these facilities. Approximate land requirements are described in Section 2.1.3 below and summarized in Table 2.1-3.

TABLE 2.1-1 Pipeline Crossing Lengths for the Project

Segment	Boroughs/Census Area	Milepost (MP)		Length (miles)
		Begin	End	
Mainline				
GCF to MP 540	North Slope	0	186.8	186.8
	Yukon-Koyukuk	186.8	490.5	303.7
	Denali	490.5	540.0	49.5
Segment Subtotal				**540.0**
MP 540 to MP 555	Denali	540.0	555.0	15.0
Segment Subtotal				**15.0**
MP 555 to End	Denali	555.0	575.6	20.6
	Matanuska-Susitna	575.6	736.4	160.8
Segment Subtotal				**181.4**
Mainline Total				**736.4**
Fairbanks Lateral				
	Yukon-Koyukuk	0	4.8	4.8
	Fairbanks North Star	4.8	34.4	29.6
Lateral Total				**34.4**
Project Total				**770.8**

[a] The segment through the Denali Borough is broken into two segments so the Denali National Park Route Variation and the segment it would replace may be evaluated and compared separate from one another. A description of the Denali National Park Route Variation is located in Section 4.0.

To increase the volume of natural gas transported through a pipeline, the gas is transported under pressure. The maximum allowable operating pressure (MAOP) of the proposed Project mainline pipeline would be 2,500 pounds per square inch gauge (psig). This would be the first 2500 psi transmission pipeline to operate in a public area within the USA. The MAOP for the Fairbanks Lateral would be 1,400 psig. Flow of natural gas through a pipeline causes friction, which results in a reduction of pressure. Compressors are used to increase the pressure and keep the flow of natural gas moving through the pipeline at an appropriate rate. Further, a gas compressor would be installed at the Cook Inlet NGLEP Facility, as discussed further below, to provide sufficient compression of gas for the ENSTAR Pipeline System.

While US cross-country pipelines currently transport high pressure product such as CO2, and natural gas pipelines in Canada are routinely designed for and operated at high pressures, this proposed pipeline would be among the highest pressures currently planned for natural gas transmission lines in the US. Among other lines being planned for high pressure is the Alaska Pipeline Project.

The proposed Project is planned to operate at 2,500 psi in order to maintain a dense phase fluid in the line. If the pipeline is operated at sufficient pressures, two phases (liquid and vapor) will not form and a single, dense phase fluid will be maintained. Further, if the minimum temperature of the fluid is at all times greater than the critical temperature of the mixture, the dense phase fluid will have the properties of a gas.

The word "fluid" refers to anything that will flow and applies equally well to gas and liquid. Dense phase has a viscosity similar to that of a gas, but a density closer to that of a liquid. Because of its unique properties, dense phase has become attractive for transportation of natural gas. Pipelines have been built to transport natural gas in the dense phase due to its higher density, and this also provides the added benefit of no liquids formation in the pipeline. The proposed Project is designed to transport both natural gas and natural gas liquids (an "enriched" gas composition) in order to maximize market opportunities.

TABLE 2.1-2 Aboveground Facilities for the Proposed Project

Type of Facility	Facility ID Number or Name	Borough/Census Area	MP	Project Segment
GCF		North Slope	MP 0.0	GCF to MP 540
Compressor Stations (CS)	GCF Compressor	North Slope	MP 0.0	GCF to MP 540
	CS 1[a]	Yukon-Koyukuk	MP 225.1	GCF to MP 540
	CS 2[a]	Yukon-Koyukuk	MP 285.6	GCF to MP 540
	CS 3/Straddle and Off-Take Facility Compressor[a, b]	Yukon-Koyukuk	MP 458.1	GCF to MP 540
	Cook Inlet NGLEP Facility Compressor	Matanuska-Susitna	MP 736.4	MP 555 to End
Straddle and Off-Take Facility[b]		Yukon-Koyukuk	MP 458.1	GCF to MP 540
NGL Extraction Facility	Cook Inlet NGLEP Facility	Matanuska-Susitna	MP 736.4	MP 555 to End
Meter station		North Slope	MP 0.0	GCF to MP 540
		Yukon-Koyukuk	MP 458.1	GCF to MP 540
		Matanuska-Susitna	MP 736.4	MP 555 to End
Pig Launcher/Receiver	Pig launcher	North Slope	MP 0.0	GCF to MP 540
	Pig launcher / Receiver[d]	Yukon-Koyukuk	MP 225.1	GCF to MP 540
	Pig launcher / Receiver[d]	Yukon-Koyukuk	MP 285.6	GCF to MP 540
	Pig launcher	Yukon-Koyukuk	MP 458.1	GCF to MP 540
	Pig receiver	Fairbanks North Star	MP FL 34.4	Fairbanks Lateral
	Pig receiver	Matanuska-Susitna	MP 736.4	MP 555 to End

Mainline compressor units are proposed at the GCF and the Cook Inlet NGLEP Facility. The Fairbanks Lateral compressor facilities are proposed at the straddle and off-take facility. Compressor equipment collocated with other aboveground facilities are described further below with the collocated facilities. Up to two additional natural gas-fired compressor stations would be located along the proposed Project mainline. The AGDC is currently evaluating the number of additional required compressor stations, but it is anticipated that one to two additional compressor stations would be required to provide 500 MMscfd. Under the one compressor station scenario, the compression facility would be located at approximately MP 285.6. Compression facilities would be located at MP 225.1 and MP 458.1 (collocated with the straddle and off-take facility at this location) under the two compressor station scenario. The location of these compressor station facilities may change during final engineering, but for the purposes of this document, the analysis includes the locations of the compressor station facilities described in Table 2.1-2 and presented in Figures 2.1-2 and 2.1-3 are analyzed. These facilities would typically contain gas turbine-driven centrifugal compressors that would encumber approximately 1.4 acres (Table 2.1-3). Additional facilities at these compressor stations would include gas and utility piping, a filter separator/scrubber, refrigerant condensers, a helicopter port, communication tower, tank farm, power generators, and various control and compressor buildings. Further, propane-cycle gas-chiller plants would be installed at the compressor station (CS) 1 and CS 2, which would be located north of Minto Flats. CS 3 would not require natural gas cooling equipment.

Module sections of the GCF would be transported via barge to West Dock and trucked on existing roads and assembled on-site. The barge lift is expected to require nine barges to transport the modules. The barge lift would occur during the open water season and would meet the necessary scheduling, regulatory and safety standards associated with a large-scale barge lift. West Dock infrastructure would not require modification to accommodate the modules. Module design, construction, transport and assembly details would be developed later in the Project. The GCF would be installed at MP 0.0 (Figure 2.1-1) of the mainline. The approximate 68.7-acre facility would receive natural gas from an existing central natural gas facility and remove carbon dioxide (CO_2), hydrogen sulfide (H_2S) and other impurities. Impurities (CO_2 and H_2S) removed during conditioning would be compressed and returned to the producers for reinjection into the reservoir. The natural gas would be compressed to required delivery pressures, and then NGLs (propane, butane, and pentanes) would be injected to enrich the natural gas. After the natural gas is compressed and enriched, it would then be cooled. The GCF would contain several modular buildings that would house equipment, utilities, workspaces, and personnel. Primary and backup power generation, natural gas compressors, and heating and refrigerant equipment in addition to other ancillary facilities would be located at this facility to drive the natural gas conditioning process.

The straddle and off-take facility would be installed at the proposed Fairbanks Lateral tie-in (MP 458.1; Figure 2.1-4). This facility would be used to provide utility grade natural gas, primarily through the removal of NGLs, prior to sending natural gas into the Fairbanks Lateral. Extracted NGLs would be injected back into the mainline natural gas. Further, compression facilities for the Fairbanks Lateral would be located within the facility footprint. A metering station and pig launcher and receiver, as described further below, would also be located within the facility. Further, under the mainline two compressor station scenario, mainline compressor facilities (CS 3) could be installed. Due to the location of the straddle and off-take facility, no gas refrigeration would be required prior to natural gas reentering the mainline and Fairbanks Lateral pipeline.

A NGL extraction facility, the Cook Inlet NGLEP Facility, would be located at MP 736.4 (Figure 2.1-5) and would remove propane, butane, and pentane NGLs. To remove NGLs, the extraction facility would contain an inlet and liquid separators, molecular sieve, and a storage facility. The AGDC anticipates that up to 60 MMscfd day of NGLs would be extracted and sold separately from the natural gas. After processing, the utility-grade natural gas would be compressed and transferred via a metering station, as described further below, to the ENSTAR pipeline system. At this time, the AGDC has identified three potentially foreseeable options for NGL fractionation and storage following the Project terminus. These facilities are discussed further in Section 3.

Metering and flow control of natural gas between the proposed Project pipeline and interconnects with the central gas facility, ENSTAR pipeline system, and the Fairbanks Lateral would be accomplished via meter and regulation facilities provided at meter stations located at each proposed interconnect. The AGDC proposes a meter station at MP 0.0 (GCF), MP 458.1 (straddle and off-take facility), and MP 736.4 (Cook Inlet NGLEP Facility). Each of the proposed meter stations would be located within the footprint of the larger facility with which they would be collocated.

Pig launcher and/or receiver assemblies would be located at all major aboveground facilities, including the GCF (MP 0.0), straddle and off-take facility (MP 458.1), Cook Inlet NGLEP Facility (MP 736.4), and any additional stand alone mainline compressor stations (CS 1 or CS 2; MP 225.1 or MP 285.6). Further, the AGDC indicated that they would install a pig receiver at the terminus of the Fairbanks Lateral (MP FL 34.4). Additional valves and ancillary facilities that would be identified at a later date could also be installed with the pig receiver in this location. The AGDC has not specified the pig receiver facility dimensions or footprints.

Thirty-seven MLVs would be installed along the proposed mainline and Fairbanks Lateral. MLVs would allow the AGDC to shut down or isolate portions of the pipeline, if necessary, and to allow controlled venting during non-routine system blowdowns (see Section 5.19). The MLVs would be installed in areas accessible to operating personnel and at intervals of no greater than 20 miles as specified in U.S. Department of Transportation (USDOT) safety standards for natural gas pipelines (49 CFR Part 192). Each MLV assembly would consist of a below-ground valve with valve operators and bypass extending aboveground. Line break detection systems capable of closing the valve upon sensing a significant drop in pressure potentially indicative of a pipeline rupture would be installed at each MLV site. Blowdown systems at each site would be designed to initiate a blowdown whereby in the event the pipeline becomes overpressurized, the pipeline is rapidly depressurized through the automatic opening of blowdown valves and any released gases are dispersed to the atmosphere. Security fencing would surround the aboveground piping and valves at each mainline valve site. The consequences of an accidental spill of NGLs as a result of a pipeline rupture could include fire and/or explosion of NGL vapors. Potential spill impacts would likely be short-term and low magnitude due to the volatility of NGL components. However, a small portion of the NGLs may not easily vaporize, particularly during the winter, but may remain to potentially migrate through the soils and enter the groundwater if spill cleanup procedures were not implemented.

FIGURE 2.1-1 Gas Conditioning Facility Location Map

FIGURE 2.1-2 Compressor Station 1 Location Map

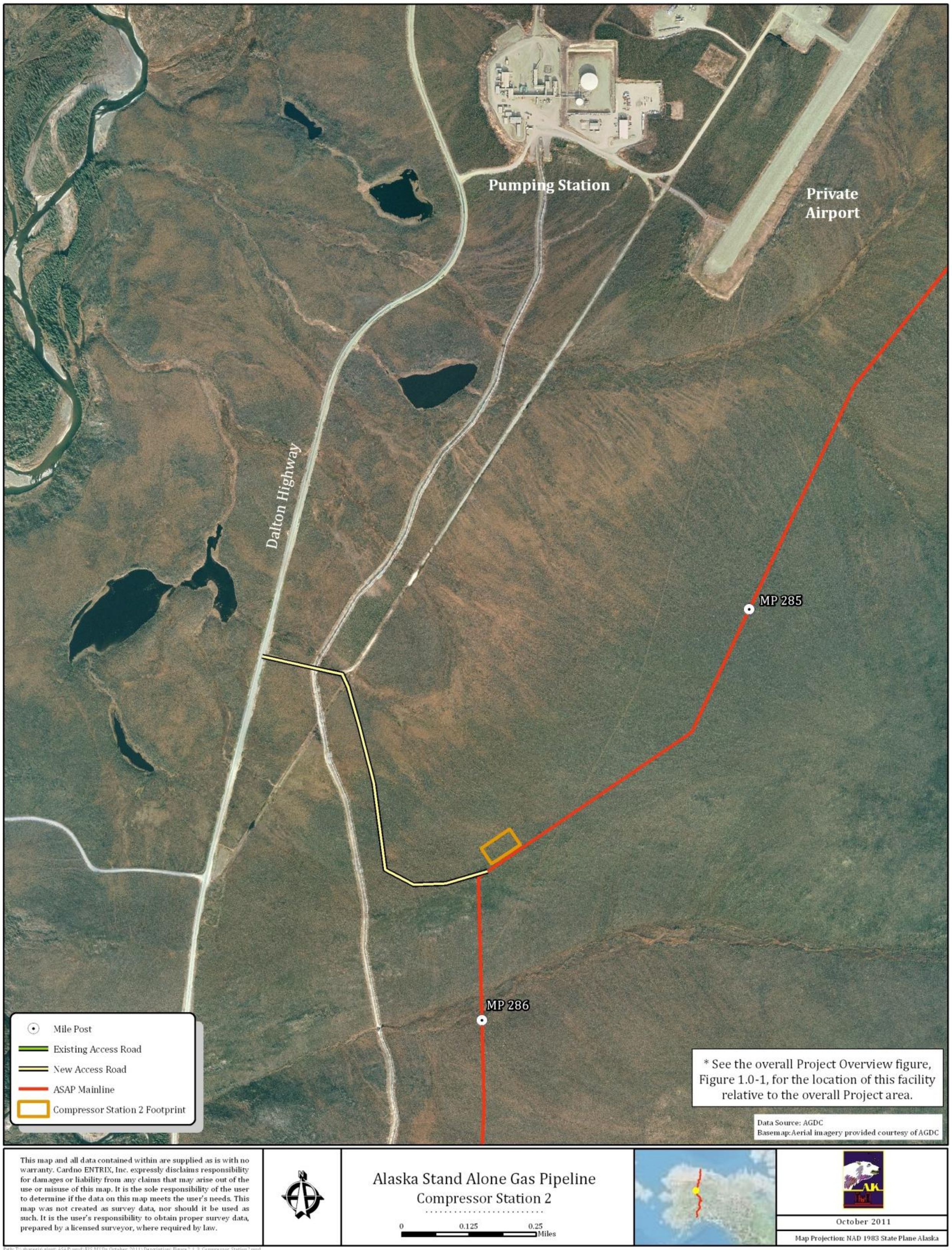


FIGURE 2.1-3 Compressor Station 2 Location Map

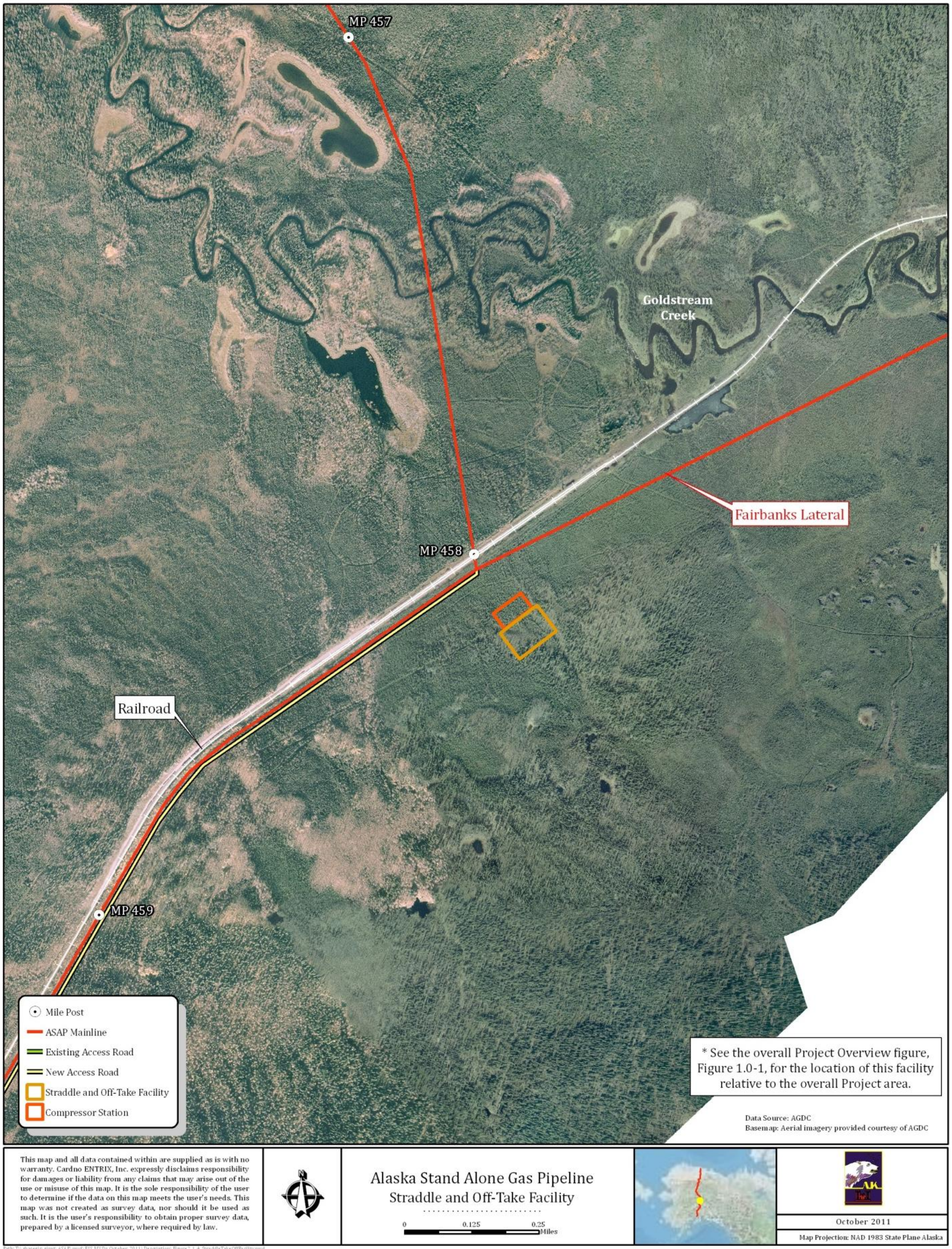


FIGURE 2.1-4 Straddle and Off-Take Facility Location Map

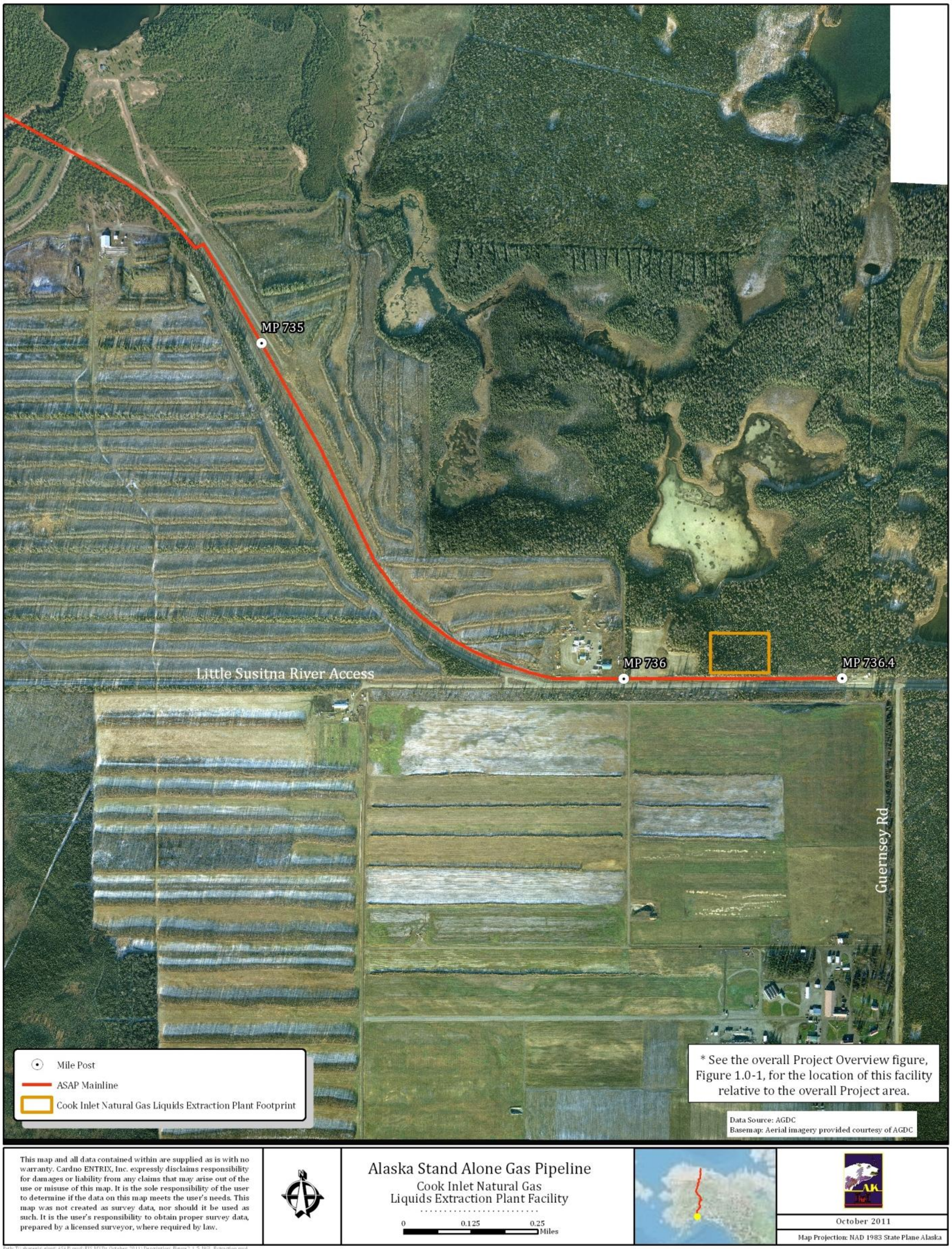


FIGURE 2.1-5 NGL Extraction Facility Location Map

2.1.3 Land Requirements

The land requirements of the proposed Project are summarized in Table 2.1-3. This summary identifies the construction and operational land requirements of the proposed pipeline, aboveground facilities, and extra work areas. Temporary land requirements for the proposed Project during construction would total 11,468 acres, including the proposed pipeline construction ROW; construction areas for aboveground facilities; pipe storage, contractor, and rail yards; construction camps; and access roads. Note that additional lands would be required during construction for temporary extra workspaces (TEWS). All TEWS will be constructed outside of wetlands areas. With the exception of the HDD crossings at the Yukon, Nenana, and Tanana Rivers the locations of these workspaces are not available and have, therefore, not been included in the total land requirements. It is estimated that the TEWS associated with these HDD crossings would require approximately 2 acres of uplands each for a total land use of 6 acres. The pipe string for the crossings would be laid out within the existing Temporary Construction Easement (TCE) and would not require any additional workspace.

Approximately 4,063 acres of land would be retained as permanent easements associated with operation of the proposed pipeline, aboveground facilities, and access roads. The approximately 7,405 acres in the construction ROW, construction camps, and storage yards that would not be retained as part of the permanent easement would be returned to pre-construction uses. During operation of the Project, land within the boundaries of the aboveground facilities would be converted to developed land. Vegetation within the permanent easement would be maintained in a non-forested vegetative cover. The land requirements of the proposed Project facilities are discussed below and additional information is provided in Section 5.9 (Land Use).

TABLE 2.1-3 Locations and Land Requirements for the Proposed Project

Project Component	Construction Footprint (acres)	Operational Footprint (acres)
Mainline Pipeline	10,138.4[a]	3,314.6[b]
Fairbanks Lateral	417.2[a]	125.2[b]
Compressor Stations[c]	1.4	1.4
Gas Conditioning Facility	68.7	68.7
Cook Inlet NGLEP Facility	5.2	5.2
Straddle and Off-Take Facility	3.3	3.3
Meter stations	0.0[d]	0.0[d]
Mainline valves[e,f]	0.8	2.4
Pig Launcher/Receiver	0.0[d]	0.0[d]
Pipe storage, rail, and contractor yards	182.7	0.0
Construction Camps	126.5	0.0
Access roads[e,g]	523.8	542.3[h]
Total	**11,468.0**	**4,063.1**

[a] Acreage calculations are based on an offset 100-foot-wide ROW (40 foot on the western side and 60 foot on the eastern side of the centerline). The construction ROW was expanded to 230-feet in width along the approximately 77-mile-long segment that would require cut and fill.

[b] Mainline pipeline operational footprint calculations are based on a 52-foot-wide ROW on federal lands and an approximately 30-foot-wide ROW on private lands. Fairbanks Lateral operational footprint calculations are based on a 51-foot-wide ROW on federal lands and an approximately 30-foot-wide ROW on private lands.

[c] Acreages for compressor stations are only depicted for those compressor stations not collocated with other aboveground facilities. Under the one mainline compressor scenario, the AGDC would install CS 2; under the two mainline compressor station scenario, the AGDC would install 2 compressor stations: CS 1 and CS 3. CS 3 would be collocated with the straddle and off-take facility. As only one standalone compressor station would occur under each scenario, the cumulative impact would be the same for either facility.

[d] All pig launcher and/or receiver facilities would be collocated with other facilities. Land encumbrance is reported for the facility with which these pig launchers/receivers are collocated.

[e] To avoid double counting, only those lands extending beyond the permanent or construction ROW are reported.

[f] Note that the AGDC indicated that two MLVs would be required along the Fairbanks Lateral, but has not identified their location. It is assumed that these facilities would encumber approximately 0.1 acre of land. Because the location of these facilities is not known, their overlap with the proposed construction and operational rights-of-way could not be determined. Therefore, acreages associated with the two MLVs are not included in the above table.

[g] Access road calculations based on a 50-foot-wide ROW.

[h] Because the permanent ROW would be smaller than the construction ROW, the potential access road overlap with pipeline facilities, as described in footnote e above, would be reduced. Therefore, less of the access road area would overlap with Project acreages reported elsewhere and therefore be greater area.

2.1.3.1 Pipeline Right-of-Way

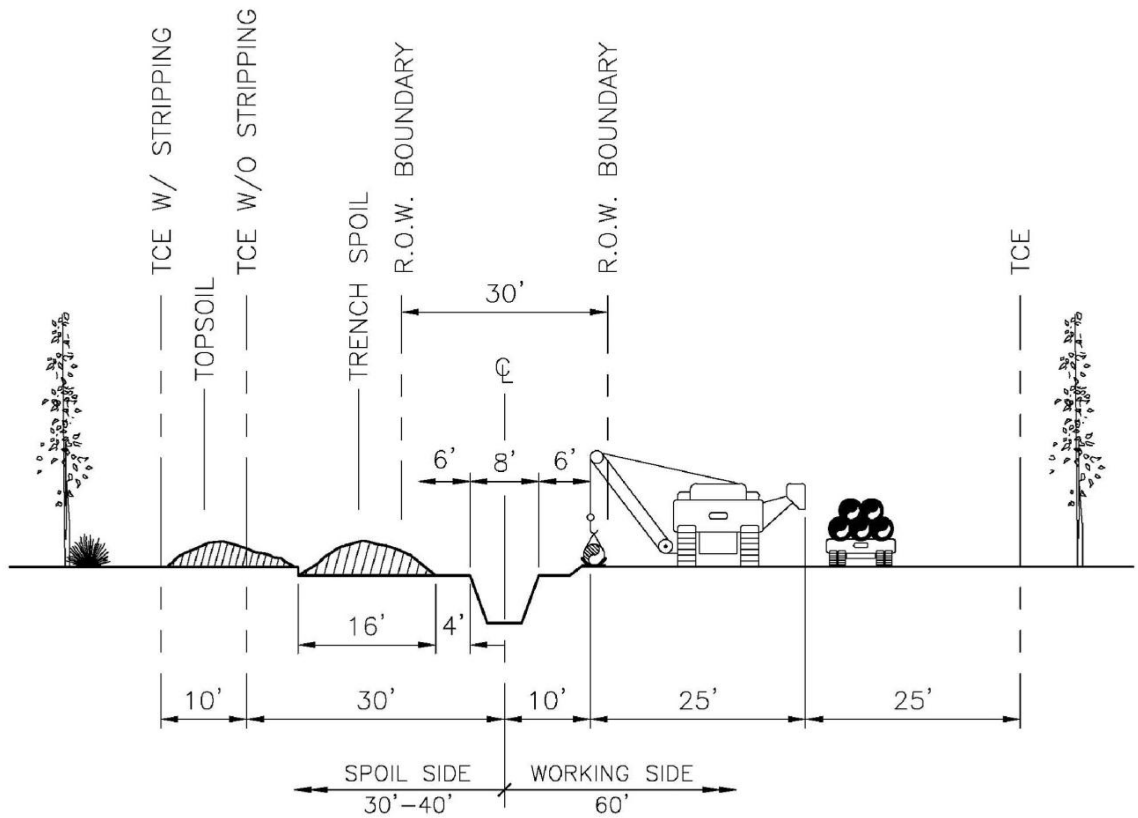
The proposed Project would include approximately 6 miles of aboveground pipeline installed on steel vertical support members (VSMs) located in the Prudhoe Bay operational area. Except for at specific aerial crossing locations, such as at some bridge crossings and at fault crossings, the remaining portions of the proposed pipeline would be installed underground. As proposed by the AGDC, the construction right-of-way (ROW) width along underground and aboveground portions of the proposed pipeline would be 100 feet for the proposed mainline. A 100-foot-wide construction ROW has also been proposed along the Fairbanks Lateral. Open-cut trenching techniques would primarily be used to install the pipeline underground (see Section 2.2.2). The 100-foot-wide construction ROW for normal open-cut conditions would include 10 feet on the construction side for temporary storage of topsoil, where required. This 10-foot wide topsoil storage area would be used only in areas where topsoil stripping would be required. The AGDC has indicated that the identification of topsoil stripping locations would be required but would not be available until final engineering; therefore, this additional land requirement has been assumed to be required for the entire Project length. Figure 2.1-6 depicts a cross-section of the typical proposed construction ROW.

Temporary land requirements would include land required for a relatively short duration and refers primarily to the TCE. For the purposes of this analysis, the 100-foot-wide construction ROW with a 10-foot offset from the centerline was used (Figure 2.1-6). This would result in dividing the ROW to allow 30-40 feet for the spoil-side and 60 feet for the working side of the ROW. In some areas, the proposed construction ROW widths would be expanded to account for site-specific construction requirements; such as ensuring safe working conditions in areas of rugged terrain (see Section 2.2.3) and/or areas requiring rock ditching, gravel or ice workpads, or snow storage. Similarly, the construction ROW would be reduced, or 'necked down', in some areas to minimize impacts to sensitive resources, such as residences or wetlands. These locations would be determined during permitting and final engineering. This land is intended to provide adequate space to facilitate safe movement of materials, equipment, and personnel during construction. Additional temporary land requirements would include temporary access roads, construction camps, materials sites, temporary workspace (beyond the boundary of the typical TCE), and other construction support sites. Occupation of real estate included in the

TCE would generally be limited to periods of major construction and initial pipeline startup activities.

Impact acreages reported in this document do not account for site-specific conditions that would require additional TEWS beyond the typical construction ROW. With the exception of the HDD crossings at the Yukon, Nenana, and Tanana Rivers, the locations of these workspaces are not available and have, therefore, not been included in the total land requirements. It is estimated that the TEWS associated with the HDD crossings of the Yukon, Nenana, and Tanana Rivers would require approximately 2 acres each for a total land use of 6 acres. The pipe string for the crossings would be laid out within the existing TCE and would not require any additional work space.

Permanent land requirements include the pipeline operating ROW and select sites where aboveground facilities and permanent access roads would be constructed. Possession of the land would be maintained by the pipeline owner and/or operator throughout the operational life of the pipeline facility. BLM requirements stipulate a ROW of 50 feet plus the width of the pipe on federal lands. Therefore, following construction, the AGDC would retain a 52-foot-wide and 51-foot-wide permanent ROW along portions of the mainline and Fairbanks Lateral, respectively that would cross federal lands. A 30-foot-wide permanent ROW would be maintained for the mainline and Fairbanks Lateral for all other non-federal lands. The AGDC has indicated that a larger permanent ROW may be maintained in some locations. These areas have not been identified; therefore, a 30-, 51-, or 52-foot-wide permanent ROW width was used to calculate potential Project-related impacts. The permanent ROW would be within the construction ROW and centered on the pipeline for operation of both the mainline pipeline and Fairbanks Lateral.



NOTES

1. CROSS SECTION BASED ON:
   - –TOPSOIL THICKNESS: 6"
   - –TRENCH OVER–EXCAVATION: 6" FOR PADDING
   - –DEPTH OF COVER: 36" – CLASS 1; 42" – CLASS 2,3,4
   - –TRENCH SLOPE: 0.5H:1V
   - –TRENCH SPOIL BULK FACTOR: 15%
   - –TRENCH SPOIL SLOPE: 1H:1V
   - –TOPSOIL BULK FACTOR: 15%
   - –TOPSOIL SLOPE: 2H:1V
2. DEPTH OF COVER MEASURED FROM TOP OF PIPE TO EXISTING GRADE.

* See the overall Project Overview figure, Figure 1.0-1, for the location of this facility relative to the overall Project area.

Alaska Stand Alone Gas Pipeline
Typical Construction Right-of-Way

Source: ADGC Plan of Development Rev 1 March 2011

October 2011

FIGURE 2.1-6 Typical Construction Right-of-Way

2.1.3.2 Aboveground Facilities

The land requirements for the proposed aboveground facilities would total approximately 79.4 acres during construction and 81 acres during operation (Table 2.1-3). The proposed aboveground facilities include up to two new compressor stations, three meter stations, 37 MLVs, and five pig launcher and/or pig receiver facilities. Furthermore, the AGDC proposes to construct the GCF near MP 0.0, a straddle and off-take facility at MP 458.0, and the Cook Inlet NGLEP Facility at MP 736.4.

As shown in Tables 2.1-2 and 2.1-3, multiple aboveground facilities would be collocated within the same fenced facility footprint. Thus, construction and operation of these facilities would not result in additional land requirements beyond that noted for those aboveground facilities. The remaining MLV sites would typically be located on a 0.1-acre parcel largely within the limits of the construction or permanent pipeline ROW.

2.1.3.3 Extra Work Areas Outside of Right-of-Way

Temporary Extra Workspaces

Beyond those lands within the construction ROW, additional construction areas, or TEWS, would be required for construction at road crossings, railroad crossings, crossings of existing pipelines and utilities, stringing truck turnaround areas, wetland crossings, points of inflection (PIs), and waterbody crossings. These TEWS would be located adjacent to the construction ROW and could be used for such things as spoil storage, staging, equipment movement, material stockpiles, and pull string assembly associated with HDD installation. The size of the TEWS would vary depending on site-specific conditions and the proposed use of the TEWS.

Along some sections of the proposed Project route (for example, at some major waterbodies, special use areas, roads, and/or railway crossings), pipeline installation would be accomplished via HDD or horizontal bores. HDDs require an entry and exit box, typically 200 feet by 300 feet for the entry box and approximately 100 feet by 200 feet for the exit box, placed on either side of the feature to be crossed. Some or all of the HDD entry and exit workspace may be contained within the overall construction ROW. In addition, an HDD requires a workspace approximately equivalent to the length of the pipe to be installed. Therefore, a 1,000-foot HDD would require a straight 1,000 feet of TEWS for the pipe to be laid out; the TEWS may or may not be located within the construction ROW for the adjacent segment of the pipeline. Horizontal bores also require two pits, typically 100 feet by 250 feet, a majority of which would typically be contained within the construction ROW, on either side of the road or railroad to be crossed. These TEWS would be set back at least 50 feet from all waterbodies and wetlands.

The AGDC has not identified the site-specific locations of the TEWS; therefore, these areas have not been included in the Project impact calculations and assessment. With the exception of the HDD crossings at the Yukon, Nenana, and Tanana Rivers the locations of TEWS are not available and have, therefore, not been included in the total land requirements. It is estimated that the TEWS associated with the HDD crossings of the Yukon, Nenana, and Tanana Rivers would require approximately 2 acres each for a total land use of 6 acres. The pipe string for the crossings would be laid out within the existing TCE and would not require any additional work space.

Construction Camps, Pipe Storage Yards, Air Facilities, Rail Yards, and Ports

The location of the proposed construction camps, pipe storage yards, air facilities, rail yards, and ports are depicted in Figure 2.1-7 and the land requirements for these facilities are described further in Section 5.9. The Port of Seward would be the primary port of entry for pipe and equipment for Project construction. Pipe would be stored at the Port of Seward and then transported via the Alaska Railroad Corporation (ARRC) to Fairbanks, where it would be double jointed and coated. Pipe would then be transported to pipe storage and lay down yards via truck or rail. The AGDC has proposed to offload pipe at 13 locations along the ARRC system. The West Dock at Prudhoe Bay would be used to receive materials for the construction of the proposed GCF. The AGDC does not anticipate the need for any modification of existing port or rail infrastructure in connection with the Project.

The AGDC has proposed the use of 26 off-site pipe storage and lay down yards, including 14 that would be located with stationary construction camps. Further, 14 existing air strips or airports would be used to transport equipment and materials and workers to the Project area. Several of these air facilities would be located at the stationary construction camps or pipe storage and lay down yards. The AGDC anticipates that there could be a need to upgrade existing airports and airstrips by carrying out improvements to runways, runway lights, and communication and navigation aids.

Mobile and stationary construction camps would be constructed in locations along the proposed mainline pipeline where construction and facility crews would require temporary housing during Project construction. Typically, these camps would only be located north of approximately MP 708.0 along the mainline. Mobile construction camps would typically require a footprint of 8.5 to 10 acres and exist for a short duration during activities that would support the preparation of the ROW for construction activities. All mobile construction camps would be located within previously cleared and disturbed areas. The AGDC will obtain all permits required to utilize the previously cleared and disturbed areas. The use of mobile camps would be primarily limited to the construction preparation phase prior to the establishment of stationary construction camps.

Stationary construction camps would be used for Project personnel, including construction workers, Project management, agency staff, and support service personnel. Further, stationary construction camps would be used for fuel and equipment storage and as laydown yards. The AGDC has proposed the use of 15 stationary camps that would each house between approximately 250 and 500 workers. These camps would range in size from 8.5 to 10 acres. Further, approximately 250 workers would be housed in existing facilities at Prudhoe Bay.

All of these facilities would be located in previously cleared and disturbed areas and are accessible by the use of existing roads. The stationary construction camps and/or pipe storage and lay down yards would primarily be located in previously disturbed areas that were used for construction of the Trans Alaska Pipeline System (TAPS), ARRC facilities, or for public events.

The AGDC would develop a Comprehensive Waste Management Plan that would include details of how waste would be handled in these areas. Solid waste produced at camps would be reused, recycled, burnt, or disposed of at ADEC approved disposal sites in accordance with applicable regulations. Domestic wastewater produced from camps would be treated and discharged in accordance with the applicable permits. The AGDC would develop a Spill Prevention and Control Plan that would outline measures that specify where and how hazardous substances, such as fuel, paint, and solvents, would be stored and handled. Further, a Spill Prevention Control and Countermeasure Plan would be developed for storage facilities where capacity exceeds 1,320 gallons of fuel. Additionally, an Oil Discharge Prevention and Contingency Plan would be developed if the volume of an oil storage facility exceeds 420,000 gallons.

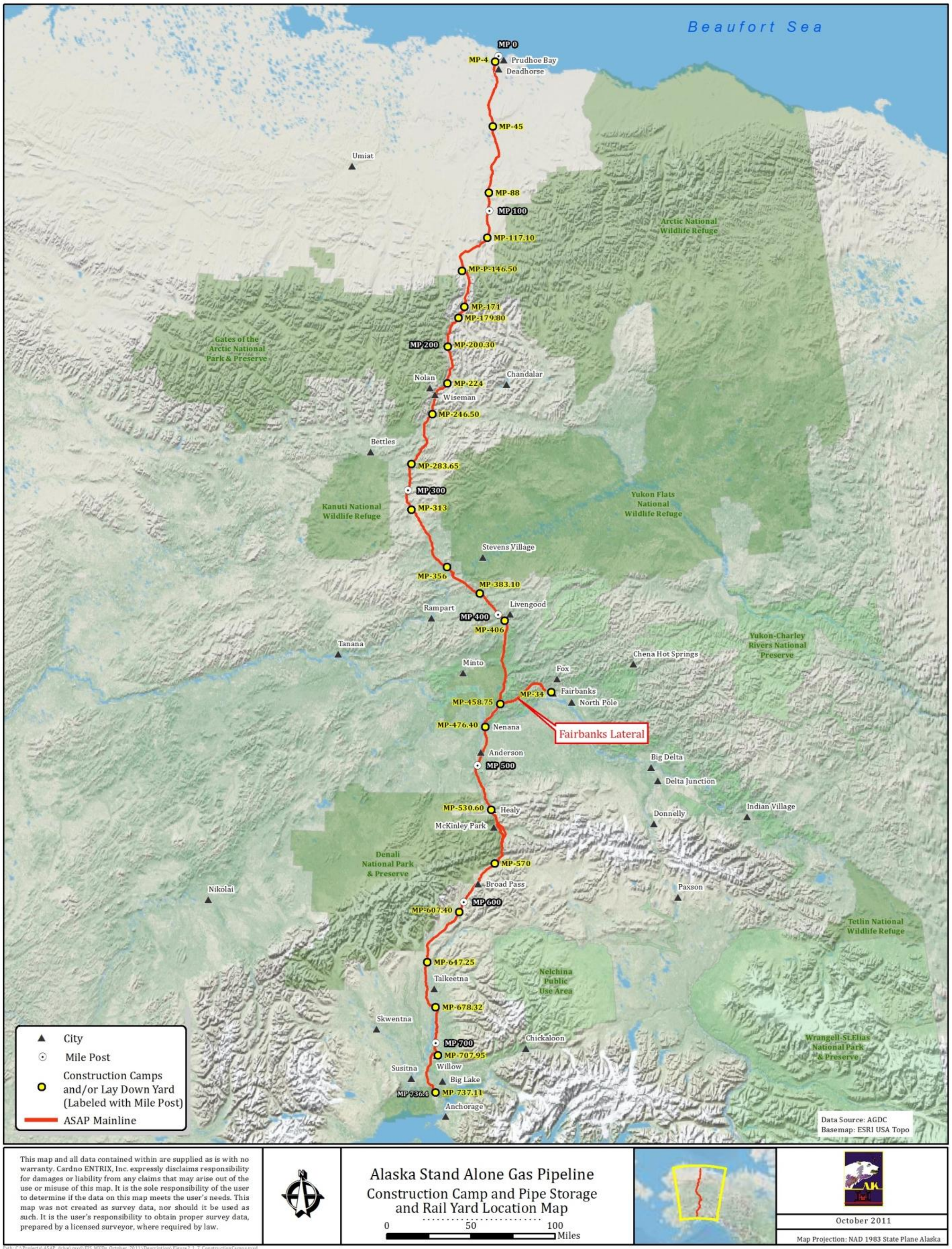


FIGURE 2.1-7 Construction Camp and Pipe Storage and Rail Yard Location Map

Material Sites

Material sites (i.e., sand and gravel pits) located along the proposed Project would be used to provide gravel for workpads, access roads, pipeline bedding and padding, and the construction of aboveground facilities. The AGDC has estimated that approximately 13.1 million cubic yards of material may be required for Project construction. The AGDC has identified 546 existing material sites using the ADOT&PF material site information sources and expects that the use of these sites would be sufficient to meet the proposed Project's needs. A majority of these sites would be located within 10 miles of the proposed Project; therefore, reducing the material hauling distance. The AGDC would develop Material Site Mining Plans and Reclamation Plans for each proposed site prior to development. The AGDC would also develop a Storm Water Pollution Prevention Plan (SWPPP) for each proposed site prior to development and maintain best management practices (BMPs) during construction and operation of the material source. The AGDC will obtain all permits and authorizations for material site mining prior to the start of construction.

Additional Support Facilities

The Project offices would be located near a major airport in either Fairbanks or Anchorage and would consist of a Project headquarters, logistic support sites, and construction support offices. This facility would support the Project from the pre-construction phase through the initial operations phase. The proposed Project would require two temporary logistics support sites in Fairbanks and Seward. The Seward logistics support site would be located on or near the ARRC's Seward Track Yard and the site would oversee the reception and distribution of pipe, valves, and other materials. Furthermore, the Fairbanks logistics support site would facilitate both logistics management personnel and quality assurance staff to ensure the quality of pipe coatings and double-jointing procedures.

Three permanent operations and maintenance (O&M) facilities would be developed in support of long term Project operation. O&M facilities would be located at the GCF at Prudhoe Bay, the straddle and off-take facility, and at the Cook Inlet NGLEP Facility. Each facility would include office facilities, a maintenance garage, and both warm and cold warehouse space. The O&M facility located at the Cook Inlet NGLEP Facility would also house the pipeline control systems.

Access Roads

The AGDC would use existing public roads and railroads (as described further in Section 5.9 Land Use) to facilitate equipment and material distribution along the proposed Project route. Several temporary and permanent access roads would be required to transport equipment, materials, and workers to the proposed Project areas. Furthermore, access roads would be used to access water sources, material sites, and various aboveground facilities.

The AGDC would construct gravel roads, ice roads, and snow roads; and improve existing roads for Project construction and/or operation. As proposed, mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which already exist, to access the Project ROW. Furthermore, 90 permanent gravel roads, of which 60 would be new gravel roads, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral. Appendix D identifies access roads that have been proposed for Project use.

New gravel access roads would typically be approximately 20 to 24 feet wide and would be located within a 50-foot-wide ROW. Culverts, 18 inches in diameter, would be installed as necessary to facilitate surface water flow under the access roads. Road shoulders surrounding culverts would be lined with rip-rap.

Detailed engineering efforts and geotechnical studies would identify areas where permafrost, frost heave, fault crossings, thaw settlement, frost bulbs, slope and soil instability, areas sensitive to erosion, and where unique soil structures are likely to occur. These findings, as well as construction methods to appropriately mitigate these conditions, would be defined during detailed engineering.

Project-related use of highways, maintained county roads, and other types of public roadways would typically not require improvements. Additional information on access roads and the associated land requirements is provided in Section 5.9 (Land Use).

2.2 DESIGN AND CONSTRUCTION PROCEDURES

2.2.1 Pipe Design and Wall Thickness

The proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with the USDOT regulations under 49 CFR Part 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*, and other applicable federal and state regulations. Among other design standards, these regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. Depending on pipeline class designations, the proposed Project pipeline wall thickness would typically be between 0.6 (Class 1) and 1.1 inches (Class 4). Specific pipeline and aboveground facility design would be the subject of a supplemental EIS at a later date.

2.2.2 Standard Design and Construction Procedures

The majority of the proposed pipeline construction process would be accomplished using conventional open-cut methods, which typically include the steps described below. The proposed methods for accomplishing pipeline installation across waterbodies and wetlands, as well as other specialized construction procedures, are described in Section 2.2.3.

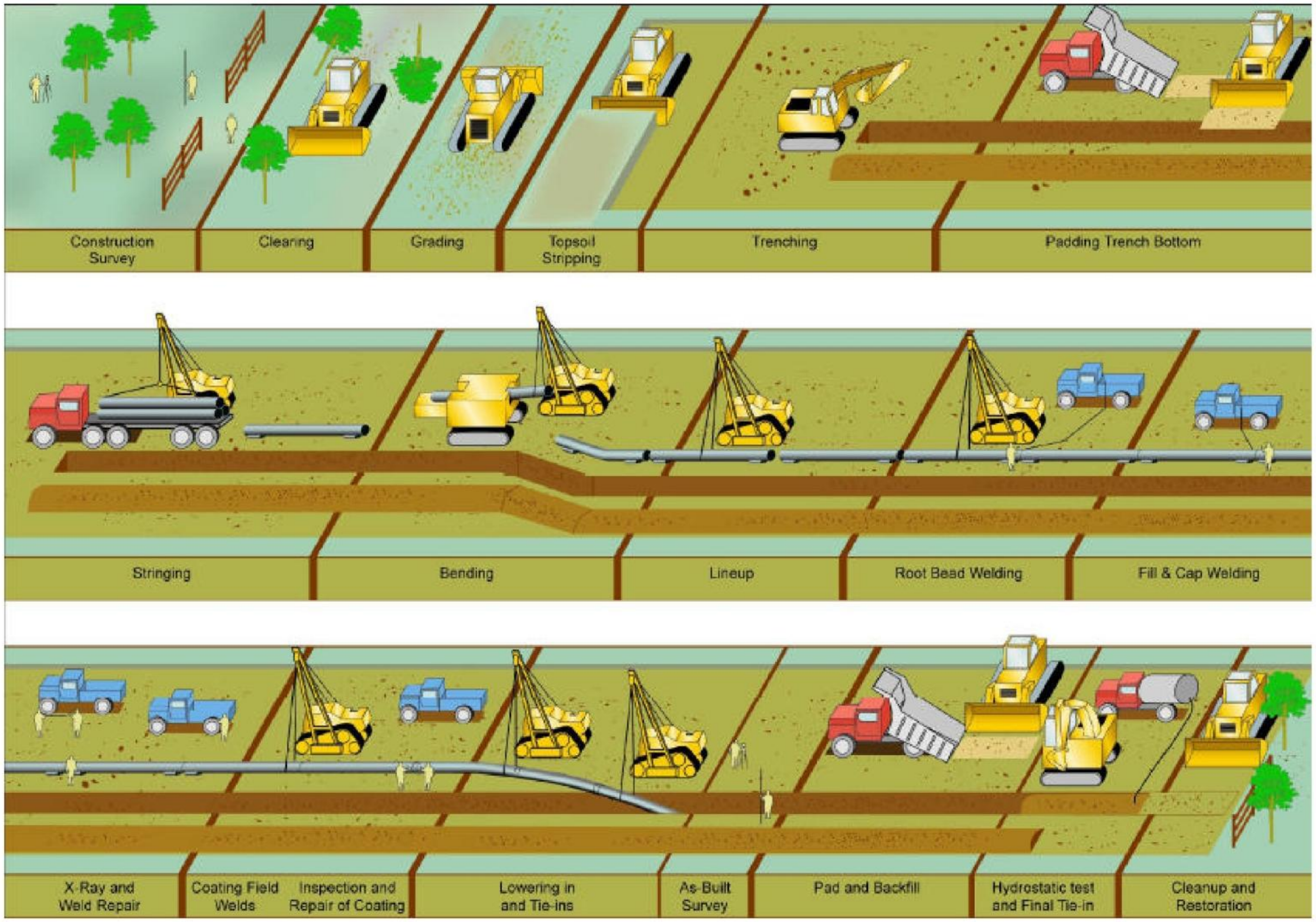
Conventional overland installation of the pipeline is best represented as a moving assembly line with a construction spread (crew and equipment) proceeding along the construction ROW in a continuous operation, as depicted in Figure 2.2-1. Construction at any single point along the pipeline, from ROW surveying and clearing to backfill and finish grading, would last about 90 to

120 days (3 to 4 months). Due to weather and terrain features, the AGDC proposes only winter and summer construction.

Prior to initiating construction-related activities, the AGDC would secure ROW easements from private landowners and ROW grants from managers of public lands whose properties would be crossed by the pipeline route. All owners, tenants, and lessees of private land, and lessees and managers of public lands along the ROW would be notified in advance of construction activities that could affect their property, business, or operations.

2.2.2.1 Right-of-Way Survey

Prior to construction activities, the pipeline centerline, construction ROW, and additional TEWS would be surveyed and staked. The AGDC would locate, identify, and flag existing underground utilities to prevent accidental damage during pipeline construction. Other sensitive resources, such as trails and easements, wetland boundaries, cultural resources, and any areas of protected species habitat, also would be marked as restricted.



Alaska Stand Alone Gas Pipeline

Typical Pipeline Construction

Source: ADGC Plan of Development Rev 1 March 2011

October 2011

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FIGURE 2.2-1 Typical Pipeline Construction Sequence

2.2.2.2 Clearing, Grading, and Work Pads

The construction ROW and TEWS areas would be cleared and graded, where necessary, to provide a relatively level surface for trench-excavating equipment and the movement of other construction equipment. Brush, trees, roots, and other obstructions such as large rocks and stumps would be cleared from all construction work areas. The AGDC would complete a merchantable timber survey, and would determine removal methods based on the location of these resources. Stumps would be removed from the proposed construction ROW. Cleared woody debris would be chipped and left in place, burned, provided to local populations for firewood, or otherwise disposed of according to local restrictions, regulatory requirements, and landowner agreements. Work pads would be installed to provide a level work surface during Project construction. Snow/ice, gravel, and/or graded work pads would be installed after clearing and grading.

The AGDC would develop an Erosion Sediment Control Plan (ESCP) and Stormwater Pollution Prevention Plan (SWPPP) prior to the commencement of construction. These plans would outline erosion control BMPs to minimize soil erosion after soil disturbance such as the use of silt fences, bale checks, swales, root waddles, trench and ditch reinforcement with geotextile fabric or rock, gabions and sediment traps. Where present, topsoil would be segregated from subsoil along the proposed Project pipeline. To contain disturbed soils in upland areas and minimize the potential for sediment loss to wetlands and waterbodies, temporary erosion controls would be installed in accordance with the Project's ESCP and SWPPP prior to initial disturbance of soils and would be maintained throughout construction. Erosion and sediment control devices would be installed in accordance with federal, state, or local requirements for the control of stormwater during construction.

2.2.2.3 Trenching

A trench would be excavated using chain excavator and/or track hoes. Excavated materials would normally be stored on the non-working side of the trench, away from construction traffic and pipe assembly areas. Temporary trench breakers (or barriers) would be used to create segments within the open trench to reduce erosion. Trench breakers would typically consist of polyurethane foam, sandbags and/or gravel placed across the ditch. Trench dewatering may also be required along portions of the route.

The pipeline would be buried below the ground surface to a depth that would meet or exceed USDOT standards at 49 CFR 192.327. USDOT minimum depth requirements range from 30 inches of soil or 18 inches of consolidated rock for Class 1 pipeline locations to 36 inches of soil or 24 inches of consolidated rock for Class 2, 3, and 4 locations as well as drainage ditches of public roads and railroad crossings. The actual installation depth of the pipeline would vary and would range from the minimum depth requirements to the depth required for safe crossing of a feature such as a road, highway, railroad, or waterbody. Final design depth would be based on detailed site evaluations. At crossings of utilities or foreign pipelines, the proposed pipeline would be installed at a greater depth, so as to provide for a minimum clearance of 12 inches.

Areas of frozen soil and/or bedrock that might be encountered along the proposed Project route may require blasting. Safety controlled blasting techniques would be used in accordance with a Blasting Control Plan, which would be developed and would follow all applicable requirements for health, safety, and environmental protection, including Alaska Department of Fish and Game (ADF&G) blasting standards.

2.2.2.4 Pipe Stringing, Bending, and Welding

Sections of double jointed, pre-welded pipe would be delivered in straight sections. The straight sections of pipe would be temporarily placed or "strung" along the excavated pipeline trench, where they would be bent as necessary to follow the natural grade and direction changes of the ROW. Following stringing and bending, the ends of the pipeline would be carefully aligned and girth welded together. The girth welds would be visually inspected and tested to ensure their structural integrity using non-destructive examination methods such as radiography (x-ray), gamma ray, or ultrasound. Those girth welds that do not meet established specifications would be repaired or replaced.

A high-integrity coating, such as fusion-bonded epoxy or a multi-layer pipe coating system would cover and protect the pipeline sections from corrosion. Following welding, the previously uncoated ends of the pipe at all joints would be coated with material compatible with the coating in preparation for installation. The coating on the remainder of the completed pipe section would be inspected for defects, and any damaged areas would be repaired prior to lowering the pipe into the trench. At locations with saturated soils, the pipeline would be coated with concrete, bolt-on river weights, or saddle bags to provide negative buoyancy, if required.

2.2.2.5 Lowering-In and Backfilling

Prior to lowering the pipeline, the trench would be cleaned of debris and foreign material, and dewatered, as necessary. Trench dewatering would entail pumping accumulated groundwater or rainwater from the trench to stable upland areas. Dewatering would be performed in accordance with applicable federal, state, and local permitting requirements. The bottom of the trench may be padded with course grained materials to protect the pipe coating. The AGDC will adhere to USDOT safety requirements related to the quality of bedding and padding material as well as construction techniques to ensure that the protective coating of the pipeline is not damaged. The pipeline would then be lowered into the trench by appropriately spaced, sideboom tractors working in unison to avoid buckling of the pipe. Trench breakers would be installed at regular intervals where appropriate to prevent subsurface erosion and flow of water between the trench and crossed waterbodies, wetlands, and near-surface groundwater.

After the pipeline is lowered into the trench and adequately protected, previously excavated materials or imported material would be used to backfill the trench. Any excess excavated materials or materials deemed unsuitable for backfill would be evenly spread over the ROW or disposed of in accordance with applicable regulations and landowner requirements. In areas where topsoil has been segregated, the subsoil would be placed into the trench first and topped with the topsoil. Backfilling would occur to approximately 1-foot above existing grade or higher to accommodate future soil settlement. In areas where the proposed pipeline would cross off road trails, the trail crossing would be backfilled with non-frost-susceptible fill, and compacted to the previously existing grade. No spoils, overburden or unused fill would be disposed of within any existing trail corridor. This will be done to avoid abrupt trail surface obstacles and/or grade changes that could result in injuries or death for winter trail users.

2.2.2.6 Hydrostatic Testing

Once installation and backfilling are completed and before the Project begins operation, the pipeline would be hydrostatically pressure tested in accordance with USDOT safety standards (49 CFR Part 192) to verify its integrity and to ensure its ability to withstand the MAOP. Hydrostatic testing consists of installing a hydrostatic test cap and manifold, filling the pipeline with a methanol solution, warm water, or compressed air depending on the ground temperature. The pipeline would be pressurized to exceed its MAOP, and the pipeline would maintain that test pressure for an amount of time in accordance with the USDOT safety standards. Ultimately, the entire pipeline would be tested; typically, extended segments of pipeline would be tested individually. Any leaks or loss of pressure detected during the test would be repaired, and that segment of pipeline would be re-tested.

Water used for hydrostatic testing would be obtained from designated, permitted, surface water sources. The AGDC proposes to discharge hydrostatic test water directly to upland areas or test water would be diverted to settling basins, as necessary, and then discharged to upland areas to comply with discharge permit limitations in accordance with applicable regulations.

2.2.2.7 Cleanup and Restoration

After completion of backfilling the trench, all remaining trash, debris, surplus materials, and temporary structures would be removed from the ROW and disposed of in accordance with applicable federal, state, and local regulations. Snow pads may require additional summer cleanup; cleanup of these areas would be conducted with low-ground pressure vehicles. All disturbed areas would be finish graded and restored as closely as possible to pre-construction contours. Permanent erosion control measures also would be installed during this phase in accordance with AGDC's Stabilization, Rehabilitation, and Restoration Plan.

The AGDC would consult with the BLM and follow ADNR's Plant Materials Center Revegetation Manual for Alaska. The Stabilization, Rehabilitation, and Restoration Plan would stipulate native seed mixes for different geographic areas, seed application methods, and application rates for fertilizers. Additional information on restoration and revegetation procedures in upland and wetland areas is provided in Sections 5.3 (Vegetation) and 5.4 (Wetlands), respectively.

Pipeline markers and/or warning signs that would be resistant to vandalism would be installed along the pipeline centerline at specified intervals to identify the pipeline location. Furthermore, the AGDC would install boulders, berms, and/or fencing, as appropriate, to limit unauthorized access of the permanent ROW.

2.2.3 Other Construction Procedures

2.2.3.1 Aerial Pipeline

The first 6 miles (MP 0 to MP 6) of the proposed Project would be constructed as aboveground pipeline installed on steel VSMs in the Prudhoe Bay operational area. VSMs would be spaced approximately 20 feet apart and would require a minimum of 7 feet of clearance to the lowest obstruction. After ROW preparations, including clearing and grading, are complete, borings for the VSMs would be drilled by a VSM drill rig. The VSM support column would be set in the boring and the annulus space would be backfilled with concrete slurry. After the required time for the support column to set, horizontal pipe support cross beams would be installed. The pipeline sections would be strung and welded, as described in Section 2.2.2, and then placed on the VSM via sidebooms. Tie-ins and testing of the aerial pipeline would be similar to those described in Section 2.2.2. Figure 2.2-2 depicts a typical VSM configuration.

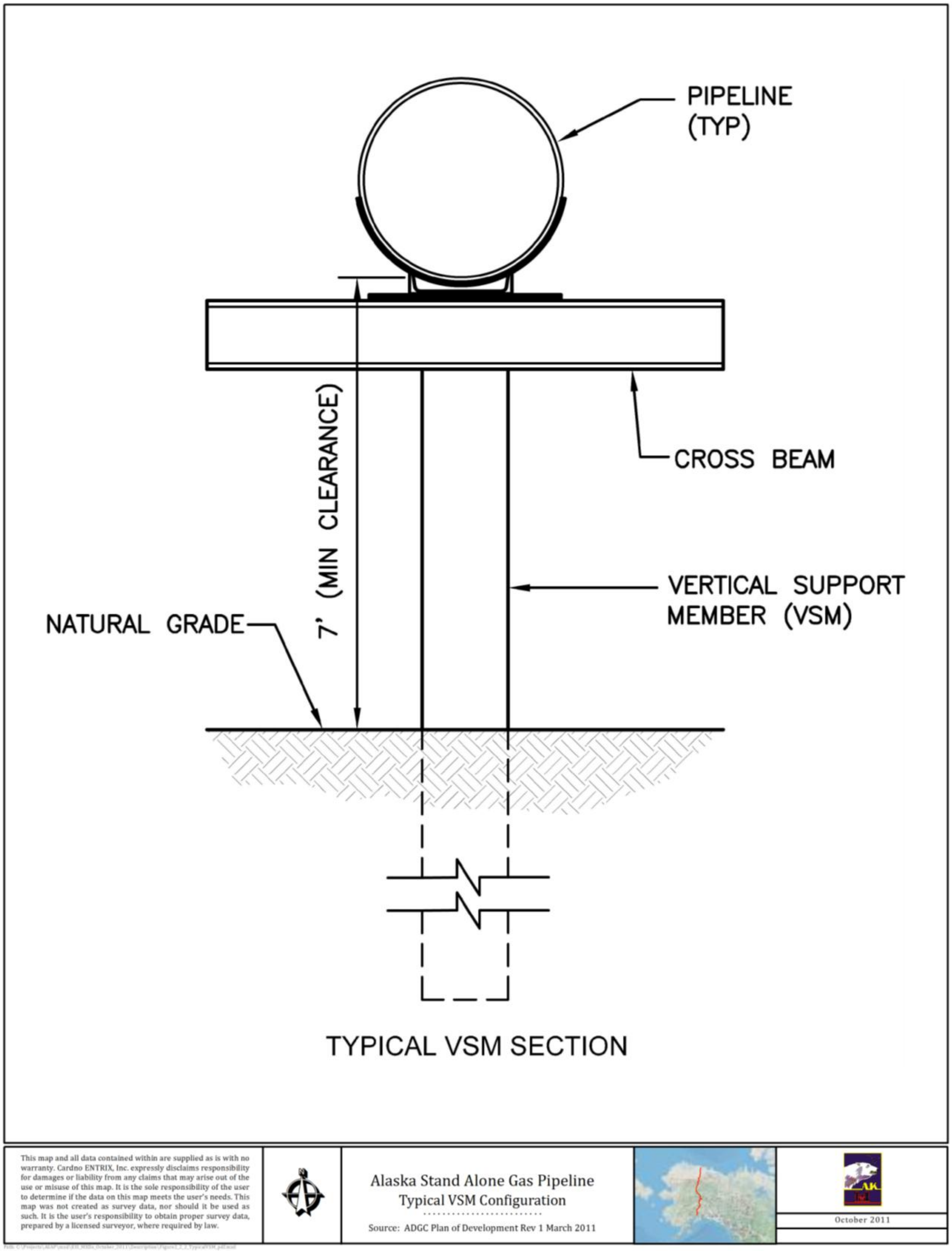


FIGURE 2.2-2 Typical VSM Configuration

2.2.3.2 Waterbody Crossings

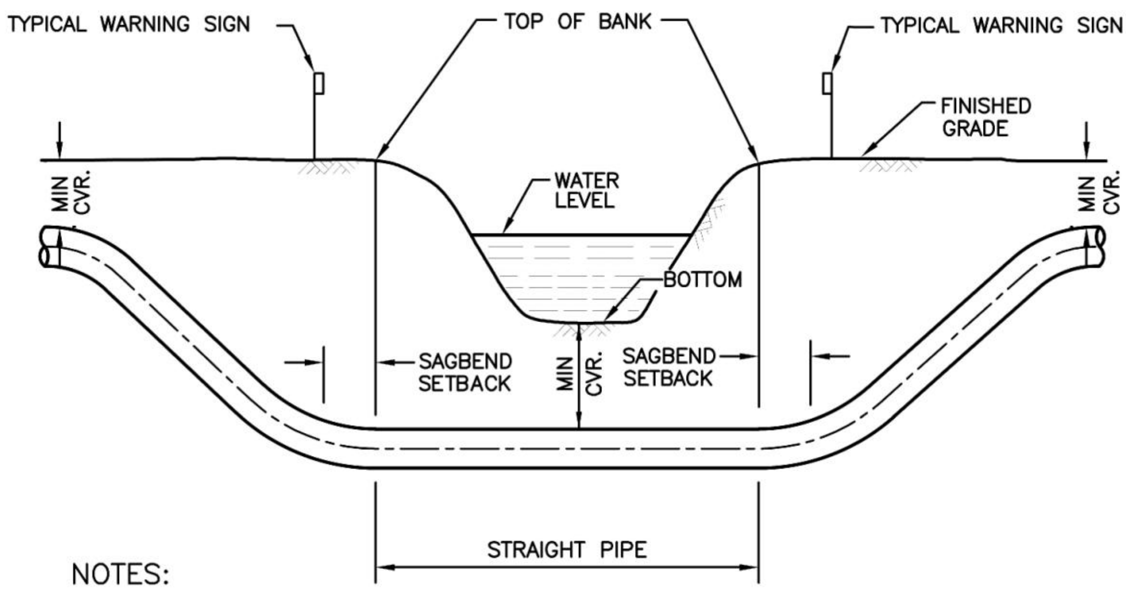
A total of approximately 495 waterbody crossings would be required for the proposed Project (see Section 5.2). The AGDC has proposed to cross 41 waterbodies via trenchless technology such as the HDD method, 4 waterbodies via new or existing bridges, and the remaining waterbodies via either dry open-cut crossing methods (i.e., dam and pump or flume crossings) or via wet open-cut methods. In general, the AGDC anticipates that in-water work would be completed in 1 to 3 days after initiation. Depending on site conditions, the AGDC may install either an insulated or uninsulated pipe. Additional information on the proposed waterbody crossing procedures and potential environmental consequences is presented in Section 5.2 (Water Resources). Figure 2.2-3 depicts a typical waterbody crossing.

Wet Open-Cut Waterbody Crossing

In general, a wet open-cut waterbody crossing is accomplished using methods similar to conventional open-cut trenching methods used in upland areas. The open-cut construction method involves excavation of the pipeline trench across the waterbody; installation of a prefabricated segment of pipeline; and backfilling of the trench with native material, with no effort to isolate flow, if any, from construction activities. Some waterbodies could require drilling or blasting to install the proposed Project pipeline. The AGDC would develop a Blasting Plan prior to construction to minimize potential blasting impacts to sensitive resources, including aquatic organisms.

Mitigation measures would be implemented to minimize impacts on the aquatic environment during construction. Construction would be scheduled so that the trench would be excavated immediately prior to pipe laying activities. After the design grade is obtained, cut slopes would be stabilized immediately. The waterbody banks would be returned to as near pre-construction conditions as possible. Furthermore, to prevent waterbody contamination, the AGDC would keep fuel storage, equipment refueling, and equipment maintenance operations at least 100 feet from waterbodies and wetlands. The AGDC would also develop an ESCP and a SWPPP prior to the commencement of construction, which would outline erosion control best management practices to minimize the potential for upland sediment to enter waterbodies.

The AGDC may also use an open-cut/push-pull crossing method. The open-cut/push pull method is similar to an open-cut waterbody crossing. The push-pull technique involves stringing and welding the pipeline from the streambank, and excavating and backfilling the trench using a backhoe or dragline. Flow within the waterbody is sufficient to float the prefabricated pipeline across the water-filled trench. After the pipeline is floated into place, the backhoe or dragline lowers the pipeline into place.



NOTES:

1. WATERBODY CROSSINGS WILL BE INSTALLED BY THE OPEN–CUT OR OTHER METHOD, UNLESS OTHERWISE NOTED.
2. BUOYANCY CONTROL REQUIREMENTS, MINIMUM COVER AND SAGBEND SETBACK TO BE DETERMINED DURING DETAILED ENGINEERING.
3. FOR PHASE 1 ESTIMATE ASSUME MINIMUM COVER = 10'
4. TYPE A & B STREAMS WILL REQUIRE SITE–SPECIFIC DESIGNS.

Alaska Stand Alone Gas Pipeline
Typical Waterbody Crossing

Source: ADGC Plan of Development Rev 1 March 2011

October 2011

FIGURE 2.2-3 Typical Waterbody Crossing

Dry Waterbody Crossing

The AGDC proposes to use a dry crossing method (flume, dam-and-pump, HDD, or bridge) at waterbodies where overwintering or spawning fish are present, or in locations where wet open-cut crossings are not practical. All work in waters of the U.S. would require authorization by a Section 404 permit to be issued by the USACE.

Flume Crossing

A flume crossing consists of temporarily directing the flow of water through one or more flume pipes placed over the area to be excavated. This procedure would allow trenching across the waterbody to be completed underneath the flume pipes without reducing downstream water flow. Streamflow would be diverted through the flumes by constructing two bulkheads, using sand bags or plastic dams, to direct the streamflow through the flume pipes. Following completion of pipeline installation, backfill of the trench, and restoration of streambanks, the bulkheads and flume pipes would be removed. This crossing method generally minimizes downstream turbidity during trenching by allowing excavation under relatively dry conditions. This method would only be used in waterbodies with flows that would not exceed the capacity of the flume.

Dam-and-Pump Crossing

Similar to the flume crossing method, the dam-and-pump method involves installing temporary dams upstream and downstream of the proposed waterbody crossing. The temporary dams would typically be constructed using sandbags and plastic sheeting. Following dam installation, appropriately sized pumps would be used to dewater and transport the streamflow around the construction work area and trench. The AGDC would use appropriate fish screening to minimize the incidental entrapment of fish and other aquatic organisms (i.e., entrainment). Trench excavation and pipeline installation would then commence through the dewatered portion of the waterbody channel. Following completion of pipeline installation, backfill of the trench, and restoration of streambanks, the temporary dams would be removed, and flow through the construction work area would be restored. This method is generally only appropriate for those waterbody crossings where pumps can adequately transfer streamflow volumes around the work area and there are no concerns about sensitive species passage.

HDD Crossing

The AGDC proposes to use a trenchless, most likely HDD, crossing method at 41 waterbody crossings. Figure 2.2-4 illustrates a typical HDD installation process. The waterbodies that would be crossed using HDD and other trenchless techniques are described further in Section 5.2 (Water Resources).

HDD is a trenchless crossing method that may be used to avoid direct impacts on sensitive resources, such as waterbodies, by directionally drilling beneath them. HDD involves installation of the pipeline beneath the ground surface by pulling the pipeline through a pre-drilled bore hole. HDD installation is typically carried out in three stages: (1) directional drilling of a small-diameter pilot hole; (2) enlarging the pilot hole to a sufficient diameter to accommodate the pipeline; and (3) pulling the prefabricated pipeline, or pull string, into the enlarged bore hole.

Throughout the process of drilling and enlarging the pilot hole, a bentonite clay slurry (drilling mud) would be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and stabilize the open hole. The drilling mud would be a mixture of non-toxic clays and rock particles consisting of about 1 to 5 percent bentonite clay and 0 to 40 percent inert solids. Water required to prepare the slurry of drilling mud would be appropriated from the waterbody being directionally drilled, in accordance with state and local permit stipulations, or transported to storage tanks onsite. Additives may be mixed into the drilling mud to improve drilling conditions, but the AGDC has stated that no synthetic or potentially toxic drilling fluid additives would be used. Drilling mud and slurry would be stored away from the waterbody in tanks, behind earthen berms, or by other methods that would prevent it from flowing off the work area. After the pipeline is installed, the mud would be disposed of in upland areas according to applicable regulations.

A successful HDD would result in little or no impact on the waterbody being crossed. HDD is not without risk, however, as inadvertent drilling fluid releases could result if the fluid escapes containment at pits that would be excavated at the HDD entrance and exit points or if a "frac-out" occurs. A frac-out occurs when drilling fluids escape the drill bore hole and are forced through the subsurface substrate to the ground surface. Frac-outs occur most often in highly permeable soils during the entrance and exit phases of the pilot hole drilling, as this is when the greatest pressures are exerted on the bore walls in shallow soils. Drilling fluid pressures in the bore hole and drilling fluid pumping and return flow rates would be monitored to detect the potential occurrence of a frac-out. The AGDC would develop and implement contingency plans for HDD operations with an HDD contractor during final design. This plan would specify drill monitoring, frac-out clean up and contingency procedures. A discussion of the potential impacts of HDD on waterbodies is provided in Section 5.2 (Water Resources).

Bridge Crossings

The AGDC has proposed the use of new or existing bridge crossings in four locations along the proposed Project alignment. Bridge crossings would result in the proposed Project pipeline being aerially strung across waterbodies without any surface water disturbance.

The AGDC proposes to attach the pipeline to three existing highway bridges: Chulitna River Bridge, Coal Creek Bridge, and Hurricane River Bridge. In addition, the E.L. Patton Bridge that crosses the Yukon River may also be used, although alternative options are discussed below.

Yukon River Crossing Options

The AGDC has proposed three options for crossing the Yukon River: construct a new aerial suspension bridge across the Yukon River (Option 1); cross the Yukon River by attaching the pipeline to the existing E.L. Patton Bridge (Option 2); or utilize HDD to cross underneath the Yukon River at the location of the proposed new suspension bridge (Option 3). If a new Yukon River suspension bridge were constructed (Option 1), no permanent structures, such as footings, would be installed within the Yukon River. Figure 2.2-5 depicts the proposed new Yukon River suspension bridge crossing details. If the pipeline were attached to the existing E.L. Patton Bridge (Option 2), no surface water disturbance would occur as the proposed pipeline would be installed on a hanger pipe assembly that would be placed underneath the existing bridge deck (Figure 2.2-6). The HDD crossing (Option 3) would require a 1 acre work area at each end of the crossing. The work area would be within the pipeline TCE. The feasibility of an HDD crossing is unknown at this time due to limited soil information. If the soils are similar to those found during the geotechnical exploration of the E.L. Patton Yukon River Bridge 0.6 mile upstream, then the HDD method may not be feasible due to the presence of gravel and fractured bedrock. Further study is required to investigate and evaluate the in-situ soils, analyze scour limitations, and to address seismic concerns. Figure 2.2-4 shows a typical HDD waterbody crossing.

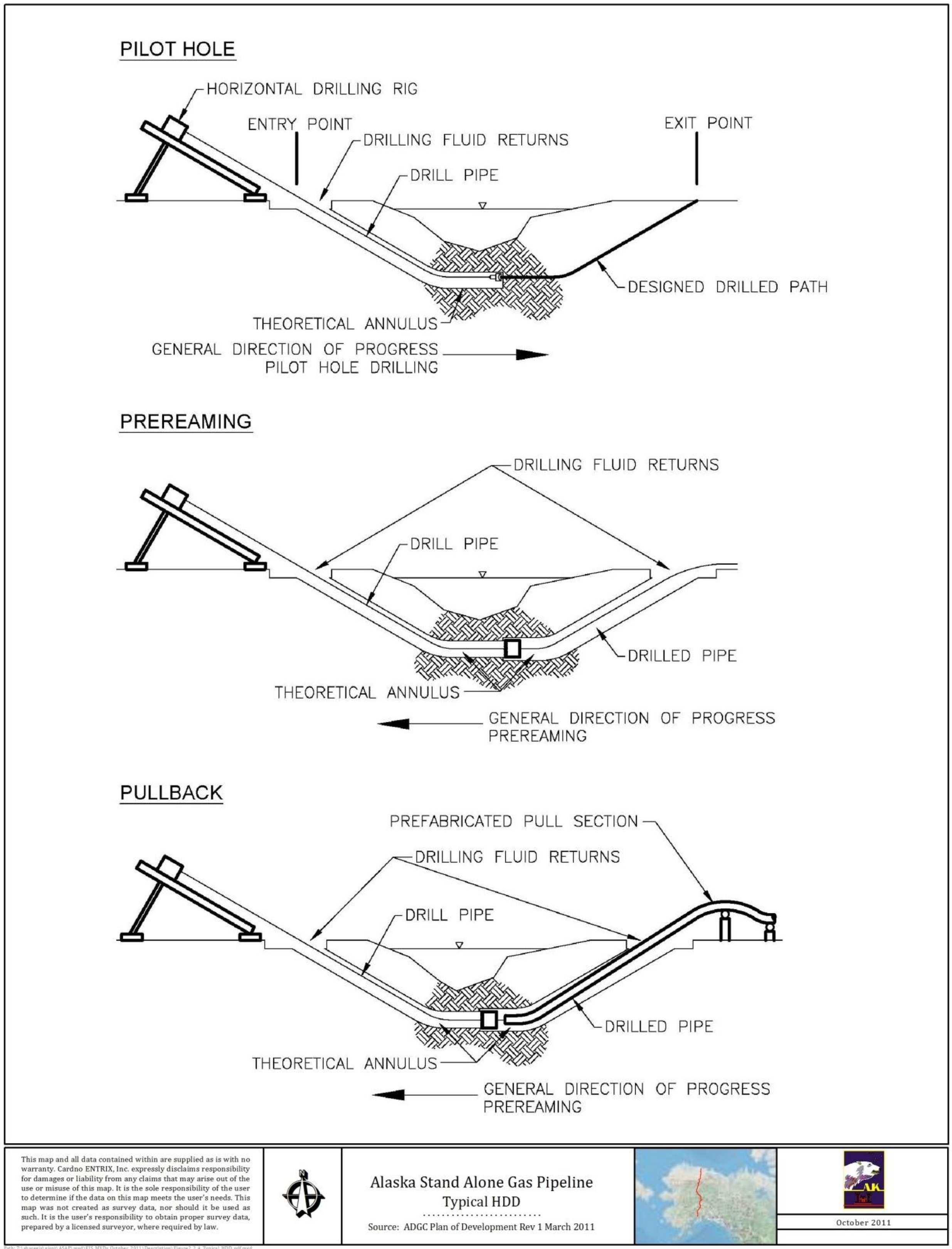
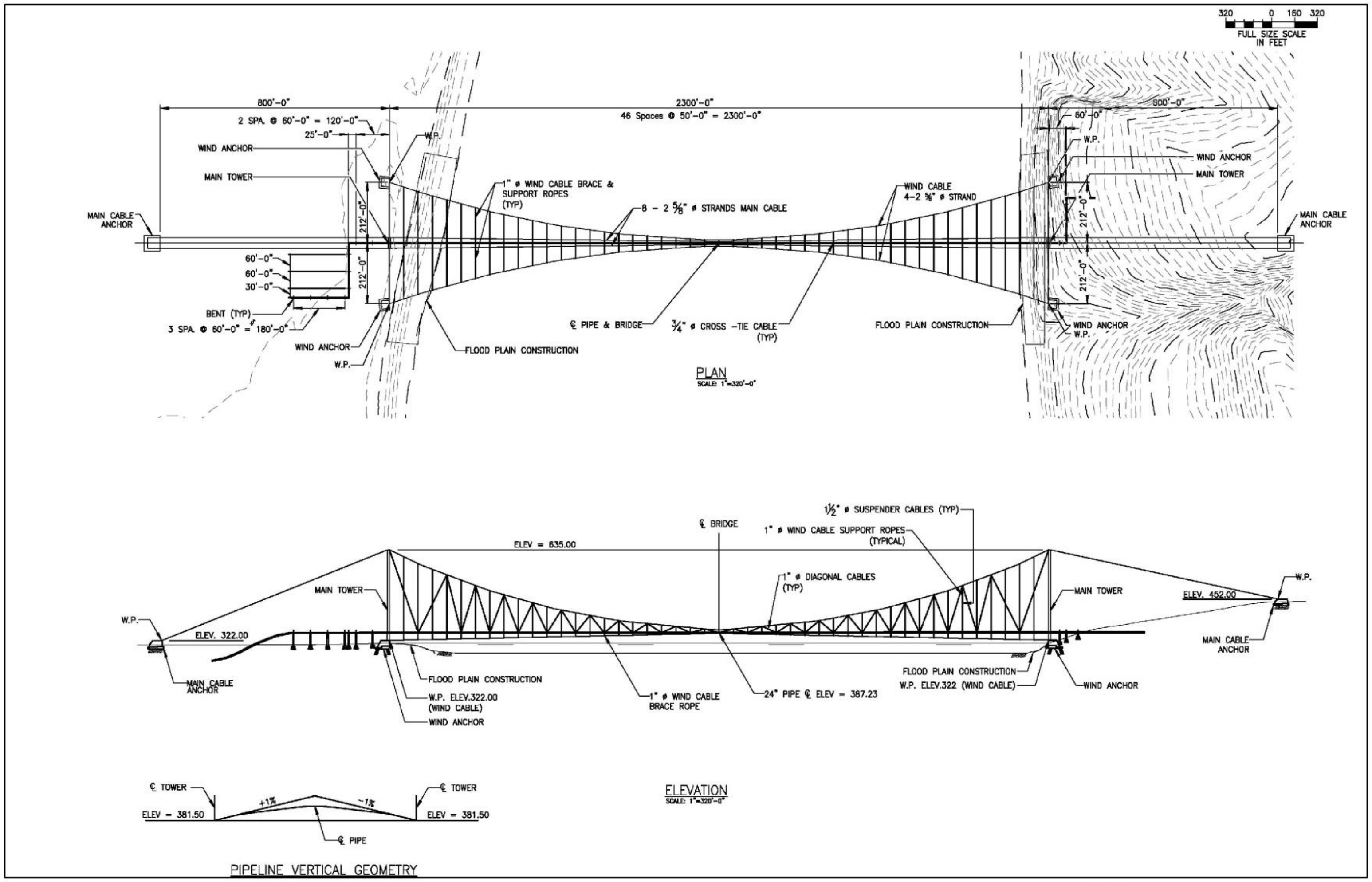


FIGURE 2.2-4 Typical HDD Waterbody Crossing (Option 3)



Alaska Stand Alone Gas Pipeline

Yukon River Bridge Crossing

Source: ADGC Plan of Development Rev 1 March 2011

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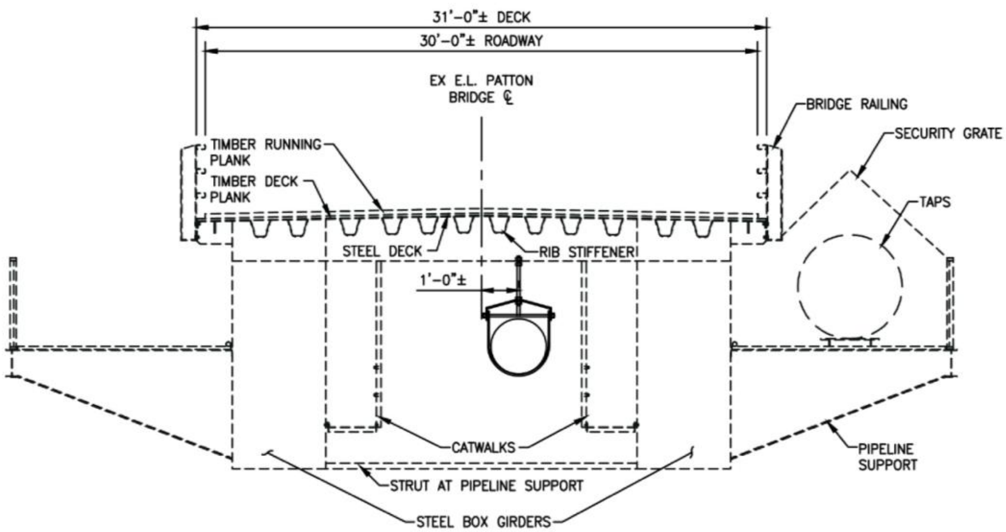
FIGURE 2.2-5 Yukon River New Bridge Crossing (Option 1)



E.L. Patton Yukon River Bridge ASAP Placement

* See the overall Project Overview figure, Figure 1.0-1, for the location of this facility relative to the overall Project area.

Alaska Stand Alone Gas Pipeline
Yukon River Existing Bridge Crossing

Source: ADGC Plan of Development Rev 1 March 2011

October 2011

FIGURE 2.2-6 Yukon River Existing Bridge Crossing (Option 2)

Wetland Crossings

Construction of the proposed Project would be conducted across 593 wetland areas in accordance with applicable permits. The site-specific crossing procedures used to install the pipeline across wetlands would vary depending on the level of soil stability and saturation encountered during construction. Installation of the pipeline across wetlands would be accomplished using one of three crossing methods: open-cut without matting, open-cut with matting or geo-fabric and fill, or open-cut/push-pull. At this time, the AGDC has not proposed to cross any wetlands using the HDD method.

To the maximum extent possible, the AGDC would construct during the winter to minimize potential impacts to wetlands. Grading would primarily be limited to trenching over the trench line to preserve root stock contained in topsoil or the top vegetated mat. During ditch excavation, the top vegetated mat wetland layer would be removed and separated from the subsoil. After pipeline installation and during backfill activities, the vegetative mat would be placed back in the ditch as the last (i.e., top) item with the top of the vegetative mat at the surface of the backfilled ditch. Materials such as timber mats or geo-fabric and fill placed in wetlands during construction would be removed during final cleanup, and the pre-construction contours of the wetland would be restored. Any required permanent erosion control measures would then be installed, and disturbed areas within the wetland would be seeded with native, annual wetland grasses to provide stabilization until natural revegetation occurs.

The wetlands that would be affected by construction of the proposed Project are described further in Section 5.4 (Wetlands). Section 5.4 also provides further discussion of the wetland restoration and mitigation procedures that would be implemented by the AGDC.

Open-Cut Wetland Crossing

During crossings of unsaturated wetlands (those wetlands without standing water or saturated soils), construction would primarily be similar to the upland construction procedures described in Section 2.2.2, with the pipeline segment to be installed through the wetland assembled adjacent to the excavated trench. In wetlands with soils too wet (saturated) to support the construction equipment, timber mats or geo-fabric and fill would be used to minimize the impacts of equipment traffic.

Open-Cut/Push-Pull Crossing

If wetland soils are saturated or inundated at the time of construction, the AGDC may use an open-cut/push-pull wetland crossing method. The open-cut/push-pull technique involves stringing and welding the pipeline from the edge of the wetland, and excavating and backfilling the trench using a backhoe or dragline. All equipment would be positioned on platforms that are constructed on each side of the wetland crossing. The prefabricated pipeline would be installed in the trench within the wetland by equipping it with buoys and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats would be removed and the pipeline would sink into place. In saturated areas or locations with high water tables, the proposed pipeline would be fitted with buoyancy controls.

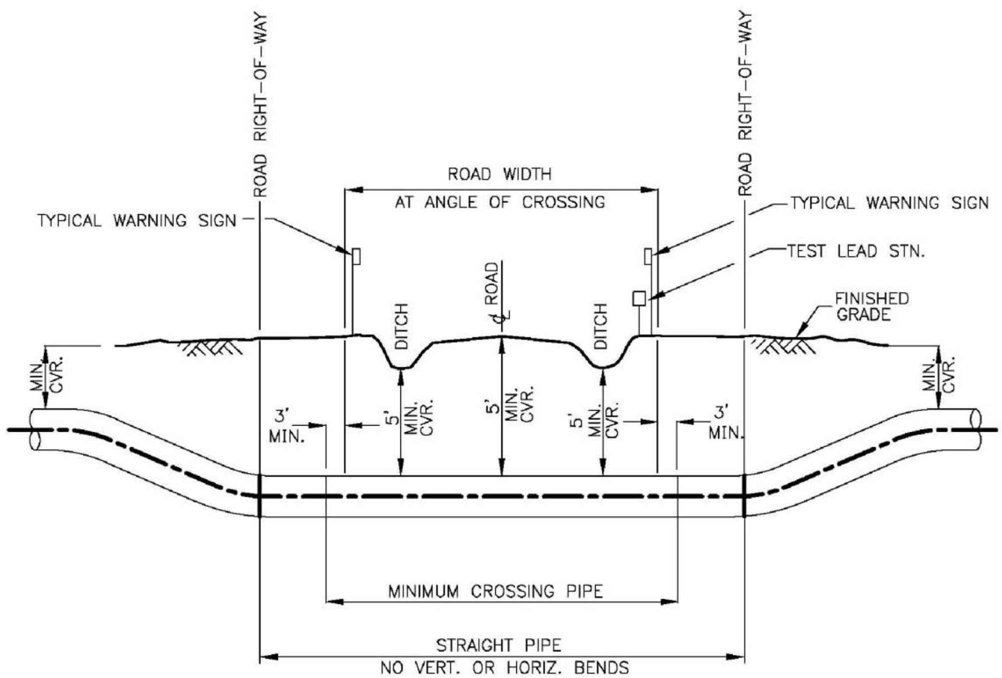
2.2.3.3 Road, Highway, and Railroad Crossings

The proposed pipeline route would cross paved and unpaved roads, highways, and railroads. Construction across these features would be accomplished in accordance with the requirements of all applicable crossing permits and approvals. During construction across roadways, the AGDC would incorporate any safety precautions required by federal, state, and local transportation agencies. Figure 2.2-7 provides a typical arterial road crossing.

Railroads, paved roads, and high-use gravel roads would be crossed via subsurface boring techniques where feasible (horizontal bore or ‘slick bore’). Further, the AGDC proposes to cross all TAPS access roads via horizontal bore. Section 5.9 (Land Use) provides additional information on the proposed major road crossing locations. Horizontal bores are similar to HDDs in that they avoid direct surface impacts on sensitive resources by installing the pipeline beneath the feature. Horizontal bores are typically much shorter and are used to cross such features as roads or railroads.

Horizontal bores would be accomplished by excavating pits on both sides of the feature to be crossed and boring a horizontal hole equivalent to the diameter of the pipe. The pipeline section would then be pushed through the bore hole. If additional pipeline sections are required, they would be welded to the first section of the pipeline in the bore pit before being pushed through the bore hole.

Where the proposed Project would cross roads via open-cut installation, temporary bypasses or bridges may be installed to facilitate traffic movement. In these areas, heavy walled pipe would be installed to a depth that would withstand vehicle loads. The AGDC would develop and implement a Traffic Control Plan prior to construction. This plan would outline measures that would be implemented to minimize traffic impacts.



NOTES:

1. ARTERIAL ROAD, TYPICALLY A 2 OR 4 LANE PAVED, UNDIVIDED OR DIVIDED HIGHWAY WITH SHOULDERS AND DITCHES. INCLUDES THE DALTON, ELLIOT AND PARKS HIGHWAYS. TYPICAL CROSSING PIPE LENGTH FOR 4 LANE ARTERIAL ROAD = 160' AT 90° CROSSING. TYPICAL CROSSING PIPE LENGTH FOR 2 LANE ARTERIAL ROAD = 80' AT 90° CROSSING.
2. COLLECTOR ROAD TYPICALLY A 2 LANE UNPAVED OR PAVED, UNDIVIDED HIGHWAY WITH SHOULDERS AND DITCHES. INCLUDES STATE HIGHWAY, U.S. HIGHWAY AND BOROUGH ROADS. TYPICAL CROSSING PIPE LENGTH FOR SECONDARY ROAD = 80' AT 90° CROSSING.
3. MEDIAN AND ADDITIONAL 2 LANES FOR ARTERIAL ROAD, NOT SHOWN. ASSUME 12' LANES, 4' SHOULDERS, 20' DITCHES, 50' MEDIAN (ARTERIAL ONLY)
4. CROSSING SHALL BE CONSTRUCTED USING BORE METHOD UNLESS OTHERWISE SPECIFIED.
5. THE CONSTRUCTED PIPELINE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS BETWEEN ROAD RIGHT-OF-WAY BOUNDARYS.
6. FOR TYPICAL EXTRA TEMPORARY WORKSPACE FOR ARTERIAL AND COLLECTOR ROAD CROSSINGS SEE DRAWING SD-ROW-05.

Alaska Stand Alone Gas Pipeline
Typical Road Crossing

Source: ADGC Plan of Development Rev 1 March 2011

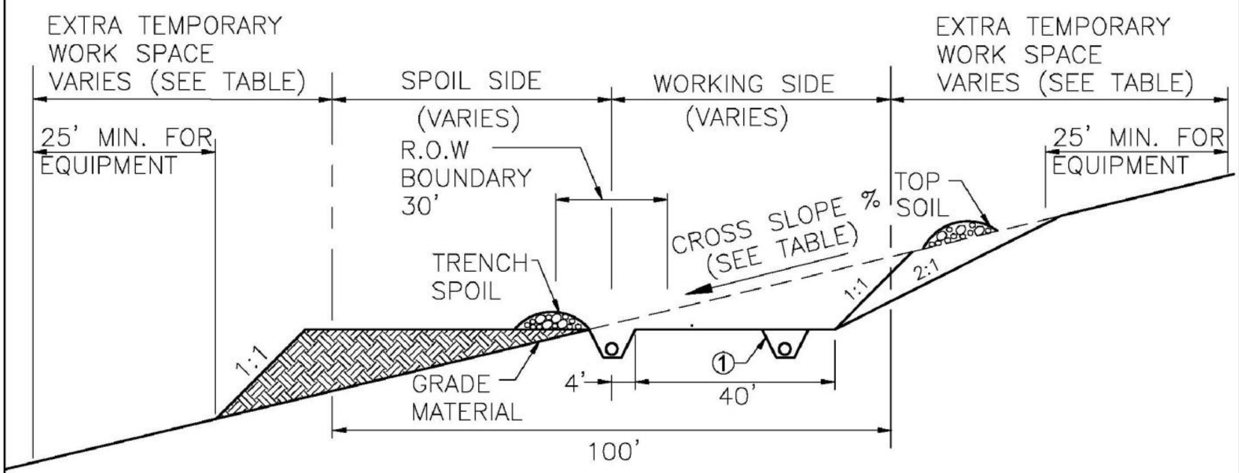
October 2011

FIGURE 2.2-7 Typical Road Crossing

2.2.3.4 Rugged Topography

Portions of the proposed Project would traverse areas of side slopes and rolling terrain that could require additional area to create level and safe workspaces. Two-toned or single cut (side hill cuts) construction is a common method of accomplishing pipeline construction in areas of side slopes. The side hill cut construction techniques involve cutting the uphill side of the construction ROW during grading. The material removed from the cut would be used to fill the downhill side of the construction ROW, to provide a safe and level surface from which to operate heavy equipment. The pipeline trench would then be excavated along the newly graded ROW at the appropriate depth beneath the original grade. Figure 2.2-8 provides a typical cross section of the single cut side hill construction technique. The pipeline would be located in undisturbed material to address safety and stabilization issues in a cost effective manner in accordance with PHMSA requirements.

The side hill construction techniques would likely require TEWS areas to accommodate the additional volumes of fill material generated by this technique. For the purposes of the analysis in this document, a construction ROW was expanded to 230-feet in width along the multiple segments, which combined are approximately 77 miles long and would require cut and fill. Following pipeline installation and backfill of the trench, excavated material would be placed back in the cut and appropriately compacted to restore the approximate original contours. Additional information on construction through steep slope areas is provided in Section 5.1 (Geology and Soils).



TYPICAL SECTION

25% GRADE AS DRAWN

CROSS SLOPE	CUT cu.yd	CUT cu.yd	TRENCH SPOIL cu.yd	ETWS Spoil side		ETWS Working side		TOTAL DISTURBANCE	
%	1:1	2:1		1:1	2:1	1:1	2:1	1:1	2:1
25%	14.01	22.00	1.10	45'	55'	45'	75'	190'	230'
24%	13.60	20.00	1.10	40'	55'	45'	75'	185'	230'
22%	12.14	17.00	1.10	40'	50'	45'	70'	185'	220'
20%	10.70	14.30	1.10	40'	50'	40'	60'	180'	210'
18%	9.50	12.10	1.10	40'	50'	40'	60'	180'	210'
16%	8.20	10.10	1.10	35'	45'	40'	55'	175'	200'
14%	7.00	8.35	1.10	35'	40'	40'	50'	175'	190'
12%	5.85	6.70	1.10	35'	40'	40'	50'	175'	190'
10%	4.70	5.35	1.10	30'	35'	35'	40'	165'	175'
8%	3.75	4.05	1.10	30'	35'	35'	40'	165'	175'
6%	2.75	2.95	1.10	30'	30'	30'	35'	160'	165'
4%	1.75	1.85	1.10	30'	30'	30'	35'	160'	165'
2%	0.85	0.88	1.10	30'	30'	30'	30'	160'	160'

* 15% SWELL / BULK NOT INCLUDED

① ALTERNATE PIPE LOCATION. PIPELINE MUST BE LOCATED IN UNDISTURBED MATERIAL.

Alaska Stand Alone Gas Pipeline
Side Slope (Single Fill)
Construction Right-of-Way

Source: ADGC Plan of Development Rev 1 March 2011

October 2011

FIGURE 2.2-8 Typical Side Slope (Single Fill) Construction Right-of-Way

2.2.4 Construction Procedures for Aboveground Facilities

The aboveground facilities would be constructed prior to and concurrent with pipeline installation, but construction would be conducted by special fabrication crews generally working separately from the pipeline construction spreads.

Typically, construction of the GCF, straddle and off-take facility, compressor stations, and Cook Inlet NGLEP Facility would involve clearing, grading, and/or compacting the sites to the surveyed elevations, where necessary, and installing a gravel ground cover for placement of modular buildings and to support equipment. Site components at aboveground facilities would be modularized to minimize construction, logistics, and commissioning activities. The module sections of the GCF would be transported to the facility site via nine barges to West Dock and then transported on existing roads and assembled on site. Section 2.1.2 provides additional details regarding barging. Prefabricated segments of pipe, valves, fittings, and flanges would be shop- or site-welded and assembled at the aboveground facility sites. As necessary, electrical, domestic water and septic, and communications utilities would be installed. Facility piping, both above and below ground, would be installed and hydrostatically tested before being placed in service. Controls and safety devices, such as the emergency shutdown system, relief valves, gas and fire detection facilities, and other protection devices, would also be checked and tested. Upon completion of construction, all disturbed areas associated with the aboveground facilities would be finish-graded and covered with gravel, as appropriate. All roads and parking areas would be graveled. Additionally, the aboveground facilities would be fenced for security and protection.

Construction of meter stations, MLVs, and pig launcher/pig receiver facilities would generally be similar to that described for the other aboveground facilities, as most of them would be located within the fenced perimeter of the GCF, compressor stations, straddle and off-take facility, and/or Cook Inlet NGLEP Facility. MLVs and the pig receiver outside of other aboveground facilities would follow a similar construction process, which would entail site clearing and grading, installation and erection of facilities, hydrostatic pressure testing, cleanup and stabilization, and installation of security fencing around the facilities. Typical MLV and pig launcher/receiver configurations are depicted in Figures 2.2-9 and 2.2-10, respectively.

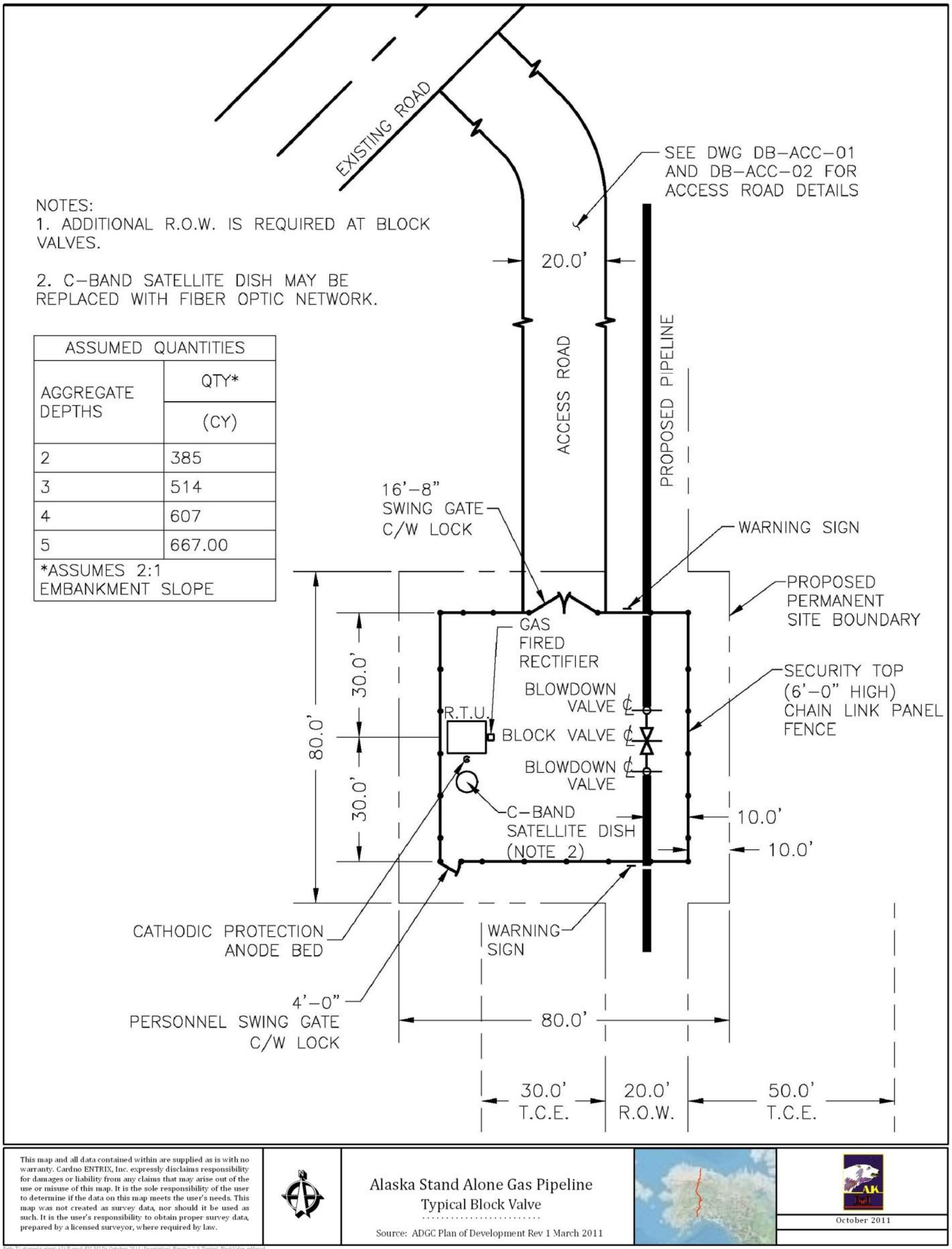


FIGURE 2.2-9 Typical Block Valve

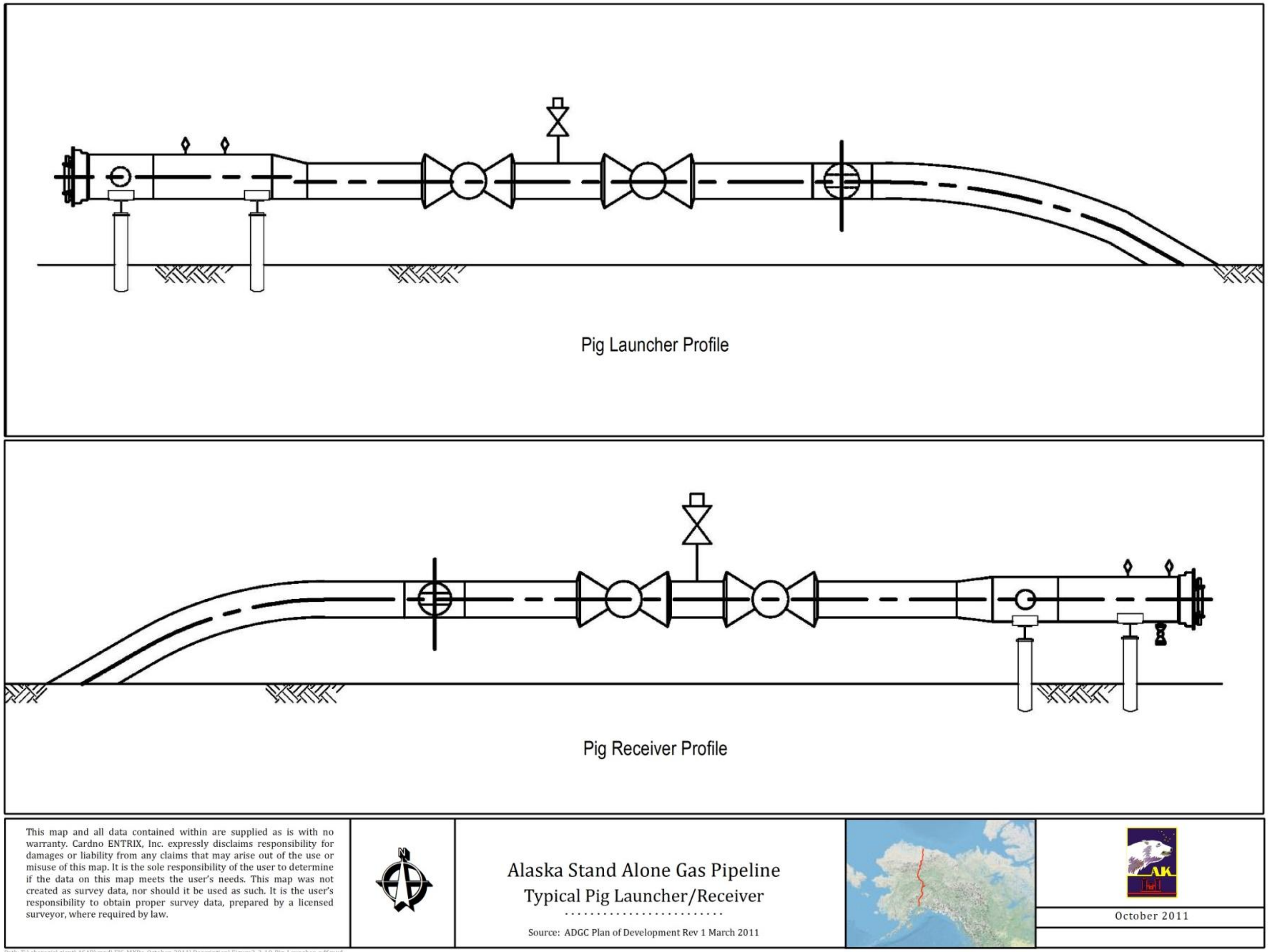


FIGURE 2.2-10 Typical Pig Launcher and Receiver Profiles

2.2.5 Corrosion Protection and Detection Systems

Cathodic corrosion protection (CP) is generally applied by two methods; either through the use of sacrificial anodes or by an impressed current system powered by a direct current (DC) source. For this proposed Project, both a galvanic magnesium ribbon anode system and impressed current systems primarily located (where necessary) at block valve locations would be used.

Sacrificial anodes are sometimes referred to as a galvanic system because the anodes used are higher (more active) in the galvanic series than the steel they are protecting. With this type of system a metal rod, ingot or ribbon of either high purity zinc or magnesium is placed in the pipeline trench and connected to the pipeline through a test station via an insulated wire.

The impressed current system method of CP operates by impressing a DC through the soil by way of an anode groundbed. There are many configurations for impressed current CP systems. Deep groundbed anodes, for example, are used to protect long sections of pipelines and distributed buried assets such as those found at pump/compressor stations, refineries and terminals. DC Power for the impressed current system can be supplied by either an alternating current (AC) to DC rectifier or a Thermo-Electric-Generator (TEG). AC power could come from existing electrical grids where available. However, due to the remoteness of the pipeline and associated facilities, it is assumed all power would come from gas-fired TEGs near pipeline facilities, such as block valve sites or power generated at a compressor station. Based on this assumption, no power transmission systems outside of the proposed Project footprint would be required for cathodic protection. TEGs, fueled by natural gas, would provide the DC power to the anodes by means of thermocouple heat to electrical energy transfer. Small tubing, tapped to the gas line with pressure reducing regulators, would be required to supply fuel to the TEG at each installation.

All cathodic protection system facilities including deep groundbed anodes, where required, would be located within the permanent ROW, at MLVs, at meter stations, or within the compressor stations. As specified by USDOT regulations, aboveground cathodic protection system test stations would be located at less than 1 mile intervals along the proposed route. A cathodic protection system test station typically consists of a test wires within a metal conduit, leading to a junction box. The conduit is supported with a painted metal punched post. A testing terminal is located at the top of the pipe that can be accessed by operations personnel to measure the current and determine the potential for corrosion. The cathodic protection system test sites are often located adjacent to pipeline markers. Land impacts for the cathodic protection system test stations have been accounted for within the temporary construction easement, permanent ROW, and permanent workspace requirements for the other proposed Project facilities.

2.2.6 Construction Work Force and Schedule

As currently proposed by the AGDC, construction of the major aboveground facilities would commence in the summer of 2016 and would extend to the summer of 2019. Pipeline construction would be initiated in the winter of 2017 and completed to accommodate an in-service in the fall of 2019. The AGDC primarily proposes winter and summer construction and intends to use five construction spreads to construct the proposed Project. According to the AGDC, the approximate mileposts for each spread are:

- Spread 1: MP 0.0 to MP 183.0;
- Spread 2: MP 183.0 to MP 360.0;
- Spread 3: MP 360.0 to MP 529.0;
- Spread 4: MP 529.0 to MP 737.1; and
- Fairbanks Lateral Spread: MP FL 0.0 to MP FL 34.4.

According to the AGDC, the length of time the trench would remain open (i.e., trenching to backfill) during construction at a location would range from one to three days. Construction at any single point along the proposed pipeline, from ROW clearing to backfill and final grading, would typically last about 90 to 120 days (three to four months). Due to weather and trench settling, final grading may occur up to one year after trench backfilling.

The AGDC has proposed 15 worker camps to house workers during Project construction (see Sections 2.1.3 and 5.9). All of these camps would be located at existing construction camps or previously cleared and disturbed areas. Workers would also be housed in local accommodations when available. The AGDC has not provided a housing plan that would address potential increases in local housing demand and the associated increases in traffic in these areas.

The AGDC anticipates that construction of the proposed pipeline at peak construction would require approximately 6,400 workers, comprised of 5,500 on the pipeline and 900 on the facilities (Table 2.3-1; also see Section 5.12 Socioeconomics). It is it's anticipated that work will continue into the winter of 2019, but at this time employment estimates are not available beyond the fall of 2018. After Project construction is completed, it is anticipated that the operations and maintenance of the facilities and infrastructure planned for development under the proposed Project would require between 50 to 75 O&M employees, with most workers concentrated at the facilities near Prudhoe Bay, Fairbanks, and Cook Inlet (See Table 5.12-15). No additional permanent O&M workers are anticipated.

TABLE 2.3-1 Estimated Workforce Numbers for the Proposed Project

Season	Summer 2016	Fall 2016	Winter 2017	Summer 2017	Fall 2017	Winter 2018	Summer 2018	Fall 2018
Persons for Pipeline	2,500	1,150	3,200	5,500	2,200	3,800	2,200	100
Persons for Facilities	200	400	800	900	600	450	850	250
Total	**2,700**	**1,550**	**4,000**	**6,400**	**2,800**	**4,250**	**3,050**	**350**

2.2.7 Water Needs and Waste Disposal

During construction and operation of the proposed Project, water would be required for multiple activities such as hydrostatic testing, ice production, dust control, and operations and maintenance activities. The AGDC anticipates that approximately 388.5 million gallons would be required for earthwork, 79.5 million gallons for hydrostatic testing, 0.1 million gallons for ice access roads, and 619.8 million gallons for ice work pads. The AGDC is currently conducting studies to ascertain appropriate water sources and would identify those sources at a later date. The AGDC has not specifically identified how wastewater (including domestic wastewater or hydrostatic test water) generated by the proposed Project would be treated, but they have indicated that it would be treated in accordance with applicable regulations and permitting. The AGDC would develop a Comprehensive Waste Management Plan that would include wastewater treatment and discharge measures.

Waste generated during Project construction and operation would be treated and disposed of in accordance with the applicable regulations and permitting. As discussed above, the AGDC would develop a Comprehensive Waste Management Plan that would describe hazardous and non-hazardous waste handling and disposal. Furthermore, the AGDC would develop a Spill Prevention and Control Plan and a Spill Prevention and Control and Countermeasure Plan. These plans would outline hazardous material storage, handling, and disposal methods.

2.3 OPERATION, MAINTENANCE, AND SAFETY CONTROLS

The proposed Project pipeline and aboveground facilities would be designed, constructed, operated, and maintained to meet all safety standards set forth in industry and in the USDOT *Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards* (49 CFR Part 192). These safety standards are discussed further in Section 5.18 (Reliability and Safety).

2.3.1 Normal Operations and Routine Maintenance

The pipeline would be constructed of welded carbon steel that meets or exceeds industry standards and would be covered with a protective coating to minimize rust and corrosion. To protect against damage from external forces, the proposed pipeline would be buried to appropriate depths that would meet or exceed the USDOT standards at 49 CFR 192.327. All welds joining each section of pipe would be visually inspected and tested using non-destructive examination methods such as radiography (x-ray), gamma ray, or ultrasound to ensure the integrity of the welds. Prior to being placed in service, the pipeline would be hydrostatically pressure tested to verify its integrity and to ensure its ability to withstand the maximum designed operating pressure. A cathodic protection system would be installed to protect all underground and submerged pipeline facilities constructed of metallic materials from external, internal, and atmospheric corrosion. These construction methods would help to assure that the proposed Project would operate as designed and to minimize the chances for leaks.

Prior to placing the proposed Project in service, the AGDC would develop an Operations and Maintenance (O&M) Plan in accordance with 49 CFR 192. This plan would provide written procedures for conducting operations and maintenance activities and it would be updated at least annually.

Pipeline maintenance includes both preventative maintenance to ensure equipment and systems continue working efficiently, and corrective maintenance to fix or replace equipment and systems that are not working. The O&M Plan includes procedures to provide safety during maintenance including procedures for operating, maintaining, and repairing the pipeline in accordance with applicable requirements; controlling corrosion; maintaining construction records, maps, and operating history and making these documents available to the appropriate operating personnel; and maintaining aboveground facilities, including provisions for isolating units or sections of pipe and for purging before returning to service. In general, removal or addition of equipment or pipe for maintenance is expected to occur at major facilities where the pipeline is aboveground. Removal or addition of equipment or pipe could take place at other locations (e.g., MLVs). All procedures for these activities would be detailed in the O&M Plan. Procedures would be developed and carried out in accordance with applicable regulation and would follow BMPs.

Three O&M facilities are planned for the proposed Project, one at the GCF in Prudhoe Bay, one in Fairbanks, and one at the Cook Inlet NGL Facility in Wasilla. Each location would include office facilities, a maintenance garage, and both warm and cold warehouse space. The Wasilla O&M facility would also house the pipeline control systems. Each O&M facility would be accessible via road and would have sufficient parking for staff, visitors, and maintenance vehicles. All major facilities would be accessible via the road system. In addition, a number of roads would provide access to the Project operational ROW. In general, it is expected that limited maintenance would be required on the ROW. A schedule for maintenance would be developed in accordance with all pertinent regulations and would follow BMPs.

Information about O&M personnel requirements and work schedules are based upon early planning stage man-load estimates. Additional information regarding the number of personnel to be employed for O&M would be developed as the proposed Project progressed. Preliminary calculations for O&M estimate that 10 workers would be required in Prudhoe Bay to run and manage the GCF and the Prudhoe Bay O&M Facility; 10 workers in Fairbanks for the Fairbanks O&M facility; and 30 workers in Wasilla for the Cook Inlet NGL Extraction Facility and the Wasilla O&M facility. Off-site housing would be provided for GCF workers, likely at a commercial camp located within Deadhorse. Personnel located in Fairbanks and Wasilla would be responsible for providing their own housing within local communities. The AGDC estimates that up to 25 workers could be employed at both the Straddle and Off-Take facility and the compressor station(s) combined. At this time it is unknown if these facilities are to be manned.

During operations, the AGDC would conduct regular patrols of the pipeline ROW in accordance with the requirements of 49 CFR Part 192. The patrol program would include periodic aerial and vehicle patrols of the pipeline facilities. These patrols would be conducted to survey surface conditions on and adjacent to the pipeline ROW for evidence of leaks, unauthorized excavation activities, erosion and wash-out areas, areas of sparse vegetation, damage to permanent erosion control devices, exposed pipe, and other conditions that might affect the safety or operation of the pipeline. The cathodic protection system also would be inspected periodically to ensure that it is functioning properly. In addition, pigs would regularly be sent through the pipeline to check for corrosion and irregularities in the pipe in accordance with USDOT requirements. The AGDC would keep detailed records of all inspections and supplement the corrosion protection system as necessary to meet the requirements of 49 CFR Part 192.

Pipeline markers would be placed and maintained at line-of-sight intervals along the ROW and at roadway crossings, railroad crossings, and other highly visible places to alert those contemplating working in the vicinity of the location of the buried pipeline.

The pipeline operator also would participate in appropriate One-Call system (Alaska Digline). This program provides telephone numbers for excavation contractors to call prior to commencing any excavation activities. The One-Call operator would notify the AGDC of any planned excavation in the vicinity of the pipeline so that the AGDC could flag the location of the pipeline and assign staff to monitor activities, if required.

2.3.2 Abnormal Operations

The O&M Plan would also include written procedures for standard Project operations and maintenance activities. Further, the O&M Plan would describe procedures that would be implemented in the event that the Project operation exceeds the design limits (abnormal operations). Specifically, the plan would include procedures for the following situations:

- Responding to, investigating, and correcting the cause of the following:
  - Unintended closure of MLVs;
  - Increase or decrease in pressure or flow rate outside normal operating limits;
  - Notification of a pipeline rupture and/or NGL spill event;
  - Loss of communications;
  - Operation of any safety device; and
  - Any other foreseeable malfunction of a component, deviation from normal operation, or personnel error.
- Post-abnormal operation monitoring to determine continued integrity and safe operation of the pipeline;
- Notifying responsible operator personnel of an abnormal operation; or
- Periodically reviewing the response of operator personnel to determine the effectiveness of the procedures controlling abnormal operation and taking corrective action when deficiencies are found.

2.4 DECOMMISSIONING AND ABANDONMENT

The AGDC has indicated that the proposed Project could be operated up to 50 years, contingent on natural gas availability. The AGDC currently has no plans for future expansion of the facilities proposed. If additional demand for natural gas supplies requires future expansion, the AGDC would subsequently seek the appropriate authorizations from any federal, state, or local agencies. When and if an application is filed, the environmental impact of the new proposal would be examined at that time.

Upon reaching the end of the Project's functional life, the pipeline would be shut down. Pipelines would be purged and cleaned. All aboveground facilities would be removed including compressor stations, piping, equipment, buildings, fencing, aboveground river crossing structures, access road culverts, and tanks. Aboveground pipelines would be removed to 1 foot below grade and underground pipelines would be capped and abandoned in place. Some belowground facilities, such as valves, may be excavated at certain locations. Gravel pads would be left in place. Materials that could be salvaged or recycled would be transported to instate and out-of-state facilities. Hazardous, solid, and liquid wastes would be properly disposed. After removal of facilities, cleared land would be contoured to restore appropriate grades and revegetated.

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3.0 CONNECTED ACTIONS

The proposed plan of development and operations for the proposed Project is based upon the assumption that several connected actions that are not a part of the proposed Project would occur prior to first operation of the ASAP in 2019. As defined by the National Environmental Policy Act (NEPA), connected actions means they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

- Automatically trigger other actions which may require environmental impact statements;
- Cannot or will not proceed unless other actions are taken previously or simultaneously; or
- Are interdependent parts of a larger action and depend on the larger action for their justification.

The connected actions for the proposed Project are:

- Construction and operation of four aboveground pipelines that would connect the Prudhoe Bay Central Gas Facility to the gas conditioning facility (GCF) for supply of natural gas and natural gas liquids (NGLs), and return of bi-products; and
- Processing and distribution of 60 million standard cubic feet per day (MMscfd) of natural gas liquids from the Cook Inlet natural gas liquid extraction plant (NGLEP) facility located at the southern end of the mainline.

The proposed Project would transport and distribute up to 500 MMscfd of natural gas and NGLs. The proposed Project could not operate as planned without these connected actions in place, if an action would be unrealistic to exclude, it would be considered a connected action.. Furthermore, these connected actions would not occur if the proposed Project is not constructed and operated as planned. Therefore, these actions would be connected to the proposed Project even though they would be planned and undertaken by others, and specific details are unknown at this time.

Several other actions are reasonably foreseeable if the proposed Project is constructed and operated, including distribution systems for up to 60 MMscfd of natural gas at Fairbanks, and future industrial gas use and/or liquefied natural gas (LNG) export of up to 130 MMscfd of natural gas in the Cook Inlet area. These reasonably foreseeable actions are further described and analyzed in Section 5.20 Cumulative Effects.

3.1 PIPELINES CONNECTING PRUDHOE BAY CENTRAL GAS FACILITY TO ASAP GAS CONDITIONING FACILITY

Four primary pipelines would be constructed to connect the Prudhoe Bay Central Gas Facility (CGF) to the ASAP Gas Conditioning Facility (GCF) as depicted in Figure 3.1-1. The pipelines would be used for the raw gas supply, the miscible injectant supply, the CO_2 return line, and the ethane return line. The pipelines would be constructed and installed on vertical support members (VSMs) using standard practices for North Slope gas production, development, and operations. Sizing of the pipelines will be completed during the next phase of engineering. A skid mounted connection constructed by BP would be used to connect the pipelines to the CGF. The GCF is expected to be constructed less than 1 mile south-southeast from the CGF. Safety studies and operational concerns will determine how close the facilities can be sited in relation to one another.

3.2 NATURAL GAS LIQUIDS DISTRIBUTION

Transportation, processing and distribution of NGLs from the Cook Inlet NGLEP Facility located at the end of the mainline could be accomplished by pipeline, fractionation facility, and storage and tanker vehicles. The AGDC evaluated the feasibility of several options for transportation, processing and distribution of NGLs (Beck 2011). The AGDC concluded that a facility located at Nikiski would be the most favorable option based upon consideration of impact on the environment, infrastructure needs, compatibility with existing plans, safety and security, and complexity (AGDC 2011a). The Nikiski option would include installation of an 80-mile-long pipeline to transport NGLs from the Cook Inlet NGLEP Facility to Nikiski for fractionation, storage and subsequent In-State and export distribution by ship. Transport of NGLs from Nikiski for In-State use by tanker trucks would also be possible.

3.2.1 Export Pipeline

As indicated above, the export pipeline would be approximately 80 miles long, 6- to 8-inches in diameter, buried, and would begin at the Cook Inlet NGLEP Facility (ASAP MP 736.4 and Beluga Pipeline MP 39) (AGDC 2011b). As shown In Figure 3.2-1, the pipeline would then be routed south and southwest, generally approaching and paralleling the north and northwest coast of Cook Inlet, passing by Tyonek at about MP 50, and reaching Cook Inlet at about MP 58. This route would follow the route of the existing Beluga Pipeline. It would then cross north-south under Cook Inlet until about MP 77, and then traverse land again until reaching the NGL fractionation facility at about MP 80.

3.2.2 NGL Fractionation Facility and Marine Terminal

The NGL fractionation facility and the marine terminal facility associated with export of NGLs would likely consist of: a fractionation plant (described below); pier facilities sufficient to dock very large gas carriers (VLGCs), which typically carry 44,000 metric tons (MT) of NGLs in four segregated butane and propane tanks of 11,000 MT capacity each; and storage facilities, warehouse buildings, and a storage yard.

To produce propane, butane, and natural gasoline for use as fuel in Alaska or for export, the conditioned residue gas from the end of the pipeline would require processing. Initial processing would include the use of a turbo-expander refrigeration process for NGL extraction and a de-ethanizer stripping column for fractionation of the natural gas liquids. The following approximate volumes are anticipated to be produced:

- Liquefied Petroleum Gas (LPG; 88 percent propane/12 percent butane blend): 30,200 barrels per day (bpd);
- Propane for In-State use: 3,200 bpd; and
- Natural Gas Liquids (NGL): 343 bpd

Tanker traffic at the marine terminal would occur year round at the rate of 1.4 to 2 tankers per month, assuming use of VLGCs. Depending upon the location of NGL fractionation facilities, storage facilities equal or similar in size to those identified for the NGLEP facility would also be necessary. Foreseeable markets for export of NGLs loaded at a marine terminal would be Japan, South Korea, and southern or eastern China.

The NGL fractionation facility and a marine terminal could be located in the existing Nikiski Industrial Area. Currently, there are three marine facilities at the Nikiski Industrial Area (the Agrium pier south [closed]), the existing LNG terminal operated by ConocoPhillips (idle[1]), and a petroleum receiving terminal that services the Tesoro Refinery (north), each of which has a long pier capable of handling ocean going tank ships. The Nikiski Industrial Area, which includes four major petrochemical processing facilities, is one of the largest existing industrial complexes in Alaska. The Kenai Peninsula Borough Comprehensive Plan designates the area as an industrial site and requires use of existing industrial facilities, areas and pipeline routes where feasible. There is sufficient land on the existing LNG facility that is not in use, and the closed Agrium facility also likely has sufficient land on which future NGL facilities could be located. No dredging has been necessary at the Nikiski terminals to date and none is anticipated for NGL facilities to be located there.

[1] The plant is currently in winterization mode but is scheduled to resume exports in 2012 (Anchorage Daily News 2011).

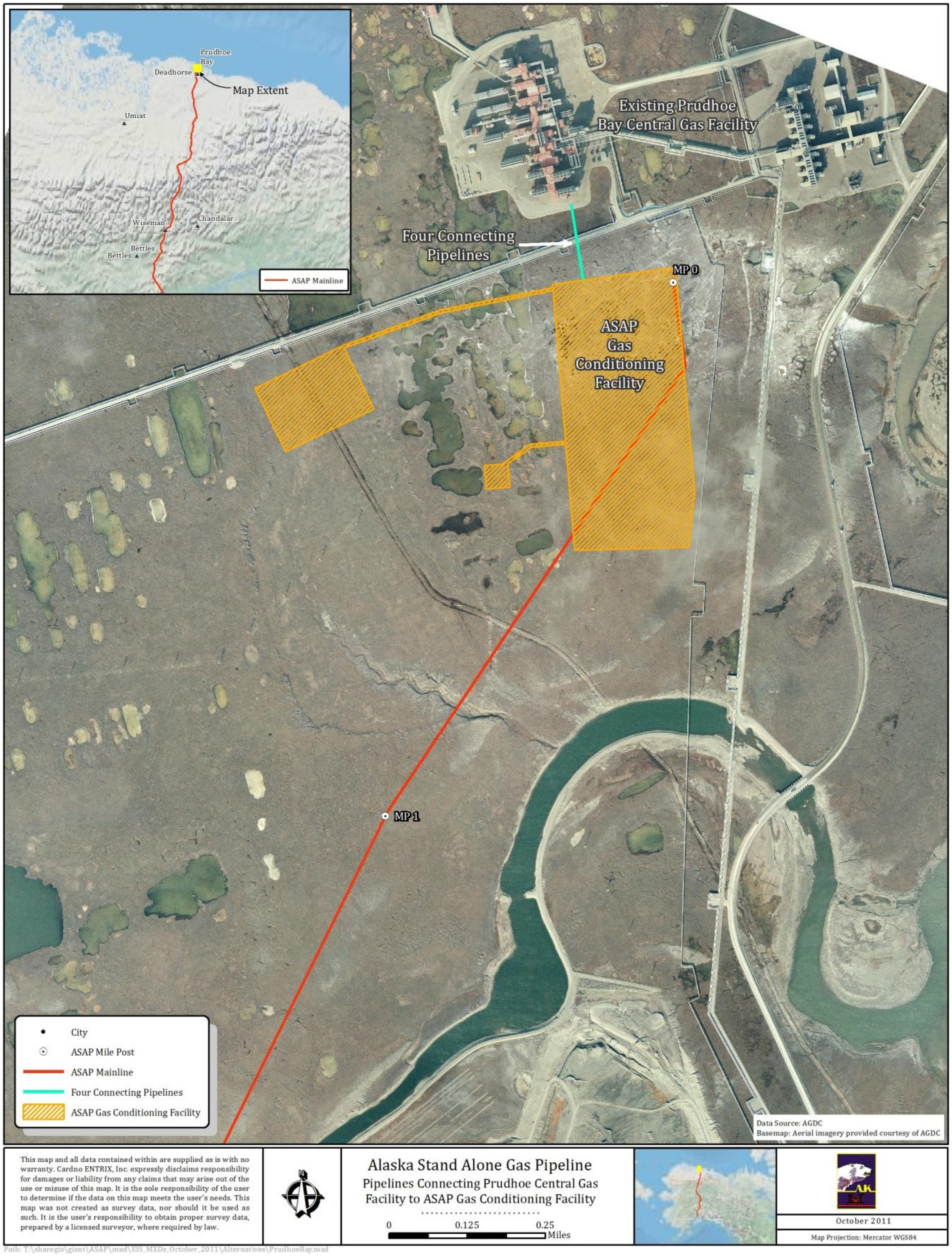

FIGURE 3.1-1 Pipelines Connecting Prudhoe Bay Central Gas Facility to ASAP Gas Conditioning Facility

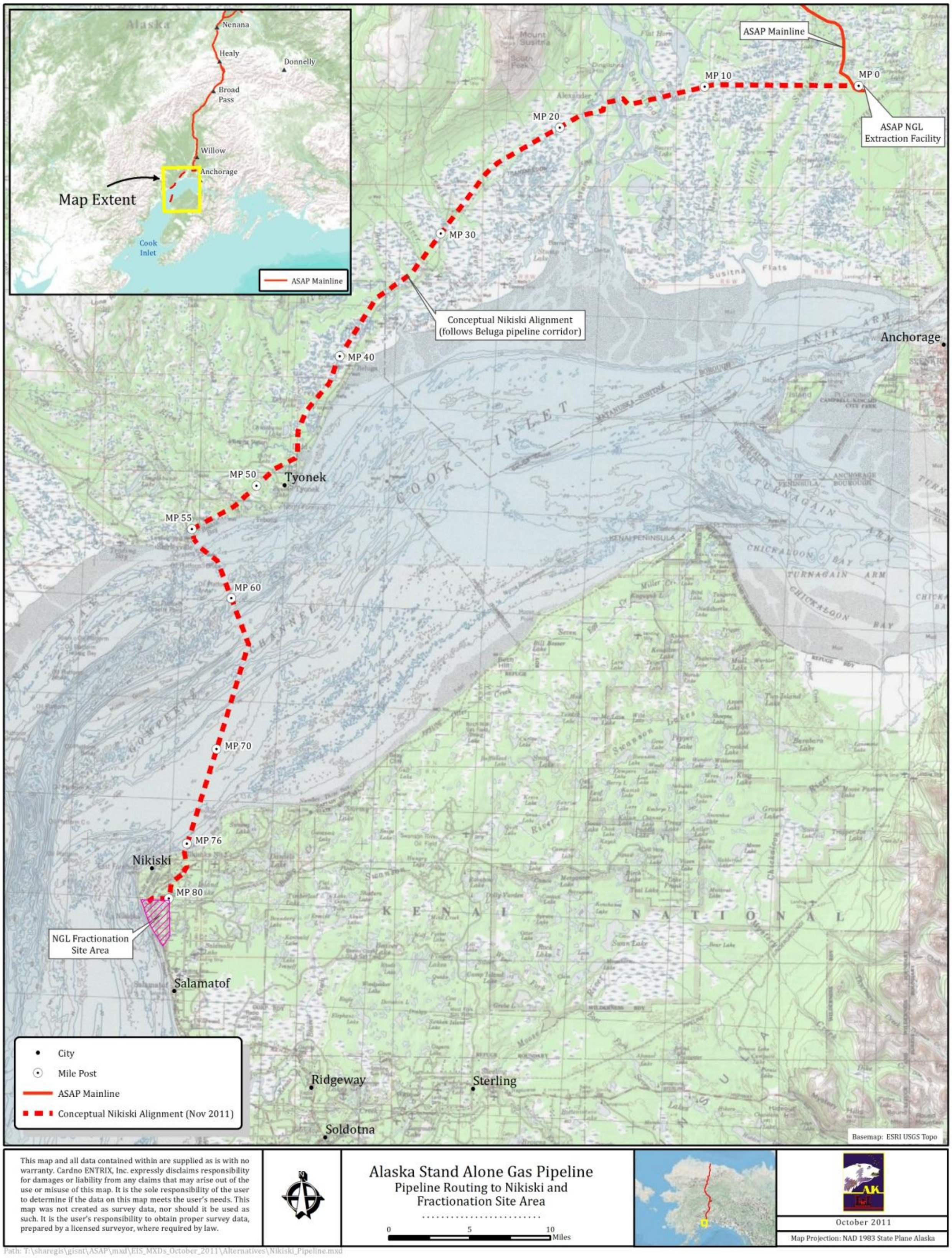

FIGURE 3.2-1 Pipeline Routing and the Potential NGL Fractionation Site Location at Nikiski

3.2.3 In-State Distribution of Propane and Butane

Fuel products would be supplied to customers along the highway system in the form of propane and butane (LPG). Fuel products could be transported by truck from the NGL fractionation facility. Typical truck/trailer transport would be accomplished by use of 44-foot-long, 13,000-gallon gross capacity trailers. The propane available for In-State distribution would require 10 trailers per day for transport from the fractionation facility to markets along the highway network.

3.3 ENVIRONMENTAL EFFECTS OF CONNECTED ACTIONS

Table 3.2-1 presents a summary of potential environmental effects that could result from implementation of connected actions as defined herein. Specific projects would require further definition, regulatory review and authorization prior to implementation. Further analysis under the NEPA could also be required, depending on specific construction and operation plans.

TABLE 3.2-1 Potential Environmental Effects of Connected Actions

Connected Action	Physical Resources Effects	Biological Resources Effects	Human Resources Effects
Pipelines Connecting Prudhoe Bay Central Gas Facility to ASAP Gas Conditioning Facility	▪ Construction of VSMs would adversely impact soils in a corridor between the Prudhoe Bay CGF and the ASAP GCF.	▪ Construction of VSMs and pipelines would adversely impact wetlands and vegetation in a corridor between the Prudhoe Bay CGF and the ASAP GCF.	▪ Negligible effects
NGL Processing and Distribution Buried and submerged pipeline would likely be collocated within existing utility road and pipeline corridors; Storage and fractionation facilities would be located on or adjacent to existing industrial use sites; In-state distribution would likely be accomplished with existing road facilities.	▪ Pipeline burial and facility construction would require excavation and grading that could result in sedimentation and erosion and fugitive dust emissions in the areas of construction; fractionation facility would have emissions, waste streams and discharges that could have adverse impacts to air and water resources during operations	▪ Pipeline and facilities at Nikiski could have adverse impacts to vegetation, wetland and stream habitats, and fish and wildlife during construction and maintenance; construction and operation of marine pipeline segment to Nikiski and shipping from Nikiski could have indirect adverse impacts to marine mammals, fish, and invertebrate species from noise and habitat disturbance.	▪ Disruptions to traffic and land uses would occur during pipeline and facility construction and maintenance; construction and operations would likely result in jobs and economic benefits; truck traffic related to In-state distribution of NGLs could have adverse impacts to transportation system operations.

3.4 REFERENCES

AGDC. See Alaska Gasline Development Corporation.

Alaska Gasline Development Corporation (AGDC). 2011a. Letter to the U.S. Army Corps of Engineers, Subject: Proposed NGL Scenario for NEPA Connected Action Analysis, November 8, 2011.

Alaska Gasline Development Corporation (AGDC). 2011b. Conceptual Scenario for NGL Fractionation at Nikiski, November 7, 2011.

Anchorage Daily News. 2011. Borough welcomes news of reopened LNG plant. December 17, 2011. Website (http://www.adn.com/2011/12/17/v-printer/2222192/borough-welcomes-news-of-reopened.html).

Beck, R.W. 2011. Economic Feasibility Study of the Transportation and Sale of Natural Gas Liquids/LP Gas for the Alaska Gasline Development Corporation, June 22, 2011.

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4.0 ALTERNATIVES

Implementation of the National Environmental Policy Act (NEPA) through the environmental impact statement (EIS) process requires consideration of reasonable alternatives[1] to the proposed Project that could minimize impacts to the natural and human environment. Consideration of the No Action Alternative is also required.

Sections 4.1 through 4.5 of this section identify and examine a number of potential alternatives to the proposed Project that were raised during the scoping process. Several types of alternatives are considered herein:

- No Action Alternative (Section 4.1) – the proposed Project would not be constructed and would not operate;
- Energy Source Alternatives (Section 4.2) – energy alternatives and energy conservation measures that could reduce or replace the North Slope natural gas and natural gas liquids that would be transported by the proposed Project;
- Natural Gas Transport System Alternatives (Section 4.3) – other systems that could transport the North Slope natural gas and natural gas liquids (NGLs) that would be transported by the proposed Project;
- Pipeline Route Alternatives (Section 4.4) – alternative pipeline routes and route segment variations; and
- Aboveground Facility Site Alternatives (Section 4.5) – alternative aboveground facility sites.

Potential alternatives are identified within Sections 4.1 through 4.5 and evaluated for:

- Consistency with the purpose and need for the proposed Project as stated in Section 1.2;
- Technical and logistical feasibility, and reasonableness; and
- Environmental advantages over the proposed Project.

Section 4.6 presents a summary of potential alternatives and identifies reasonable alternatives that meet the purpose and need of the proposed Project, are technically feasible and have potential environmental advantages over the proposed Project. Reasonable alternatives that are technically feasible and have potential environmental advantages over the proposed Project are carried forward for detailed analysis as action alternatives in Section 5 of the DEIS.

[1] The Council on Environmental Quality has defined reasonable alternatives as those that are economically and technically feasible, and that show evidence of common sense.

4.1 NO ACTION ALTERNATIVE

The No Action Alternative is defined as the proposed Project not being undertaken. The short-term and long-term environmental impacts identified in this EIS would not occur, as the proposed pipeline and associated aboveground facilities would not be constructed and 500 MMscfd of North Slope natural gas and NGLs would not be transported and made available to Fairbanks, Anchorage, and the Cook Inlet Area. The current annual demand for Cook Inlet natural gas would remain at approximately 200 MMscfd, and future demand would grow to approximately 250 MMscfd by 2030. Fairbanks' current and future demand of 60 MMscfd would not be met. Energy conservation programs and new facilities that generate electricity and heat from sources other than natural gas could reduce, but not fully provide for the current and future demand for natural gas as the existing Cook Inlet supply would continue to diminish. As described in Section 1.2.2, the natural gas shortage is projected to become acute by 2015. The proposed Project benefits would not be realized. These unrealized benefits would include: a reliable long term natural gas supply for Fairbanks and Southcentral Alaska; improved air quality in the Fairbanks area; revenues to the State of Alaska from gas sales, taxes and royalties; and jobs related to construction and operation of the proposed Project.

4.2 ENERGY SOURCE ALTERNATIVES

The Alaska North Slope gas fields are a proven, stable and reliable source of natural gas and could be developed to provide a supply of natural gas and NGLs for the proposed Project by the scheduled 2019 start of pipeline operations. Discovered technically recoverable natural gas resources on the North Slope are estimated to be about 35 trillion cubic feet (TCF) (U.S. Department of Energy 2009). Energy sources other than North Slope natural gas were examined as potential alternatives to the proposed Project that could reduce or replace the need for natural gas and NGLs that would be transported by the proposed Project. Several alternative energy resources in the Project area are currently being developed or are in the planning and feasibility analysis process. These are described and examined below.

4.2.1 <u>Kenai Peninsula and Cook Inlet Natural Gas</u>

Enhanced natural gas supplies could include potential future discovery in the Cook Inlet and on the Kenai Peninsula. Although no significant discoveries of natural gas have occurred in Cook Inlet since the 1960s (ENSTAR 2008), exploration wells have been proposed or are being considered by several oil and gas lease holders. Escopeta Oil brought a jack-up drilling rig to Cook Inlet and initiated an exploration well in September, 2011 (Anchorage Daily News 2011a). According to a November 3, 2011 statement from Escopeta Oil, a single well drilled by the Spartan 151 rig reached a depth of 8,805 feet in the inlet's Kitchen Lights Unit on October 28, discovering 46.7 billion cubic feet of natural gas (KTUU.com 2011). Work at the discovery well has been suspended until the spring of 2012. Until firm data are available from the discovery well and likely from several more wells the true potential of the discovery is not known[2]. A second jack-up rig has been proposed to facilitate additional Cook Inlet exploration (Anchorage Daily News 2011a). New Kenai Peninsula and Cook Inlet natural gas reserves that could provide a long-term, stable supply of natural gas to markets in the Fairbanks and Cook Inlet areas remain unproven at this time.

4.2.2 Gubik and/or Nenana Basin Natural Gas

If new reserves are discovered in basins within or near the Railbelt Region[3], these could be an alternative to the proposed North Slope natural gas source that would require fewer miles of pipeline. The Gubik gas field is a commercially unproven prospective gas field in the foothills of the Brooks Range. Based upon two wells drilled in 1951, the USGS estimated the total reserves of the Gubik gas field at 600 billion cubic feet of gas (Petroleum News 2009). In 2008 and 2009, Anadarko Petroleum drilled exploration and delineation wells in the known Gubik natural gas field, but did not drill in 2010 and has not announced future drilling plans (Petroleum News 2010a). In July, 2011 Anadarko announced plans to conduct testing during winter 2011 on one of the wells completed in 2009 (Anchorage Daily News 2011b).

The Nenana Basin lies under an 8,500-square-mile area of lowlands, immediately west and northwest of the Parks Highway near the village of Nenana. In the summer of 2009, Doyon and Partners drilled an 11,100-foot-deep exploration well about 5 miles west of the village of Nenana; the results have not been publically reported. As of 2010, Doyon and Partners has suspended its Nenana Basin exploration program. The Nenana Basin remains an unproven source of gas (Petroleum News 2010b).

4.2.3 LNG Import

The liquefied natural gas (LNG) import alternative would require a LNG import terminal with access to LNG suppliers outside of Alaska. A LNG terminal, storage and degasification facility would have to be constructed near Cook Inlet and connected to the existing natural gas pipeline system. LNG would have to be transported to the facility by tanker ships, degasified, and transported to market by the existing pipeline system. Although this alternative would provide LNG to meet Cook Inlet demand, it would not provide a new natural gas pipeline connection to Fairbanks, and would not utilize North Slope natural gas. Furthermore, the economic benefits of utilizing an in-state gas source would not be realized.

2 http://www.mcclatchydc.com/2011/11/08/129626/alaska-official-skeptical-of-escopeta.html accessed November 14, 2011.

3 The Railbelt Region electrical grid is defined as the service areas of six regulated public utilities that extend from Fairbanks to Anchorage and the Kenai Peninsula. These utilities are Golden Valley Electric Association (GVEA); Chugach Electric Association (CEA); Matanuska Electric Association (MEA); Homer Electric Association (HEA); Anchorage Municipal Light & Power (ML&P); the City of Seward Electric System (SES); and Aurora Energy, LLC as an independent power producing utility. Sixty five percent of Alaskan population lies within the Railbelt Region.

4.2.4 Hydroelectric Power

A hydroelectric project on the Susitna River has been studied for more than 50 years and is again being considered by the State of Alaska as a long-term source of energy. In the 1980s, the project was studied extensively by the Alaska Power Authority (APA) and a license application was submitted to the Federal Energy Regulatory Commission (FERC). The project was terminated in March 1986 due to difficulties related to developing a workable financing plan for a project of this scale, combined with the relatively low cost of gas-fired electricity in the Railbelt, the declining price of oil throughout the 1980s and its resulting impacts upon the State budget.

In 2008, the Alaska State Legislature authorized the Alaska Energy Authority (AEA) to perform an update of the project plan (Black & Veatch 2010). The AEA is currently in the planning stages for a Susitna hydroelectric project with 600 MW of electrical power generating capacity. Operating restrictions and inefficiencies would result in the facility producing an average of about 300 MW per day. The AEA plans to file a preliminary licensing application with FERC in late 2011. The earliest estimated date the project could produce power is 2022.

If the Susitna hydroelectric project displaced the demand for natural gas electrical generation associated with the proposed pipeline Project, approximately 50 MMscfd of natural gas would be conserved. Therefore, the Susitna hydroelectric project could reduce demand by approximately 10 percent, but could not replace the 500 MMscfd that would be transported by the proposed Project to meet current and future demand.

Other identified potential hydroelectric projects could also reduce, but not replace, the existing and future need for natural gas, including Glacier Fork (75 MW), Chakachamna (330 MW) and several other projects in the 1 to 5 MW range.

4.2.5 Nuclear Power

Alutiiq LLC (Alutiiq) has been marketing a new small, modular nuclear power plant based upon an advanced reactor design from Hyperion Power Generation (Hyperion) and Los Alamos National Laboratory. Alutiiq has approached the Chugach Electric Association Inc. about the development of a modular nuclear power plant for the specific purpose of repowering at the existing Beluga power plant site (a 374-MW natural gas-fired plant). The thermal output from the reactor would be converted to approximately 27 MW of electrical output through a steam turbine generator. If the Beluga nuclear power plant project moved forward, 2020 is the estimated timeframe for the start of electrical generation (Black & Veatch 2010). The project could somewhat reduce, but not completely replace, the existing and future needs for natural gas to provide the remaining 347 MW of existing natural gas fired power production. Further, the Beluga power plant project is uncertain and would not be developed within a timeframe that would meet the proposed Project's objectives.

4.2.6 Coal and Coal Gas

The existing Healy Clean Coal Project (HCCP) operated briefly following its construction as part of a demonstration program, but has been shut down since 2000. The HCCP has a 50 MW capacity (GVEA 2011). An operational HCCP could reduce, but not replace existing and future needs for natural gas. The proposed Accelergy/Tyonek Coal-to-Liquids (CTL Project) (CTL) would produce aviation fuel, as well as gasoline and diesel for military and industrial uses, and would generate 200 MW to 400 MW of electricity from waste heat. However up to 200 MMscfd of natural gas could be used in the CTL process (AGDC 2011a, Attachment A).

Several new pulverized coal power generating facilities have been proposed within the Railbelt Region of Alaska. The Usibelli Coal Mine, located south of Fairbanks, provides an available source of coal, and is currently the only operational coal mine in Alaska (Usibelli 2011). Undeveloped coal resources exist at the proposed Chuitna Coal Mine and surrounding areas near Beluga and at other sites within Alaska. Coal-generated electrical power could reduce existing daily natural gas demand.

Other coal technologies such as integrated gasification combined cycle (IGCC) or carbon capture and sequestration (CCS) could also be considered, but those technologies are not sufficiently developed to significantly penetrate the coal-generation market. These technologies could produce synthetic gas as well as electric power. Coal projects could reduce, but not replace, existing and future needs for natural gas.

4.2.7 Renewable Sources (Wind, Geothermal, Biomass, and Tidal)

A number of projects that would generate electric power from renewable resources have been identified and are in various stages of planning or implementation. These projects, which could reduce, but not replace because of their limited sizes, the existing and future need for natural gas that would be provided by the proposed Project are listed in Table 4.2-1 (Black & Veatch 2010).

TABLE 4.2-1 Potential Renewable Energy Projects

Project	Capacity	Current Phase
Fire Island Wind Project	54 MW	Planning
Nikiski Wind Project	15 MW	Planning
GVEA Eva Creek Wind Project	24 MW	Permitting
Mt. Spurr Geothermal Project	50-100 MW	Resource evaluation
Anchorage MSW mass burn	22 MW	Planning
GVEA MSW mass burn	4 MW	Planning
Turnagain Arm Tidal Project	Up to 1,200 MW	Planning (experimental technology – post 2020 implementation)

MSW = municipal solid waste.
Source: Black and Veatch (2010).

4.2.8 Energy Conservation Measures and Programs

Upgrading and replacing older, less efficient natural gas-powered electric generation facilities with current technology would improve efficiency of natural gas generation. The Southcentral Power Project and Golden Valley Electric Association (GVEA) North Pole Retrofit Project are proposed projects that would improve the efficiency of natural gas generation in the Railbelt and permit the retirement of aging units. Demand-side management and energy efficiency (DSM/EE) measures can reduce capacity requirements and annual energy requirements. Federal, state, and utility sponsored programs that encourage and reward consumers to implement energy conservation are ongoing in Alaska. Implementation of enhanced DSM/EE programs could result in a reduction of the region's capacity requirements by approximately 8 percent. A similar level of impact would also be expected for annual energy requirements (Black & Veatch 2010).

4.2.9 Alternative Energy Sources – Summary and Conclusions

Table 4.2-2 provides a summary of alternative energy sources in relationship to components of the proposed Project purpose and need. Energy sources other than North Slope natural gas and NGLs could reduce but not replace the volume of gas or the electrical power generating capacity of the gas that would be transported by the proposed Project. None of the identified energy alternatives would meet all objectives of the proposed Project purpose and need. Although some projects would provide alternative means for generating electrical power, they would only individually and collectively partially replace the electrical power generating capacity of the gas that would be transported by the proposed Project, and they would not provide the natural gas needed for home and institutional heating and industrial purposes. Some of the energy alternatives are unproven or could not be realized by 2019, which is the planned in-service date for the proposed Project. Additionally, the economic benefits of utilizing an in-state gas source would not be realized by several of the alternatives. Alternative energy projects are likely to be developed independently of the proposed Project and are discussed further in Section 5.21 (Cumulative Effects).

TABLE 4.2-2 Summary of Alternative Energy Sources Relative to the Proposed Project Purpose and Need Statement

Energy Source	A long-term, stable supply of up to 500 MMscfd of natural gas and NGLs	Deliverable to markets in the Fairbanks and Cook Inlet areas	Deliverable by 2019	Utilize proven gas supplies that provide economic benefit to the State through royalties and taxes	Other Considerations
Kenai Peninsula and Cook Inlet natural gas (new production)	no	no	no	no	Speculative
Gubik and/or Nenana Field natural gas	no	no	no	no	Speculative
LNG Import	yes	yes	yes	no	Distribution to Fairbanks would be limited to truck/trailer
Hydroelectric Power from Susitna, Chakachamna or other new projects	no	yes	no	no	Would provide only electrical power
Coal and/or coal gas	no	yes	yes	no	Would provide electrical power, synthetic gas from IGCC process is speculative
Renewable Sources (Wind, Geothermal, Tidal)	no	yes	no	no	Would provide only electrical power
Nuclear Power	no	no	no	no	Would provide only electrical power
Energy Conservation Measures and Programs	no	yes	yes	no	Could reduce natural gas consumption by up to 8 percent.

4.3 NATURAL GAS TRANSPORT SYSTEM ALTERNATIVES

Pipelines are cost-effective means of transporting large volumes of natural gas over long distances for sustained periods of time. This section examines alternatives to the proposed 24-inch-diameter proposed Project pipeline that would have the potential to meet the purpose and need for the Project and minimize environmental effects. Transportation system alternatives are alternatives to the proposed Project that would make use of existing, modified, or proposed natural gas delivery systems to meet the stated objectives of the proposed Project.

4.3.1 Dry Gas Pipeline from North Slope Alternative

This alternative would include a NGL extraction plant (NGLEP) facility at the gas conditioning facility (GCF) to remove NGLs and return them to the Prudhoe Bay central gas facility (CGF) on the North Slope, to provide utility grade natural gas for pipeline transport. Additional facilities NGLs including propane and heavier components would be removed and re-injected in wells on the North Slope. A NGLEP facility at the pipeline terminus near Wasilla would not be required, and distribution of 60 MMscfd of NGLs as described in Section 1 (Purpose and Need) and Section 3 (Connected Actions) would not take place. The proposed straddle facility near Dunbar would include an off-take for the Fairbanks Lateral, but would not require facilities to remove and re-inject NGLs.

The purpose and need of the proposed Project includes the transport of NGLs for sale and distribution at the pipeline terminus. The AGDC has stated that the value of the NGL component would be important to the economic performance of the proposed Project (AGDC 2010a). A dry gas pipeline project would not require the Cook Inlet NGLEP Facility or the NGL pipeline, fractionation plant and storage facility at Nikiski. Accordingly, there would be a reduction in overall Project impacts in the Cook Inlet area for the dry gas pipeline alternative when compared to the proposed Project.

The purpose and need of the proposed Project includes the transport of NGLs for sale and distribution at the pipeline terminus. The AGDC has stated that the value of the NGL component would be important to the economic performance of the proposed Project (AGDC 2010a). Thus, the purpose and need of the proposed Project would not be met by a dry gas pipeline that would not provide NGLs at the pipeline terminus.

4.3.2 Smaller Diameter Pipeline Alternative

A smaller diameter pipeline with additional compression was examined to evaluate if a reduction in Project construction and permanent right-of-way footprint and corresponding reduction in impacts to associated environmental resources could be achieved. The optimum diameter of the pipeline is a function of the intended continuous peak capacity, the operating pressure, the cost (capital and operating) and the required operating facilities. With increased compression (maintaining higher operating pressure), the required diameter of the pipeline may be decreased. However, to increase and maintain compression across the length of the over 737-mile-long pipeline, more compressor stations (with attendant costs and environmental impacts) would be required.

Analysis indicated that the optimum pipeline diameter in terms of cost and environmental impact considerations for the proposed 500 MMscfd, 737-mile-long pipeline Project would be between 24 and 18 inches (AGDC 2010b). However, there would be tradeoffs associated with system expandability, reliability, and cost of equipment for a configuration smaller than a 24-inch-diameter. For example, one or two compressor stations would be required for the proposed 24-inch-diameter pipeline. Conversely, with similar flow and pressure limitations, a 20-inch-diameter pipeline would require three compressor stations, and an 18-inch-diameter pipeline would require six compressor stations. Although it is technically possible to reduce the pipeline diameter to less than 18-inches, doing so would require an excessive number of compressor stations (e.g., 12 compressor stations for a 16-inch-diameter pipeline) and a cascading series of safety, proximity, design, and facility issues and changes, to the point that such a design would be neither cost effective nor practicable.

The construction methods and associated construction right-of-way (ROW) for an 18 to 24-inch diameter would be virtually the same (AGDC 2010b). Each additional compressor station would add approximately 1.5 to 2.0 acres of land disturbance and additional quantities of air, wastewater, and solid and hazardous waste emissions would be generated. Therefore, a smaller diameter gas pipeline would not appear to include features that would lessen environmental impacts when compared to the proposed Project.

4.3.3 Spur Pipeline From a Large North Slope-to-Lower 48 or Valdez Pipeline

The Alaska Pipeline Project (APP) has been proposed by TransCanada Alaska Company, LLC and ExxonMobil Corporation. The APP would be a 48-inch-diameter pipeline and would operate at 2,500 psig. As part of the proposed APP, a natural gas pipeline would connect from the Point Thomson field to a new gas treatment plant (GTP) to be constructed near existing Prudhoe Bay facilities. The GTP would be initially designed to process up to 5.3 bcf/d of raw natural gas into up to 4.5 bcf/d of pipeline quality gas.

From the GTP, two alternative routes have been proposed for the pipeline, the Alberta option and the Valdez LNG option. The Alaska portion of the Alberta option would be 745 miles long and would have a base design capacity of 4.5 bcf/d and a maximum compression design capacity of 5.9 bcf/d. This option would start at the GTP and would follow the existing TAPS alignment to points near Fairbanks and Delta Junction. It then would follow the alignment of the Alaska Highway until reaching the Alaska-Canada border, and would then extend through Canada.

The alternative pipeline route, the Valdez LNG option, would be 811 miles long, with a base design capacity of 3.0 bcf/d, This option also would extend from Prudhoe Bay through points near Fairbanks and Delta Junction, but then would diverge to LNG facilities (to be built by third parties) near Valdez, Alaska.

Regardless of the selected pipeline option, a minimum of five off-take connections would be built into the pipeline to allow local natural gas suppliers to obtain product to meet local community needs. These connections could be used to construct Spur Pipelines to serve Fairbanks and the Cook Inlet area. For both the Alberta and Valdez LNG options, a spur line could connect near Livengood or Fox, and follow the proposed Project route to the Cook Inlet area. For The Valdez LNG Option, a spur line to serve Fairbanks could connect near Fox, and a spur line to serve the Cook Inlet area could connect near Glennallen.

TransCanada conducted a FERC-approved open season in May-July 2010 to identify potential shippers. They now have entered into the FERC's pre-filing process, conducting field studies and other environmental work, with the intent of submitting their FERC permit application in the fourth quarter of 2012. The APP is in the planning process and is not currently scheduled to be completed and transporting natural gas by 2019[4]. Furthermore, implementation of the APP is uncertain. Therefore, the Spur Pipeline from a North Slope-to-Lower 48 or Valdez Pipeline would not meet the purpose and need of the proposed Project and would not be a reasonable alternative.

4.3.4 Pipeline from North Slope to Fairbanks, Transport by Rail Car to Southcentral Alaska

This alternative would involve the proposed Project terminating at a new LNG conversion/production facility near Fairbanks, located near the northern reach of the Alaska Railroad. After conversion, the LNG would be transported by rail car on the existing Alaska Railroad to new LNG storage and gasification facilities near Anchorage, which would have access to the existing Southcentral Alaska natural gas distribution system.

Transshipping LNG by rail has been accomplished by use of 82-foot long, 34,500 gallon gross capacity rail cars. Each rail car has the capacity to carry LNG that when gasified would amount to approximately 2.5 MMscf. Therefore, approximately 176 rail cars per day (equivalent to about three trains per day, one way, each almost 1 mile long) would be required to transport 440 MMscfd of natural gas as LNG from Fairbanks to Southcentral Alaska. This alternative would not be a cost efficient or logistically practicable means of moving large volumes of LNG from Fairbanks to Southcentral Alaska for 30 or more years. Therefore, the pipeline from North Slope to Fairbanks, transport by rail car to Southcentral Alaska alternative would not be a reasonable alternative.

4.3.5 Transport by Truck/Trailer

This alternative would involve conversion of natural gas to LNG at a new production facility on the North Slope and subsequent transport of LNG by truck/trailer via the Dalton, Elliott, and Parks highways to new LNG storage and gasification facilities in Fairbanks and Southcentral Alaska. Fairbanks Natural Gas is working on a plan to truck natural gas as LNG to Fairbanks from the North Slope (Fairbanks Daily News-Miner 2011). The transport of 500 MMscfd of natural gas that has been converted to LNG via truck/trailer would require trucking on a much larger scale than that proposed by Fairbanks Natural Gas.

Transshipping LNG by truck/trailer has been accomplished by use of 44-foot-long, 13,000 gallon gross capacity trailers. Each trailer has the capacity to carry LNG that when gasified would amount to approximately 1 MMscf of natural gas. Therefore approximately 500 trailers per day would be required to transport 500 MMscfd. This would require one loaded trailer leaving a North Slope LNG facility approximately every 3 minutes around the clock. Thus, this alternative would not be logistically practical or reasonable.

[4] The current estimate estimates are for APP first gas is mid-2020 (http://thealaskapipelineproject.com/project_timing 10/19/2011).

4.4 PIPELINE ROUTE ALTERNATIVES

Approximately 82 percent of the proposed Project route would be co-located with or closely parallels existing pipeline or highway rights-of-way (AGDC 2011a). Co-location is desirable as a means of concentrating development within established corridors and minimizing environmental impacts. A major route alternative is defined as a generally longer segment of right-of-way that would follow a route different from the proposed pipeline. Route variations differ from major route alternatives in that they are identified to resolve or reduce construction impacts to localized, specific resources such as cultural resources sites, wetlands, streams, recreational lands, residences, or terrain conditions. Major route alternatives and route variations that would be co-located with other established corridors were examined as potential alternatives to the proposed Project route. Several established linear corridors associated with roads, railroad, pipeline and transmission lines exist in the Project area.

4.4.1 Major Route Alternatives

4.4.1.1 Richardson Highway Route Alternative

Under the Richardson Highway Route Alternative, the 24-inch-diameter pipeline would follow the proposed Project route for approximately 405 miles to Livengood. The route alternative would then proceed southeast to Fairbanks adjacent to the TAPS ROW, then parallel the Richardson Highway up the Tanana River Valley. After crossing the Tanana River Valley at Delta, the route alternative would turn southward, paralleling the Richardson Highway, then follow the Delta River Valley into the Alaska Range, where it would cross through Isabel Pass, continuing generally southward, crossing the Gulkana River. In the Gulkana area, the route alternative would turn southwest, join the Glenn Highway, then turn west and south to generally follow the Glenn Highway. Near the Eureka Roadhouse, the route alternative would leave the highway and follow Caribou Creek to Chitna Pass, then Boulder Creek to Chickaloon, then generally parallel the Glenn Highway along the Matanuska River, terminating at ENSTAR's Beluga Pipeline (Beluga Pipeline MP 55). The Richardson Highway Route Alternative is depicted in Figure 4.4-1[5].

The distance of the Richardson Highway Route Alternative between Livengood and the termination of the route alternative would be approximately 440 miles, resulting in an overall route alternative length of approximately 845 miles. Connection to Fairbanks would be accomplished by a 12-inch-diameter lateral pipeline that would extend 32 miles from south of Eielson Air Force Base to Fairbanks. The pipeline and lateral would be buried throughout, except at compressor stations, metering stations, and certain river crossings and faults.

A Parks Highway Route and the Richardson Highway Route Alternative were examined in the 2009 Stand Alone Pipeline Alternatives Analysis conducted by the State of Alaska (State of Alaska 2009). The 753-mile-long Parks Highway Route considered in the analysis was subsequently refined to the 737–mile-long route (the proposed Project). The State of Alaska

[5] The proposed Project is identified as 'Proposed ASAP Pipeline'.

found that constructing a pipeline along the Richardson Highway Route would cost approximately 10 percent more than along the Parks Highway Route. The Richardson Highway route would be longer by 92 miles (845 miles long versus 753 miles) and would cross a greater number streams, and two mountain ranges. As a result of the increased length, the Richardson Highway Route Alternative would impact 23 percent more wetland features (730 features versus 593 features), 35 percent more wetland habitat (1,735 wetland acres versus 1,288 acres), and a greater number of wetland acres of each wetland type than the Parks Highway Route that was studied in the Alternatives Analysis conducted by the State of Alaska (AGDC 2011b). Under the Richardson Highway Route Alternative, the lateral pipeline from south of Eielson Air Force Base to Fairbanks would be 3 miles shorter than the Fairbanks Lateral associated with the proposed Project (32 miles long verses 35 miles). A summary comparing the Parks Highway Route and the Richardson Highway Route is presented in Table 4.4-3 (State of Alaska 2009).

Based upon this screening analysis, the Richardson Highway Route Alternative does not appear to include features that would result in less environmental impacts when compared to the Parks Highway Route. The route of the proposed Project is a refinement of the Parks Highway Route that was the subject of the Alternatives Analysis conducted by the State of Alaska in 2009. For the proposed Project, the Parks Highway Route was refined and shortened by an additional 16 miles, indicating further reduction in overall impacts. Therefore, the Richardson Highway Route Alternative would not present environmental advantages over the proposed Project as proposed.

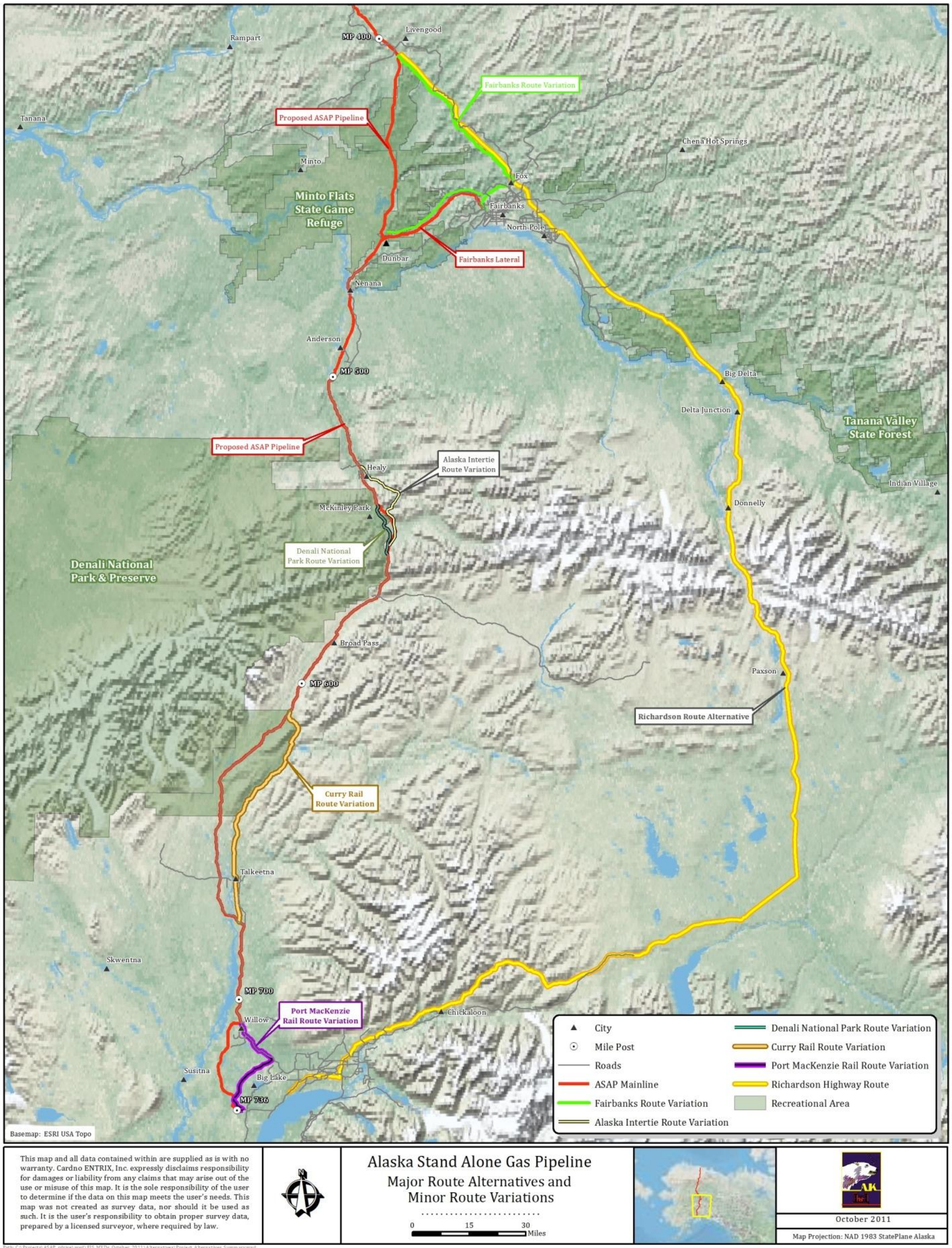

FIGURE 4.4-1 Major Route Alternatives and Minor Route Variations

TABLE 4.4-3 Parks Highway Route and Richardson Highway Route Alternatives Comparison Summary

Feature	Parks Highway Route	Richardson Highway Route
Length (miles)	753	845
Stream Crossings (number)	434	512
Road Crossings (number)	67	95
Hilly Terrain (miles)	295	449
Wetland Features (number)	593	730
Wetland (acres within a 30 ft ROW)	1,288	1,735
Fish Stream Crossings (number)	480	515
Subsistence Communities (number)	33	47
Waterfowl Habitat (miles)	200	250
Raptor/Eagle Nesting Habitat (miles)	100	115
Moose Winter Habitat (miles)	211	425
Caribou Migration Habitat (miles)	180	270
Brown Bear Habitat (miles)	105	120
Cultural Resource Sites (number)	405	450
Communities / Population (number)	33 /372,600	47 / 380,900

Source: Stand Alone Pipeline Alternatives Analysis (State of Alaska 2009).

4.4.2 Route Variations

4.4.2.1 Fairbanks Route Variation

The Fairbanks Route Variation would avoid the Minto Flats segment of the proposed Project that would extend from Livengood (MP 405) to Dunbar (MP 458). The Minto Flats portion of the proposed Project route would not be co-located with a highway corridor and access would be limited to the intersection with the Dalton Highway near MP 405 and with the Parks Highway near MP 458. Segments of the route would be located within the Minto Flats State Game Refuge which has sensitive wildlife habitats important for waterfowl production and migration staging, and supports abundant moose, black bear and furbearer populations. The Minto Flats area is also an important subsistence use area.

The Fairbanks Route Variation would begin in Livengood near MP 405 roughly following the Dalton Highway and the TAPS corridors approximately 50.5 miles to Fox. The route variation then would follow Goldstream Creek for approximately 9 miles and finally would cross the Alaska Railroad (ARR) and Sheep Creek Road where a straddle and off-take facility would be located. The route variation would include about 2 miles of 12-inch pipe from the straddle and off-take facility to a terminus that would connect to a future gas distribution system in Fairbanks. The 24-inch line would return from the straddle and off-take facility along the same route for 1.2

miles and then turn west following the ARR for roughly 32 miles to Dunbar at MP 458 (the 32 mile segment would follow the same alignment as the proposed Fairbanks Lateral from Dunbar to Fairbanks). The need for a separate Fairbanks Lateral would be eliminated under this route variation. The route variation would consist of 93.5 miles of 24-inch pipeline and 2 miles of 12-inch pipe, for a total of 95.5 miles in length (Figure 4.4-1). Without the Dunbar to Fairbanks segment that would be common to both the proposed Project route and the Fairbanks Route Variation, the length would be 61.1 miles. The temporary construction easement (TCE) for the Fairbanks Route Variation would be consistent with the proposed Project, generally 100 feet wide with segments of up to 230 feet wide in sloped areas where extensive earthwork would be required.

The alternatives study phase that resulted in the Stand Alone Gas Pipeline Route Alternatives Analysis (State of Alaska 2009) identified numerous conditions along this route that are not conducive to pipeline construction. Unfavorable site elements identified along this route variation included constructability constraints resulting from unfavorable geotechnical conditions (e.g., permafrost), as well as the presence of excessively rugged terrain throughout the northwest segment of the route variation. Figure 4.4-1 illustrates the differences in the ruggedness of the Fairbanks Route Variation compared to the corresponding Minto Route segment.

Other issues of concern for the Fairbanks Route Variation were identified by the AGDC during their route development process for the proposed Project (AGDC 2011a, Attachment B): included:

- The Fairbanks Route Variation would be 8.1 miles longer (61.1 miles as opposed to the 53 mile segment that it would replace), which would increase cost and environmental effects when compared to the corresponding proposed Minto Route segment; and
- The need for a straddle and off-take facility that would be located in the Fairbanks area within an EPA air quality non-attainment area, which would present more complex and costly permitting and compliance than for the proposed straddle and off-take facility located in Dunbar (see Section 5.16 for further details regarding the Fairbanks air quality non-attainment area).

In October, 2011, the AGDC conducted a desktop delineation and classification of wetlands along the Fairbanks Route Variation. The desktop study utilized the same resources and methodologies that were used to complete wetland delineations and classification for the proposed Project (AGDC 2011c, 2011d).

In association with the wetlands analysis conducted in October, 2011, the AGDC also refined the Fairbanks Route Variation and the proposed Minto Route segment TCEs by identifying and defining specific areas that would be wider than 100 feet. Temporary extra work spaces (TEWS) were also identified and defined for both the Fairbanks Route Variation and the proposed Minto Route segment. The TEWS would be located immediately adjacent to the TCEs, and would generally be 150 feet by 50 feet, or 300 feet by 80 feet each in dimensions.

Based upon the wetlands analysis and considering the refined TCEs and TEWS, the AGDC determined the Fairbanks Route Variation would have 399 acres of wetlands within the TCEs and TEWS. The corresponding proposed Minto Route segment would have 361 acres within the TCEs and TEWS (AGDC 2011c). A comparative summary of environmental features within the Fairbanks Route Variation and the proposed Minto Route segment is provided in Table 4.4-4.

TABLE 4.4-4 Environmental Features within the Proposed Minto Route Segment and Fairbanks Route Variation

Feature	Proposed Minto Route Segment	Fairbanks Route Variation
Pipeline Length (miles)	53 [a]	61.1 [a]
Elevation Change (feet)	450 [b]	1,848 [b]
Slopes Less than 5 Percent (miles)	8 [b]	20 [b]
Boreal Forest within TCE and TEWS (acres)	444 [c]	821 [c]
Wetlands within TCE and TEWS (acres)	361 [b]	399 [b]
Stream Crossings	39 [d]	46 [d]
Road Crossings	1 [b]	18 [b]
Straddle and Off-Take Facility Location	Outside of Fairbanks air quality non-attainment area [e]	Within Fairbanks air quality non-attainment area [e]

[a] Does not include the segment from Dunbar to Fairbanks that would be required for both options.

[b] AGDC, October 14, 2011.

[c] Data summarized from the 2008 LANDFIRE Existing Vegetation layer for the State of Alaska

[d] AGDC Version V Stream Crossing GIS Data, March, 2011.

[e] The Fairbanks area is an EPA designated non-attainment area for particulate matter air quality standards

Based upon the information presented herein, the Fairbanks Route Variation would be 8.1 miles longer than the proposed Minto Route segment and would have a greater effect on environmental resources as indicted in Table 4.4-4, and would traverse through the middle of a residential area. Therefore, the Fairbanks Route Variation would not present environmental advantages over the proposed Project route for this segment.

4.4.2.2 Alaska Intertie Route Variation

The Alaska Intertie Route Variation would avoid Denali National Park (NP). The route would depart the Parks Highway in the vicinity of Healy (MP 530) and would generally follow drainages east of Sugar Loaf Mountain and the Alaska Intertie (the Anchorage – Fairbanks intertie transmission line corridor) before crossing the Yanert Fork and returning to the Parks Highway at MP 553 (Figure 4.4-2[6]). The terrain on the east side of Sugar Loaf Mountain is deeply dissected by steep drainages flowing directly into Moody Creek. The terrain is so steep that the Intertie towers were placed on the flanks of Sugar Loaf Mountain without aid of surface transportation. A summary report by ENSTAR concluded a route around the east side of Sugar Loaf Mountain was not practicable for a variety of reasons including rugged terrain; significant engineering, construction, and maintenance challenges; and lack of road access (ENSTAR

[6] The proposed Project is identified as 'ASAP Pipeline' on this figure.

2008). An alignment was identified further west that also would avoid the Denali NP (now the proposed Project route). The Alaska Intertie Route Variation is not considered reasonable, and would not present environmental advantages over the proposed Project route for this segment.

4.4.2.3 Denali National Park Route Variation

The proposed Project route in the vicinity of Denali National Park and Preserve (NPP) would traverse east of the Nenana River and would avoid Denali NPP lands. The proposed route would involve steep slopes and potential visual impacts when viewed from Denali NPP. The Denali National Park Route Variation would follow the Parks Highway corridor through Denali NPP, avoid the slopes east of the highway and potentially minimize visual impacts. The route variation would leave the proposed Project route (ASAP Pipeline) near MP 540 (Figure 4.4-2). The Denali National Park Route Variation would be in close proximity to the Parks Highway. Typical pipeline installation associated with this route variation would be within the road ditch near the toe of the east road slope. South of the Denali Park commercial area, the pipeline would cross the Nenana River on the pedestrian/bicycle bridge and enter the Denali NPP. The route variation would cross under the highway north of the junction with the Denali Park Road and then continue south following the Parks Highway corridor. The route variation would cross the Nenana River at McKinley Village and continue south within the Parks Highway ROW. The Denali National Park Route Variation would have two major river crossings: Nenana River using the existing pedestrian/bike bridge south of the Denali Park commercial area, and Nenana River by McKinley Village (buried) (ENSTAR 2008).

The Denali National Park Route Variation would be approximately 15.3 miles long, and would be within Denali National Park for approximately 7 miles, but would stay in the Parks Highway ROW. None of the Denali National Park lands that would be crossed are designated wilderness areas. Currently, federal laws would not allow construction of this route variation within Denali National Park (see further discussion of applicable National Park Service regulations in Section 1.2.6.3). Federal legislation that would allow the route variation has been introduced by the Alaska delegation, and is currently being considered by the U.S. Congress. If such legislation is passed into law, the NPS would have authority to issue a ROW permit for a pipeline route which would result in the fewest or least severe adverse impacts upon the Park. For this reason, the description of the Denali National Park Route Variation includes the provision that the AGDC would work with the NPS to adjust and refine the proposed route variation through Denali National Park to assure that the route or mode would be constructed that would result in the fewest or least severe adverse impacts.

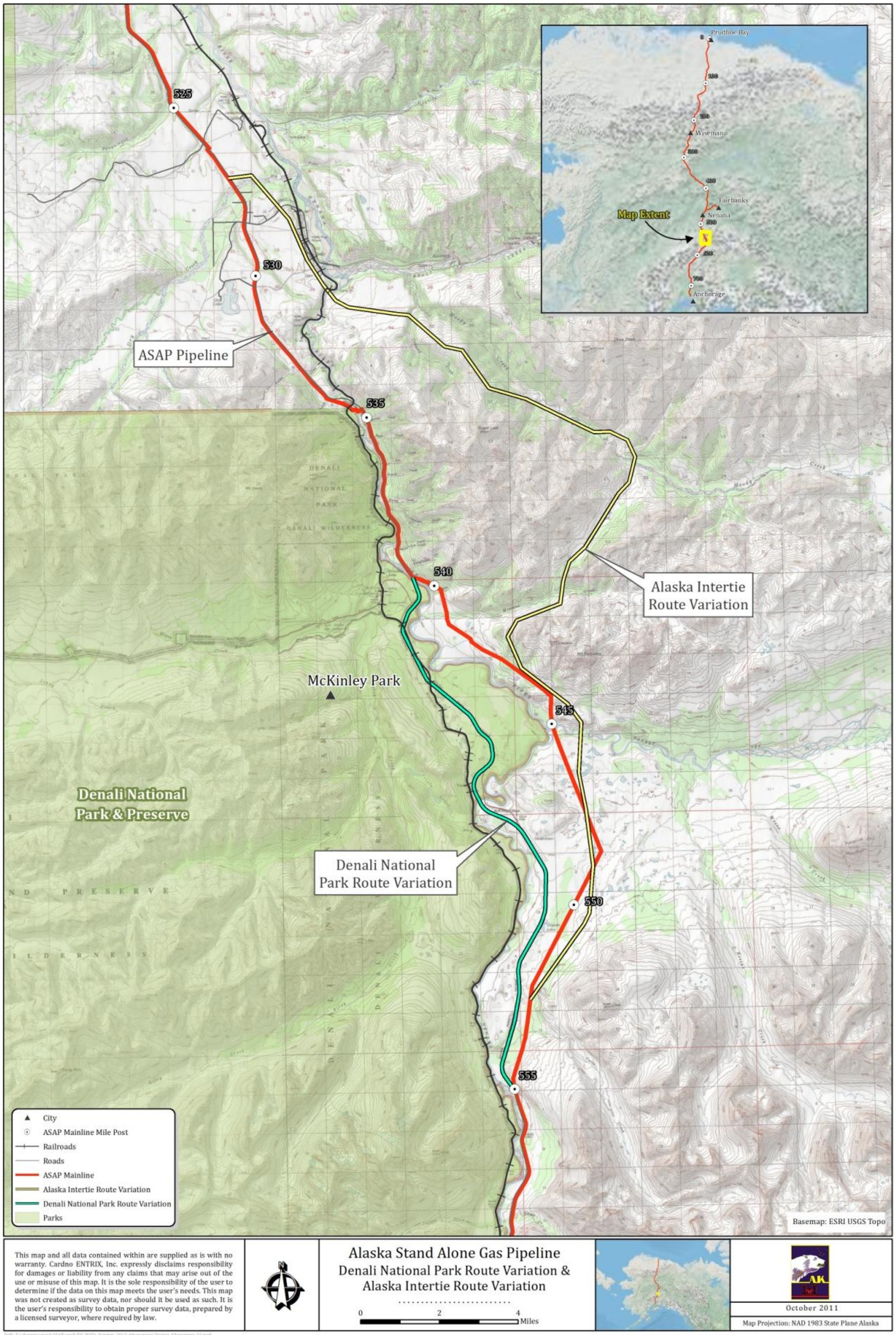

FIGURE 4.4-2 Denali National Park Route Variation and Alaska Intertie Route Variation

The 15.3-mile-long Denali National Park Route Variation would replace a 15.5-mile-long segment of the proposed Project between approximately MP 540 and MP 555. Wetland and riverine impacts associated with this route variation would be approximately 3.5 acres, or less than 2 percent of the total area affected. The corresponding proposed Project segment would require removal of trees and vegetation on a steep slope and elevated bench that would be visible from Denali NPP and the Parks Highway. The Denali National Park Route Variation would be of similar length and would be co-located with the Parks Highway. Therefore, the Denali National Park Route Variation is reasonable alternative that could minimize visual impacts in the area of Denali NPP.

4.4.2.4 Alaska Railroad Route Variations

Several potential route variations that would be co-located with segments of the existing Alaska Railroad were identified during scoping, including potential co-location with the rail line near Curry, and with the proposed Port MacKenzie Rail Extension Project near Houston. These routes were examined for their potential to reduce the length of the pipeline, wetland impacts and stream crossings.

Curry Rail Route Variation

The Curry Rail Route Variation would follow the existing ARR ROW from where it would cross the Parks Highway at MP 608.5 north of Curry Ridge, and would extend south along the east side of the Curry Ridge, crossing the Susitna River, then extending along the east side of the Susitna River past the former town of Curry. The route variation would cross the Talkeetna River north of Talkeetna, and extend through Talkeetna south, where it would rejoin the Parks Highway Corridor at MP 677.8 (Figure 4.4-3[7]).

Co-locating the proposed Project route with the railroad ROW would require a new 100-foot-wide construction ROW located east of the rail line for a distance of 65.6 miles, and would impact approximately 796 acres of land. The rail line segment between Gold Creek and Curry is constrained by the Susitna River to the west and the Talkeetna Mountains to the east. Pipeline construction would be difficult in this area. The segment of the proposed Project route that would be replaced by the Curry Route Variation is 69.1 miles long, approximately 3.5 miles longer. However, 202 acres of lands outside of the existing Parks Highway ROW would be affected by this segment due to co-location with the highway. Therefore even though the Curry Route Variation would be 3.5 miles shorter, it would require new ROW impacts on 594 more acres of lands. The Curry Route Variation would cross approximately 64 streams as opposed to 39 stream crossings for the segment of the proposed Project route that it would replace. The Curry Route Variation would not be road accessible and would require access from the Parks Highway at the north or south ends, or from the ARR. Based upon this analysis, the Curry Route Variation would present construction and maintenance access issues and would not present environmental advantages over the proposed Project route.

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7 The proposed Project is identified as 'ASAP Mainline' on this figure.

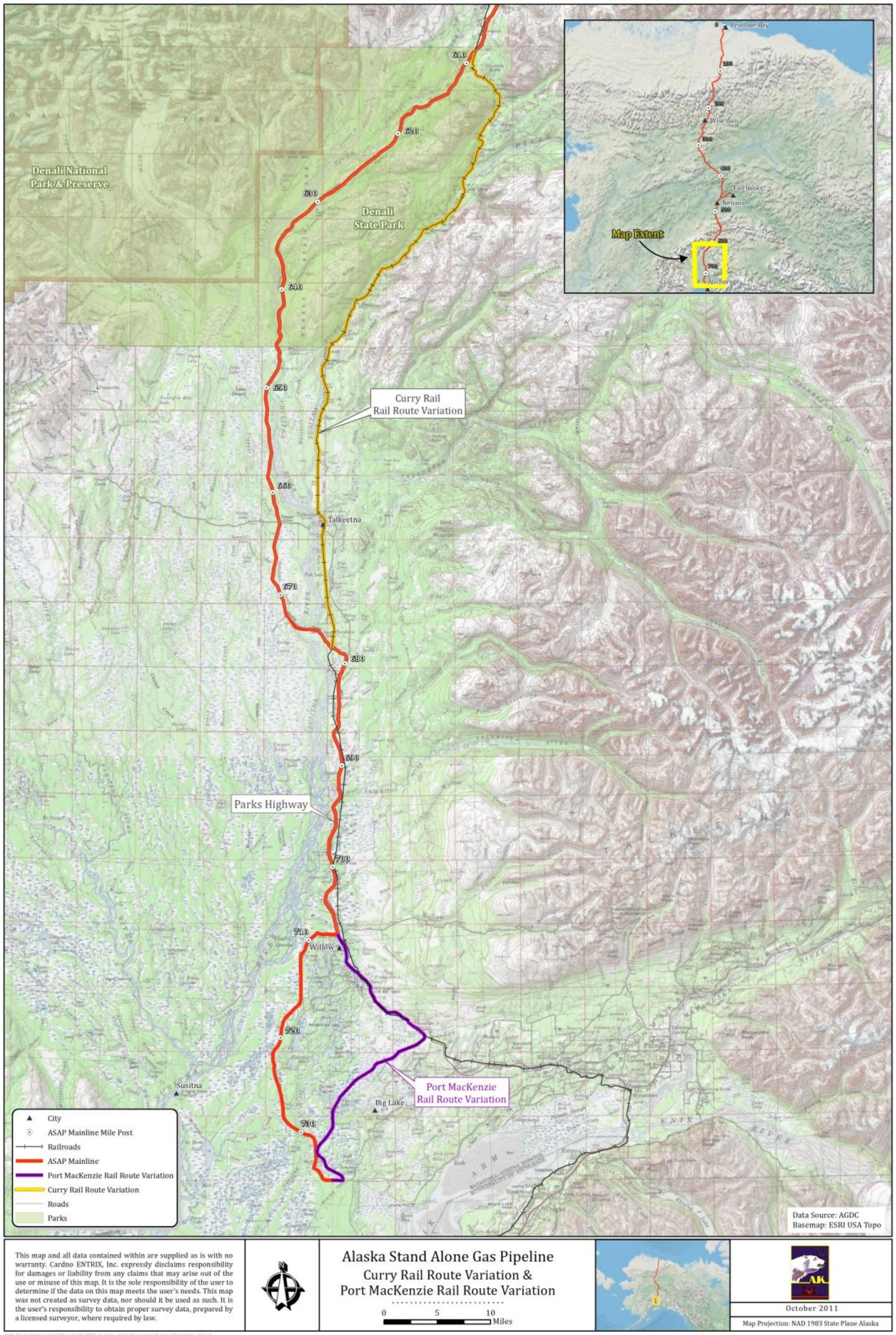

FIGURE 4.4-3 Curry Rail Route Variation and Pork MacKenzie Route Variation

Port MacKenzie Rail Route Variation

The Port MacKenzie Rail Route Variation would follow the ROW of the proposed Port MacKenzie Rail Extension Project (Figure 4.4-3). The total length of the route variation would be 33.1 miles. Approximately 11.3 miles would parallel the existing rail line and Parks Highway from Willow to near Houston, and 21.8 miles would be located adjacent to the proposed Port MacKenzie Rail Extension Project that would extend from near Houston to Point MacKenzie.

The segment of the proposed Project route that would be replaced by the Port MacKenzie Rail Route Variation would be 30.6 miles, would impact approximately 140 acres of wetlands within a 100-foot-wide construction ROW, and would cross 12 streams. The 21.8 mile segment of the Port MacKenzie Rail Route Variation extending from near Houston to Point MacKenzie would impact approximately 160 acres of wetlands within a 70 to 80 feet wide area to be occupied by the rail bed and adjacent access/service road, and would cross 25 streams (Surface Transportation Board 2011). Similar impacts would result from extending the width of the ROW to accommodate the proposed Project. Additional wetland impacts and stream crossings would occur within the 11.3 mile segment from Willow to near Houston. Based upon this comparison, co-location of the proposed Project pipeline with the Port MacKenzie Rail Extension Project would result in a 2.5 mile longer pipeline, more wetland impacts and a greater number of stream crossings than the segment of the proposed Project pipeline that would be replaced. Based upon this analysis, the Port MacKenzie Rail Route Variation would not present environmental advantages over the proposed Project route. In addition, the Port MacKenzie Rail Extension Project is in the planning and permitting stages and construction is uncertain. Therefore, the proposed Project could be the only feature constructed in the corridor and the benefits of access by the rail project service road and co-location with the service road and rail may not be realized.

4.5 ABOVEGROUND FACILITY SITE ALTERNATIVES

Aboveground facilities that would be components of the proposed Project include: a North Slope gas conditioning facility (GCF); a Fairbanks gas straddle and off-take facility; one or two compressor stations; a NGLEP facility; access roads; valves; pigging facilities; maintenance facilities; and pipe yards and camps. The general locations of these facilities are constrained by proximity, technical and logistical issues related to Project construction and operations. For example, the GCF would need to be near the gas source and pipeline; the NGLEP facility would need to be near the pipeline terminus; and compressor stations would need to be within defined increments of the pipeline to efficiently compress and transport the natural gas. Considering these constraints, the AGDC applied other siting criteria to determine the specific locations of the proposed aboveground facilities. These siting criteria included limiting impacts to: topography; waters, wetlands and habitats; visual resources; cultural resources; and people and communities. Considering the AGDC facility siting process, it is reasonable to assume that environmental impacts could be more effectively reduced by employment of site specific mitigation measures rather than by alternative facility sites. Mitigation measures have been identified in Section 5 (Environmental Analysis). Accordingly, specific alternative aboveground facility sites have not been identified.

4.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The alternatives analysis described in Section 4.2 through 4.5 indicates that the Denali National Park Route Variation should be carried forward for detailed analysis in Section 5 (Environmental Analysis) as a reasonable alternative that may have environmental advantages over the segment of the proposed Project route that it would replace. The other alternatives that have been identified do not meet the purpose and need objectives of the proposed Project, are not reasonable and/or do not include features that would lessen environmental impacts when compared to the proposed Project. Therefore, the other alternatives considered herein are not carried forward for detailed analysis in Section 5 (Environmental Analysis). A summary of alternatives and their status is presented in Table 4.6-1.

TABLE 4.6-1 Summary of Alternatives and Their Status

Type Alternative	Specific Alternative	Conclusion	Status
No Action	No Action Alternative	Analysis required by NEPA	Analyzed herein and in Section 5 of this document
Alternate Energy	Kenai Peninsula and Cook Inlet Natural Gas	New Kenai Peninsula and Cook Inlet natural gas reserves that could provide a long-term, stable supply of natural gas to markets in the Fairbanks and Cook Inlet areas remain unproven at this time.	Considered But Eliminated from Detailed Analysis
Alternate Energy	Gubik Field Natural Gas	Gubik Field remains a commercially unproven source of gas.	Considered But Eliminated from Detailed Analysis
Alternate Energy	Nenana Basin Field Natural Gas	The Nenana Basin remains an unproven source of gas.	Considered But Eliminated from Detailed Analysis
Alternate Energy	LNG Import	The economic benefits of utilizing an in-state gas source would not be realized.	Considered But Eliminated from Detailed Analysis
Alternate Energy	Hydro Power	Could reduce, but not replace, the existing and future need for natural gas within the proposed Project's timeframe (2019).	Considered But Eliminated from Detailed Analysis
Alternate Energy	Nuclear Power	Could reduce, but not replace, existing and future needs for natural gas within the proposed Project's timeframe (2019).	Considered But Eliminated from Detailed Analysis
Alternate Energy	Coal and coal gas	Could reduce, but not replace, existing and future needs for natural gas.	Considered But Eliminated from Detailed Analysis

TABLE 4.6-1 Summary of Alternatives and Their Status

Type Alternative	Specific Alternative	Conclusion	Status
Alternate Energy	Renewable Sources (Wind, Geothermal, Biomass, Tidal)	Could reduce, but not replace, existing and future needs for natural gas.	Considered But Eliminated from Detailed Analysis
Energy Conservation	Energy Conservation Measures and Programs	Enhanced programs could result in a reduction of the region's capacity and annual energy requirements, but not in sufficient quantities to meet future energy needs.	Considered But Eliminated from Detailed Analysis
Natural Gas Transport System	Dry Gas Pipeline from North Slope	Would not lessen environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis
Natural Gas Transport System	Smaller Diameter Pipeline	Would not lessen environmental impacts when compared to the proposed Project	Considered But Eliminated from Detailed Analysis
Natural Gas Transport System	Spur Pipeline From a Large North Slope-to-Lower 48 or Valdez Pipeline	Large pipeline is uncertain and would not likely be completed and transporting natural gas by 2019.	Considered But Eliminated from Detailed Analysis
Natural Gas Transport System	Pipeline from North Slope to Fairbanks, Transport by Rail Car to Southcentral Alaska	Not a cost efficient or logistically reasonable means of moving large volumes of natural gas from Fairbanks to Southcentral Alaska for 30 or more years.	Considered But Eliminated from Detailed Analysis
Natural Gas Transport System	Transport by Truck/Trailer	Not logistically viable or reasonable.	Considered But Eliminated from Detailed Analysis
Pipeline Route	Richardson Highway Route Alternative	Longer route does not include features that would lessen environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis
Pipeline Route	Fairbanks Route Variation	Longer route does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis
Pipeline Route	Alaska Intertie Route Variation	Route has access, engineering and constructability issues, and does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis
Pipeline Route	Denali National Park Route Variation	A reasonable, constructible alternative that could minimize visual impacts in the area of Denali National Park.	Carried forward for detailed analysis in Section 5.
Pipeline Route	Curry Rail Route Variation	Route has access and constructability issues and does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis

TABLE 4.6-1 Summary of Alternatives and Their Status

Type Alternative	Specific Alternative	Conclusion	Status
Pipeline Route	Port MacKenzie Rail Project Route Variation	Rail project uncertainty results in potential co-location and access issues. Route does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered But Eliminated from Detailed Analysis
Above Ground Facility Site	None identified	Project siting process to avoid environmentally sensitive areas suggests environmental impacts could be more effectively reduced by employment of site specific mitigation measures rather than by alternative facility sites.	Considered But Eliminated from Detailed Analysis

4.7 REFERENCES

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5.0 ENVIRONMENTAL ANALYSIS

The environmental analysis of the proposed Project and alternatives describes: the affected environment; direct, indirect and cumulative impacts that would result from construction and operations; and mitigation measures that could reduce impacts to each affected resource. The environmental analysis is organized by physical, biological and human environmental resources in Sections 5.1 through 5.22.

Sections 5.1 through 5.22 discuss the affected environment, construction and operations impacts, and measures to mitigate impacts to affected resources. The environmental consequences of constructing and operating the proposed ASAP Project would vary in context, intensity and duration. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts would generally occur during construction, with the resources returning to pre-construction conditions almost immediately afterward. Short-term impacts would continue for approximately 3 years following construction. Impacts were considered long term if the resources would require more than 3 years to recover. Permanent impacts would occur as a result of activities that modify resources to the extent that they would not return to pre-construction conditions during the life of the proposed Project, such as with construction of aboveground structures. Impacts that would result in change in the environment are quantified and described qualitatively.

The proposed Project would incorporate measures to reduce environmental impacts as described in Appendix H. Mitigation measures that could further reduce impacts are identified for each affected resource in Sections 5.1 through 5.19. The AGDC would incorporate mitigation measures required in authorizations and permits issued by environmental permitting agencies into the construction, operation, and maintenance of the proposed Project.

5.1 SOILS AND GEOLOGY

This section describes the soils and geology encountered in the Project area. Soils are defined by the Soil Science Society of America as “The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro and microorganisms, conditioned by relief, acting on parent material over a period of time.” Since the proposed Project route traverses a wide variety of terrain types and permafrost characteristics, land features are presented in the context of ecoregions. Ecoregions are defined as ecologically distinct areas based on climate, terrain, soils, and vegetation.

In addition, several geomorphic processes and features are encountered in the proposed Project area and are also described: mass wasting, permafrost degradation/aggradation and frost action, and seismicity. Paleontological resources are also provided.

The State of Alaska does not contain prime farmland, prime forest land, or prime rangeland soils. In addition, no soils designated as unique farmlands or farmlands of statewide importance have been designated in Alaska.

5.1.1 Affected Environment

5.1.1.1 Ecoregions

Ecoregions represent a rigorous interagency and multidisciplinary approach to mapping and managing Alaska’s natural resources at the landscape level. The development of ecoregions required a cooperative consensus between the USFS, NPS, USGS, The Nature Conservancy, and many other agencies and private organizations. Ecoregion units are delineated along gradients of climate, vegetation and disturbance processes (Gallant 1995). Out of the 32 ecoregions that exist in the state; nine ecoregions are traversed by the proposed Project (Figure 5.1-1).

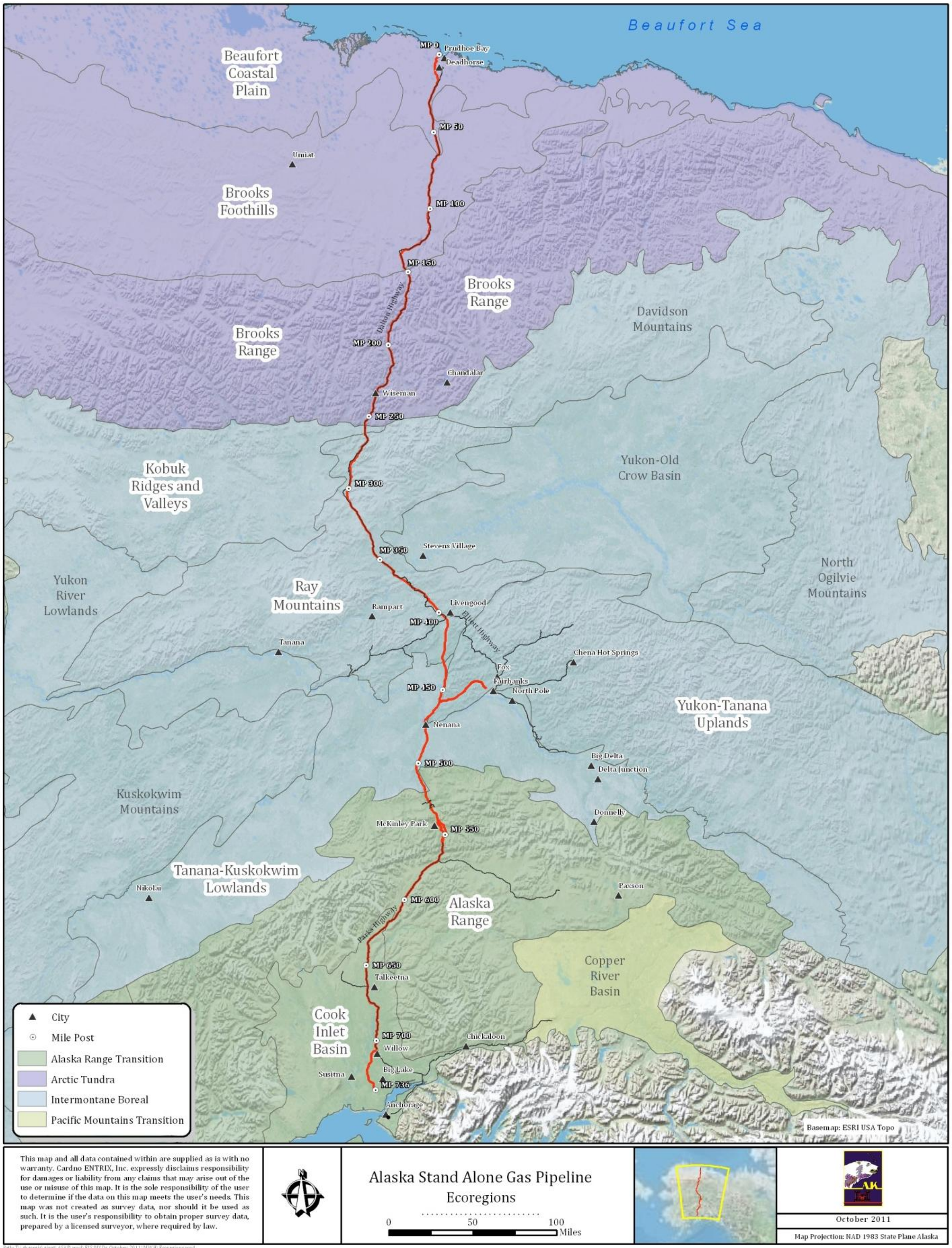


FIGURE 5.1-1 Alaska Stand Alone Gas Pipeline Ecoregions

There are eight ecoregions crossed by the proposed Project from the GCF in Deadhorse to MP 540 near Denali NPP which is in the Alaska Range Ecoregion. From MP 540, the route continues through the Alaska Range Ecoregion and then crosses the Cook Inlet Basin Ecoregion to the terminus of the pipeline in Beluga. There are three route variations proposed to cross the Yukon River which are located entirely within the Ray Mountains ecoregion, the two route variations near Denali NPP are located within the Alaska Range ecoregion, and the Fairbanks Lateral is located entirely within the Yukon-Tanana Uplands ecoregion (Table 5.1-1).

Each ecoregion traversed by the proposed Project is described in the following sections, presented from north to south: Beaufort Sea Coastal Plain Ecoregion, Brooks Foothills Ecoregion, Brooks Range Ecoregion, Kobuk Ridges and Valleys Ecoregion, Ray Mountains Ecoregion, Yukon-Tanana Uplands Ecoregion, Tanana-Kuskokwim Lowlands Ecoregion, Alaska Range Ecoregion, and Cook Inlet Basin Ecoregion.

TABLE 5.1-1 Ecoregions of the Proposed Project

Ecoregion[a]	Segment Name and Location									
	MP 0 to MP 540		MP 540 to MP 555		Denali National Park Variation		MP 555 to End		Fairbank Lateral	
	GCF to Denali NPP		Around Denali NPP		Through Denali NPP		Denali NPP to Beluga		Dunbar to Fairbanks	
	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent
Beaufort Coastal Plain	63.6	11.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brooks Foothills	83.7	15.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brooks Range	108.5	20.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kobuk Ridges and Valleys	5.05	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ray Mountains	171.3	31.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Yukon-Tanana Uplands	14.7	2.7	N/A	N/A	N/A	N/A	N/A	N/A	34.4	100
Tanana-Kuskokwim Lowlands	72.0	13.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alaska Range	20.1	3.7	15	100	15.3	100	61.2	33.7	N/A	N/A
Cook Inlet Basin	N/A	N/A	N/A	N/A	N/A	N/A	120.2	66.3	N/A	N/A
Totals	**539**	**100**	**15**	**100**	**15.3**	**100**	**181.4**	**100**	**34.4**	**100**

Key:
[a] – Ecoregions of Alaska (Nowacki et al., 2001).
[b] – Alignments provided by Alaska Gasline Development Corporation.
GCF – Gas Conditioning Facility
NP – National Park
N/A – not applicable

Beaufort Sea Coastal Plain Ecoregion

The Beaufort Sea Coastal Plain Ecoregion features smooth, planar topography, rising gradually for 60 miles north to south to an elevation of approximately 600 feet (Wahrhaftig 1965). The Beaufort Sea Coastal Plain Ecoregion is characterized by a network of polygonal ground features, forming shallow troughs at the borders, and oriented thaw lakes formed by permafrost processes. Locally, pingos (mounds of earth-covered ice) form in flat, low-lying, drained or sediment-filled ponds (BLM and ANHA 1993, French 2007). The polygonal ground features are generally comprised of marine, fluvial, eolian, and lacustrine sediments of Quaternary age (Kreig and Reger 1982). The coastal plain is mantled with quaternary deposits of alluvial, glacial, and aeolian origin. Siltstone and sandstone lie beneath the unconsolidated materials at varying depths ranging from 10 to more than 30 feet (Gallant 1995). The Project would not cross any faults within this ecoregion.

Throughout most of the Project area in this ecoregion, the floodplain of the Sagavanirktok River grades from a braided river system to a meandering channel flowing north toward the Beaufort Sea. The braided nature of the river channels reflects the unconsolidated nature of the bedrock, the availability of abundant bedload, and the highly seasonal discharge regime. During summer, the gradual melt of snowbanks on east-facing slopes provides moisture for mass wasting (solifluction) to occur (French 2007). Locally, channels may be floored with sandy silts that represent former, seasonal floodplain deposits overlying sand and gravel (Kreig and Reger 1982). Sheet ice from successive stream bank overflows is present on various sections of the floodplain during winter (APSC 2007).

The dominant soils of the Beaufort Coastal Plain consist of several feet of ice-rich organic silt overlaying coarse sands and gravels (APSC 2007). Massive ground ice is widespread throughout the area, appearing as vertical wedges, films, lenses, pore-fillings, and segregated masses. Networks of ice wedges create polygonal ground features on the surface.

The Beaufort Sea Coastal Plain Ecoregion is underlain by thick, continuous permafrost, with an average temperature of less than 19°F (Brown et al. 1997, Ferrians 1965). The permafrost is 670 to 2,150 feet thick in most areas (Péwé 1975). Polygonal ground features, formed by ground contraction and ice wedge formation and oriented lakes, formed by the thawing of ice-rich soils, characterize low-lying areas. Shallow thaw bulbs may be present beneath active river channels and lakes at depths greater than 6 feet (Kreig and Reger 1982).

Brooks Foothills Ecoregion

The Brooks Foothills Ecoregion features glacial moraines composed primarily of coarse-grained till covered with loess, extensive glacial outwash deposits and low-elevation bedrock landforms, generally rising to a few hundred feet in elevation and comprised primarily of sandstone, siltstone, and shale of Cretaceous age (Table 5.1-2) (BLM and ANHA 1993). The Project area in this ecoregion is drained primarily by the north-flowing Sagavanirktok River, which is characterized by a braided river system grading to a meandering channel flowing north toward the Beaufort Coastal Plain. Sedimentary outcrops of Cretaceous age are exposed to form elevated bluffs along the flanks of the river. Tilted, laminar sandstones, siltstones, and shales of Cretaceous age are also exposed in scattered outcrops throughout the Brooks Foothills (e.g., Slope Mountain) (BLM and ANHA 1993). The Project would not cross any faults within this ecoregion.

TABLE 5.1-2 Geologic Timeline

Era/Period/Epoch	Time
Cenozoic Era	**Present to 65 MYA**
Quaternary Period	Present to 1.8 MYA
Holocene Epoch	Present to 8,000 years ago
Pleistocene Epoch	8,000 years ago − 1.8 MYA
Tertiary Period	1.8 − 65 MYA
Mesozoic Era	**65 − 248 MYA**
Cretaceous Period	65 − 145 MYA
Jurassic Period	145 − 210 MYA
Triassic Period	210 − 248 MYA
Paleozoic Era	**248 − 570 MYA**
Permian Period	248 − 290 MYA
Pennsylvanian Period	290 − 330 MYA
Mississippian Period	330 − 365 MYA
Devonian Period	365 − 408 MYA
Silurian Period	408 − 430 MYA
Ordovician Period	430 − 500 MYA
Cambrian Period	500 − 570 MYA
Proterozoic Era	**570 − 2,500 MYA**

Key: MYA – million years ago.

Planar upland depressions are partially filled with ice-rich peat and organic-rich slope wash deposits. Colluvium may partially fill thaw ponds and basins. The Brooks Foothills are underlain by continuous permafrost, with an average temperature of less than 19°F (Brown et al., 1997). Although exact thickness of the permafrost is uncertain, records from other parts of the northern Brooks Range and Arctic Foothills (for example, Ferrians 1965) suggest that its base probably occurs between 490–820 feet in depth (Hamilton 2003). Massive ground ice, up to 50 percent by volume (Kreig and Reger 1982), is common in the tills of this region. Near-surface permafrost promotes solifluction, the slow flowage of soil within the active layer during the annual thaw season. Solifluction and gelifluction are widespread in the Brooks Foothills Ecoregion. Gelifluction is defined by the DGGS (2011) as progressive lateral flow of earth material in an area which is subject to intense freezing cycles and exhibits permafrost weathering and erosion characteristics. Solifluction is most active during spring and early summer when the active layer generally is saturated with moisture released by thawing that remains confined above the surface of impermeable permafrost. Movement rates up to 2 inches per year are common, but more rapid rates up to 4 or even 6 inches per year have been recorded on some solifluction slopes (Hamilton 2003). Permafrost free zones or thaw bulbs (taliks) are likely to occur only beneath water bodies with depths greater than 6 feet (French 2007). In the floodplain of the Sagavanirktok River, seasonally frozen ground occurs in areas outside of the active channel, with continuous permafrost present adjacent to the active channel.

River and stream icings, a phenomenon also called aufeis, may occur during freeze-up and in winter. Stream icings are attributed either to a reduction in the cross-sectional area of an ice covered channel as freezing advances, or to an increase in snow load on an initial ice cover thus raising the hydrostatic head beneath the ice to an elevation higher than the ice surface. If water cannot escape from the banks due to the freezing of the active layer, fractures in the ice can allow water to escape over the ice cover, freezing as an icing. In shallow braided streams, small icing mounds, 3–10 feet high may develop in response to localized restrictions of flow by ice freezing to the bed of the braid bars (French 2007).

Brooks Range Ecoregion

The Brooks Range Ecoregion is comprised of rugged, glaciated, east-west trending mountains rising from the Brooks Foothills to elevations ranging from 4,000 to 8,000 feet (Wahrhaftig 1965). Erosional landforms associated with alpine glaciers, such as cirques and U-shaped valleys, are common throughout the Brooks Range. Talus slopes, alluvial fans, moraines, and outwash fans are well developed at the bases of valleys and cirques. Drainages in the north Brooks Range discharge through the Sagavanirktok River to the Arctic Ocean; drainages in the south discharge to the Bering Sea via the Atigun and Dietrich Rivers. Most of the major drainages flow to discharge locations within U-shaped valleys, scoured by Pleistocene glaciations (APSC 2007).

Bedrock in the Brooks Range includes folded and thrusted Paleozoic and Mesozoic sedimentary rocks (exposed in the northern flank of the range), deformed Paleozoic metamorphic rocks (in the central Brooks Range), and Late Proterozoic to Paleozoic metamorphic rocks (in the southern Brooks Range) (Moore et al. 1994). Surficial deposits of the Brooks Range are modern stream alluvium and Pleistocene age fluvial, colluvial, glacial, and glaciofluvial sediments. The Project would not cross any faults within this ecoregion.

Coarse-grained sands and gravels underlie the Atigun River and Dietrich River valleys within the Project area of the Brooks Range. Windblown silts and sands are present in the Atigun River floodplain (Kreig and Reger 1982). Near the toes of steep-sloped alluvial fans, moraines, talus, and unsorted, coarse to very-coarse sediments are common. In previously scoured glacial basins (e.g., Galbraith Lake), lacustrine silt and clay may overlie coarse-grained glaciofluvial and glacial deposits.

The Brooks Range is underlain predominantly by continuous permafrost that has an average temperature of 19°F to 27°F. Ground ice contents vary from up to 15 percent ice in fluvial silts and sands, to 25 to 95 percent ice in lacustrine silts and clays near Galbraith Lake. In river valleys, vegetated areas of moraine, fan, and alluvial deposits are continuously frozen from the base of the active layer to more than 50 feet below ground surface in the northern Brooks Range (Kreig and Reger 1982). Permafrost depth is greater in coarse grained deposits than in fine grained deposits and trends from north (deeper) to south (shallower). Due to seasonal variations and the heat from water within river channels, permafrost can be discontinuous within the alluvium underlying major active rivers (Ferrians 1965, Kreig and Reger 1982).

Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valleys Ecoregion consists of low ridges and lowlands south of the Brooks Range. The Project area follows the floodplain of the Middle Fork Koyukuk River (Wahrhaftig 1965). These lowlands are underlain by unconsolidated Quaternary sediments. Late Paleozoic and Mesozoic igneous rocks (both extrusive and intrusive) are exposed at the surface of ridges (BLM and ANHA 1993). The Kobuk fault is a nearly dormant Cenozoic strike-slip fault approximately 40 miles away from the Project area, on the southern flank of the Brooks Range (Freymueller et al. 2008). The Project would not cross any faults within this ecoregion (Figure 5.1-3). The soils of Kobuk Ridges and Valleys are a function of Pleistocene glaciations. Coarse-grained glacial and glaciofluvial sediments are distributed near the main channels of the Middle and South Fork Koyukuk rivers. Away from the channels, soils consist of fine-grained silt and clay of eolian and lacustrine origins overlying coarse-grained glacial tills (Hamilton 1986). Thaw lakes are well developed in the silt of the lowlands, between the Middle and South Fork Koyukuk rivers.

This ecoregion is underlain by discontinuous permafrost with an average temperature of 27°F to 30°F (Brown et al. 1997). The Project area runs through only five miles of the Kobuk Ridges and Valleys Ecoregion and is most likely within a continuous permafrost zone. Permafrost is generally absent beneath unvegetated floodplains within the region. Vegetated floodplains can overlie permafrost between 5 and 50 feet thick in local areas (Kreig and Reger 1982).

Ray Mountains Ecoregion

The Ray Mountains Ecoregion consists of rounded hills rising from 2,000 to 4,000 feet and extending to the Hess River, marking the location of the Rampart Trough (described below) (Wahrhaftig 1965). The Ray Mountains supported glaciers in the Pleistocene, but are now largely unglaciated and commonly covered with colluvial and eolian deposits. Lower elevations are covered with retransported eolian deposits. The northern portions of the Ray Mountains are composed primarily of Proterozoic through Paleozoic age metamorphic rock, with some igneous intrusions of Cretaceous age present (BLM and ANHA 1993). The southern portion of the Ray Mountains consists predominantly of fine-grained, massive volcanics, and thinly interbedded cherts of Late Paleozoic to Middle Mesozoic ages. Bedrock in the uplands is primarily metamorphic rock of Paleozoic age (Foster et al. 1994). The Project would not cross any faults in this ecoregion (Figure 5.1-1).

The Rampart Trough, near the Hess River, is a narrow depression created by erosional processes along a tightly-folded belt of soft, coal-bearing rocks of Tertiary age. Topographically, the Rampart Trough is 500 to 2,500 feet below the surrounding upland terrain (Wahrhaftig 1965). South of the Rampart Trough, to the Tanana River, the Yukon-Tanana Uplands are characterized by rounded hills with gentle-sided slopes. The hills, at elevations of 1,500 to 3,000 feet, rise 500 to 1,500 feet in elevation above the adjacent valleys. The valleys are generally a quarter to half-mile wide and contain alluvium (APSC 2007). The Yukon and Koyukuk Rivers and their tributaries are the major drainage systems of the Ray Mountains.

Most streams in this area are tributaries of the Yukon and the Tanana rivers (Wahrhaftig 1965). Streams flow either northeast to the Yukon River or southeast to the Tanana River. These two rivers transport silt that is deposited on the top of the hills by eolian processes in the region. Several major lowlands are drained by the Yukon River, and Hess Creek. These river valleys contain extensive Quaternary fluvial and eolian deposits (APSC 2007).

The soils of the Ray Mountains depend, in part, on their distance from the Tanana and Yukon rivers. In areas farther from the rivers, residual soils from weathered bedrock are dominant on hilltops and are generally a few feet thick. In valley bottoms, soils can be more than 40 feet thick, and are a combination of colluvium, fluvial sand and gravel, and weathered bedrock (Kreig and Reger 1982). Loess is common on the Ray Mountains near the Tanana and Yukon rivers. Silt is transported from river floodplains and deposited over coarse-textured subsoils.

Colluvium deposits, mostly composed of coarse-grained rock debris and retransported silt from the hills, are transported by mass wasting, and dominate lower hillsides away from the river valleys. Colluvium is estimated to be one to 18 feet thick at these locations. In the lowlands, between the hills, silty colluvium is incorporated with organic matter (Péwé 1975, Péwé and Reger 1983).

Areas south of the Yukon River are underlain with discontinuous permafrost, with an average temperature of 27°F to 30°F (Brown et al. 1997) generally decreasing in depth from north to south. Frozen ground may be absent near major stream channels (Ferrians 1965). However, permafrost may be present in areas where a river channel has migrated from an area, since permafrost can aggrade in the absence of the influence of the heat of the water that was in the channel. Near the Yukon and the Tanana rivers, thick loess deposits on the uplands can contain ice as thick as 55 feet (Kreig and Reger 1982). Lowlands, where retransported silts accumulate, may have thicker ice-rich soils. In uplands, where loess is thin or absent, the ice content of colluvium or weathered bedrock is substantially lower. The soils in valley bottoms, surrounding rounded hills, are ice-rich and more than 50 feet deep in many locations (Kreig and Reger 1982). Thermokarst lakes are common in valley bottoms throughout the region.

Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands Ecoregion consists of rounded hills with gentle side slopes. The hills, at elevations of 1,500 to 3,000 feet, rise 500 to 1,500 feet above adjacent valleys. The valleys are generally a quarter to a half-mile wide and contain alluvium (Wahrhaftig 1965). They flow either northeast to the Yukon River or southeast to the Tanana River. The two rivers supply the silt (left behind from glacial retreat) that is deposited on the top of the hills by eolian processes. The bedrock in the uplands contains metamorphic rocks of Paleozoic age (Foster et al. 1994). Several major lowlands are drained by the Yukon River, Tolovana River, Tatalina River, Chatnika River, Chena River, and Salcha River in this ecoregion and by Hess Creek in the Ray Mountains Ecoregion. These river valleys contain extensive Quaternary fluvial and eolian sediments (APSC 2007).

The soil types on the uplands in part depend on the distance from the Yukon and Tanana rivers. In areas far from the rivers, residual soils from weathering bedrock are dominant on hilltops and are generally a few feet thick. In valley bottoms, soils can be more than 40-feet thick. The soils here are a combination of colluvium, fluvial sand and gravel, and weathered bedrock (Kreig and Reger 1982). The Project would not cross any faults within this ecoregion (Figure 5.1-3).

This ecoregion is underlain by discontinuous permafrost with a temperature of 27°F to 30°F (Brown et al. 1997). Permafrost depth generally decreases from north to south. Near the main channels of major streams, frozen ground may be absent (Ferrians 1965). However, as a stream channel migrates away from an area, permafrost can degrade because the ground refreezes in the absence of the influence of the heat of water in the channel. Near the Yukon and Tanana rivers, the thick windblown silt on the uplands can contain ice upwards of 55 feet thick (Kreig and Reger 1982). The lowlands between the uplands where retransported silts accumulate may have even thicker ice-rich soils.

Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands Ecoregion comprises a broad geographic depression between the Ray Mountains to the north and the Alaska Range to the south. Adjoining outwash fans from the Alaska Range are present in the lowlands. Near the heads of these fans, rivers flow through broad terraced valleys that can be up to several hundred feet deep. Glacial moraines are present on the upper elevations of some alluvial fans (Wahrhaftig 1965). The Project would not cross any faults within this ecoregion (Figure 5.1-3). Windblown silt and sand dominate the surface material in the Tanana-Kuskokwim Lowlands, originating from the braided floodplains and outwash plains of the major rivers in the region. The central and eastern parts of this ecoregion are drained by the Tanana River. Coarse-grained sand and gravel are common near the active channels of major rivers (Péwé 1975, Kreig and Reger 1982).

The lowlands and terraces have shallow and discontinuous permafrost, with an average temperature of 27°F to 30°F (Brown et al. 1997). The permafrost can be more than 50 feet thick in areas, but is absent under rivers. Isolated masses of permafrost are present in areas with coarse-grained sediments (Ferrians 1965, Kreig and Reger 1982). Thermokarst lakes are well developed on the terraces and low-lying areas away from the heads of the alluvial fans.

Alaska Range Ecoregion

The Alaska Range Ecoregion is comprised of a belt of flat-topped, east-trending hills (Wahrhaftig 1965), separated by lowlands composed of moraines and outwash plains of Pleistocene glacial origin. The Alaska Range proper is characterized as rugged glaciated terrain, 6,000 to 9,000 feet in elevation. Slope gradients, which are almost always greater than 5 degrees on hillslopes, exceed 25 degrees on some mountains. Gelifluction features are well developed and landslides and avalanches frequently sweep the steep, scree-lined slopes (Gallant 1995). Glacial landforms and rock glaciers are common, including cirques, U-shaped valleys, moraines, outwash fans, and alluvial fans. Alaska Range drainages north of Broad Pass discharge into the Nenana River, which flows north through Windy Pass to the Tanana River. Locally, fine-grained loess covers outwash deposits in the lowlands (Wahrhaftig 1965). Most of the range drains into the Tanana River. Streams are swift and braided, and most rivers head in glaciers (Wahrhaftig 1965). The Alaska Range spans several faults, including the Denali Fault, Healy Creek fault, Parks Road Fault, and the Northern Foothills Fold and Thrust Belt (Bemis 2010, Figure 5.1-3). Metamorphic rocks are exposed north of the Denali Fault; late Paleozoic marine sedimentary and volcaniclastic rocks are exposed to the south (APSC 2007).

Permafrost is discontinuous in the Alaska Range, with an average temperature of 30°F to 32°F (Brown et al. 1997). Ice-rich permafrost and thermokarst lakes develop in the lowlands, where loess is deposited. Permafrost is absent on south-facing slopes with coarse grained soils, due to solar gain.

Cook Inlet Basin Ecoregion

The Cook Inlet Basin Ecoregion is bound to the north and west by the Alaska Range and to the east by the Talkeetna Mountains. Elevations range from sea level to 2,000 feet. The Cook Inlet Basin Ecoregion surface deposits are primarily composed of poorly-sorted glacial moraines, tills, lake clays and peats – gradually changing to fine-grained, stratified proglacial deposits toward the south. Relatively flat, rolling topography, swampy terrain, and prominent outwash deposits represent the common landscapes seen in the Cook Inlet Basin Ecoregion. Bedrock consists primarily of Tertiary age coal-bearing sedimentary formations. The southeast portion of Cook Inlet Basin Ecoregion contains poorly-sorted tills and silty gravels, along with fluvial deposits from the Susitna River and its associated drainages (Wahrhaftig 1965).

Soils of the Cook Inlet Basin Ecoregion typically consist of peats and bogs in low lying areas, flanked by morainal deposits, till, and outwash landforms. Permafrost, ranging from discontinuous in the north, to absent in the south, varies throughout the Cook Inlet Basin Ecoregion. Isolated ice lenses may exist below peat-covered bogs. At its southern extent, permafrost exists only in isolated lenses as relic ice beneath thick peat bogs. Permafrost is unlikely near Cook Inlet (Gallant 1995).

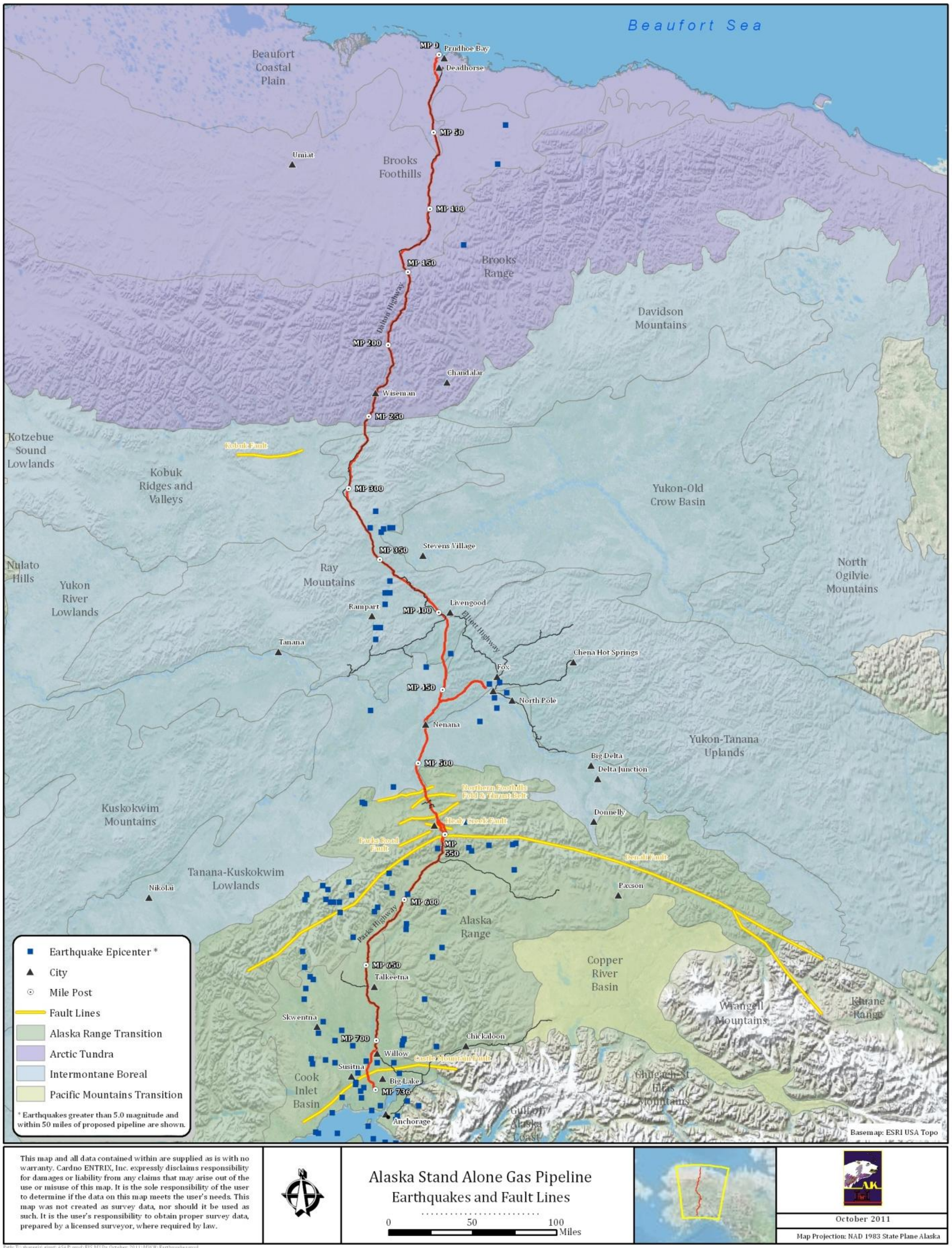


FIGURE 5.1-2 Alaska Stand Alone Gas Pipeline Earthquakes & Faults

The Castle Mountain fault is the only known active fault in the Cook Inlet Basin Ecoregion with an identified surface rupture. The fault lies along the southern margin of the Talkeetna Mountains. The eastern section is about 62 miles long and is seismically active; the western part is about 39 miles long and is seismically quiet. The most recent earthquake was about 650 years ago, which suggests the possibility a significant earthquake (~M6) may be expected in the near future (Freymueller et al. 2008, Haeussler et al. 2000, Figure 5.1-2).

5.1.1.2 Geomorphic Processes

Several geomorphic processes and features are encountered in the proposed Project area. Mass wasting, permafrost degradation/aggradation and frost action, and seismicity, glacial and fluvial processes are described in the following sections. Geomorphic processes such as these must be considered in pipeline engineering, design, siting and construction due to the fact that these processes have the potential to impact pipeline stability and operations.

Mass Wasting

Mass wasting is a general term used to describe geologic processes that are primarily driven by the action of gravity on either consolidated or unconsolidated material. These processes include avalanches, rock falls, slides, and slumps, as well as solifluction in cold regions. Where freezing and thawing of moisture-rich soil is very active, frost propagation can fracture rocks. Depending on the water, ice, and snow content, as well as slope angle, transport processes may include frost creep, rockfalls or slides, solifluction, and slopewash (Davis 2000). These processes produce depositional landforms such as talus at the bases of fans and valley bottoms. Given the distance and varied terrains traversed by the proposed Project, various mass wasting features are present in the Project area and are identified in Table 5.1-3 where the ROW is increased from 100 feet wide to 230 feet wide to implement specialized grading techniques.

TABLE 5.1-3 Approximate Locations of Mass Wasting Features

Approximate Location	From Milepost	To Milepost	Length (Miles)
Atigun Pass Area	142	183	41
Dietrich River/Chandalar Shelf	183	205	22
Cathedral Mountain	252	255	3
N/A	263	265	2
Minto Flat Area	426	429	3
Denali National Park and	540	541	1
Panorama Peak	554	556	2
Reindeer Hills–Cantwell Area	564.5	567.5	3
		Total	**77**

Source: AGDC Plan of Development Rev. 1 March 2011 Table 7.4-1.

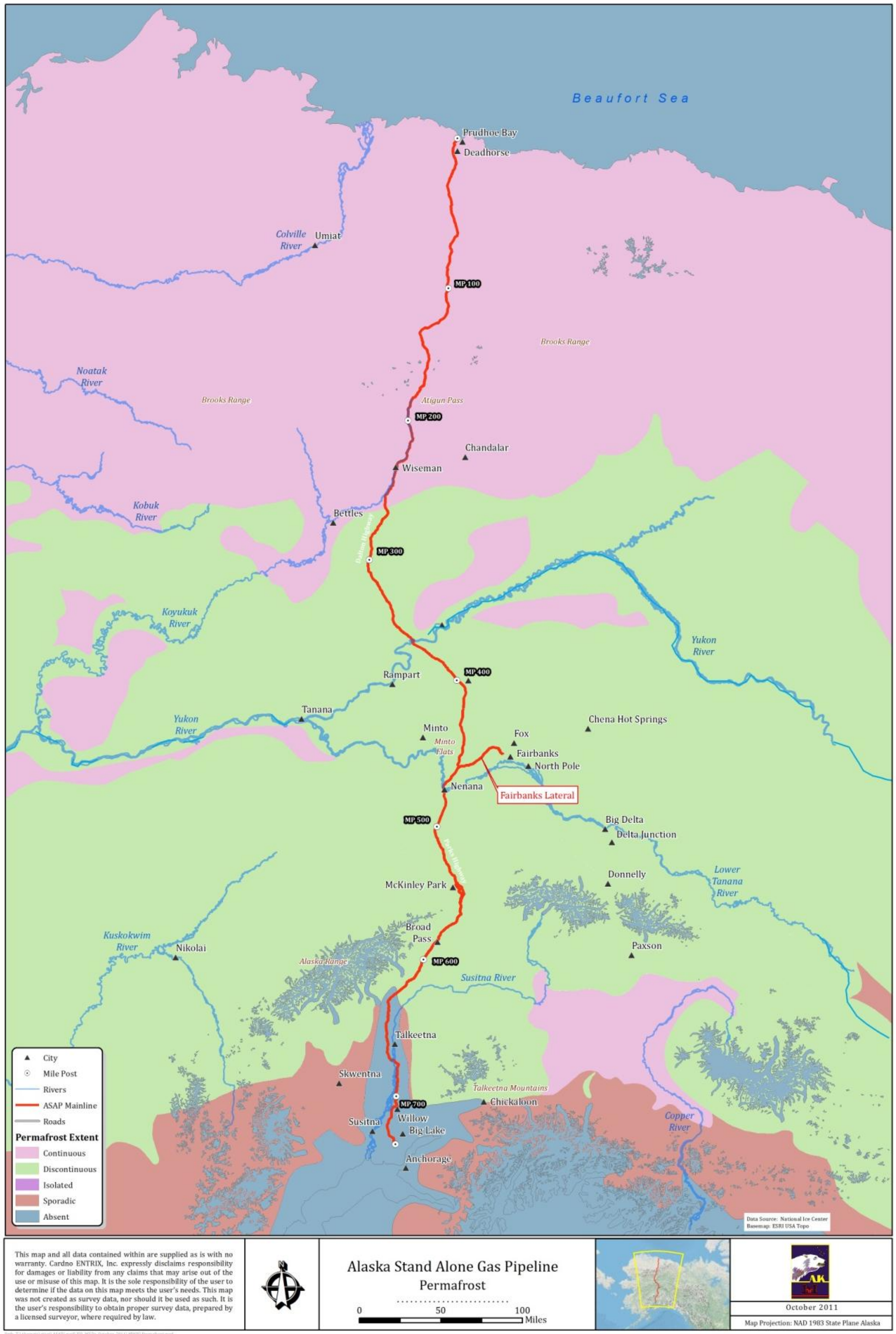
Permafrost and Soil Processes

Permafrost can occur in both soils and bedrock, and is encountered in all ecoregions traversed by the proposed Project. Generally, the ice content in the soil or bedrock is related to the porosity and the moisture content of the material before it is frozen. Higher ice content generally occurs in fine-grained soils than in coarse-grained soils. The latter, in turn, has more ice content than fractured bedrock. Permafrost and ice content are not synonymous; however, many important engineering challenges in dealing with permafrost are related, directly or indirectly, to the water, and/or ice content of permafrost. Moisture in the form of ice may or may not be present in permafrost (French 2007). Permafrost is defined by DGGS (2011) as any soil, subsoil, or other surficial deposit, or even bedrock, occurring in the arctic, subarctic, and alpine regions at variable depth beneath the Earth's surface in which a temperature below freezing has existed continuously for a long time (from two years to tens of thousands of years). On the basis of its extent, permafrost is classified as continuous (covering from 90 to 100 percent of an area), discontinuous (50 to 90 percent coverage), sporadic (10 to 50 percent coverage), or isolated patches (up to 10 percent coverage) (Brown et al. 1997). Permafrost is classified as continuous from approximately MP 0-262, discontinuous from approximately MP 262-628, and absent from approximately MP 628- 736. The depth of the active seasonal freeze-thaw layer in the Project area ranges from 1 foot to about 15 feet (Figure 5.1-3).

Permafrost stability can be disrupted naturally by climate change, forest fires or drainage of lakes, or artificially by human-impacted means. Permafrost degradation occurs as a result of progressive warming of ice-laden soils resulting in the thawing of near-surface permafrost and lowering of the permafrost table. Permafrost aggradation is the result of cooling soil temperatures and the propagation of permafrost. Both degradation and aggradation can be triggered by natural or artificial influences.

Liquefaction, a geomorphic process closely related to water content in soils, is also a condition which may be encountered in the proposed Project area. The DGGS defines liquefaction as the transformation of saturated, cohesionless soil from a solid to a liquid state as a result of increased pore pressure and reduced effective stress (in response to severe ground shaking resulting from an earthquake).

Frost heaving commonly occurs in silt-rich soils (common in areas that have been glaciated). Frost heaving is caused by the expansion of soil volume due to the formation of ice within pore spaces, and also by drawing water to the freezing front of ice lenses. If a frozen soil is subjected to warming, and the contained ground ice melts, the liquid water content in the soil increases. If the water is prevented from draining due to the presence of underlying permafrost or other confining layers, the soil may become saturated and its mechanical strength is reduced. This weakening can be significant in soils composed of loose sand or non-plastic silt when subjected to cyclic stress induced by seismic vibrations. Thermokarst features are formed by the melting of ice within a given soil leaving local voids and potentially causing the ground surface to subside. Subsidence is most pronounced in ice-rich soils, especially those with large bodies of ground ice. Generally, frost heave, subsidence, thermokarst features, and solifluction are more likely to occur in silt and clay-rich soils. Areas of coarse-grained sediment and bedrock exhibit these features less frequently.



Source: USGS, Ferrians 1998

FIGURE 5.1-3 Alaska Stand Alone Gas Pipeline Permafrost Extent

Seismicity

The northern portion of the Project area, from the Beaufort Coastal Plain to the Brooks Range, experiences regionally low seismicity (Plafker et al. 1994). The Beaufort Coastal Plain, Brooks Foothills, and Brooks Range ecoregions comprise the Arctic Tundra which has experienced 3 earthquakes in the last 50 years that were greater than magnitude 5, within 50 miles of the Project area (AEIC 2011). South of the Yukon River, the proposed Project would cross two seismic zones that trend northeast in the Ray Mountains: the Minto Flats and Fairbanks seismic zones. The Intermontane region includes the Kobuk Ridges and Valleys, Ray Mountains, Yukon-Tanana Uplands, and the Tanana-Kuskokwim Lowlands ecoregions and has experienced 23 earthquakes in the last 50 years that were greater than magnitude 5, within 50 miles of the Project area (AEIC 2011). The Alaska Range Transition, with 88 earthquakes greater than magnitude 5, within 50 miles of the Project area, has seen the most seismic activity, and includes the Alaska Range and Cook Inlet Basin ecoregions since 1960 (AEIC 2011, Figure 5.1-2).

The largest fault in the Project area is the Denali Fault. The Denali Fault is several hundred miles long, with movement recorded in several locations along its length (APSC 2007, Plafker et al. 1994). Two large earthquakes, magnitude 7.2 and 7.9, occurred on the Denali Fault in 1912 and 2002, respectively. North of the Denali fault, on the north side of the central Alaska Range, there is an active, northward-vergent fold and thrust belt called the Northern foothills fold and thrust belt. This fold and thrust belt has been active through the last 3 million years, and extends from the area near Denali to east of the Richardson Highway (Freymueller et al. 2008, Bemis 2010, Figure 5.1-3). Two smaller active faults, the Healy Creek fault in the north-central Alaska Range foothills, and larger Castle Mountain Fault in the Cook Inlet Basin ecoregion, are also located near the Project area. The Healy Creek fault is a major, steeply north dipping reverse fault that is defined on the east side by the Nenana River. On the high terrace immediately east of the Nenana River this fault forms a prominent scarp more than 6 miles long. However, it is not clear that the fault continues across the Nenana River (Bemis 2010). The Castle Mountain fault is the only known active fault in the greater Anchorage area with an identified surface rupture. The fault lies along the southern margin of the Talkeetna Mountains (Freymueller et al. 2008, Figure 5.1-3). The eastern section is about 62 miles long and is seismically active; the western part is about 39 miles long and is seismically quiet. The most recent earthquake along the eastern portion of the fault was about 650 years ago, which suggests the possibility a significant earthquake (~M6) may be expected in the near future (Freymueller et al. 2008). Southern Alaska, particularly south of the Chugach Mountains, has experienced considerable seismic activity in recent history. However, most earthquakes occur along the Alaska-Aleutian megathrust, which has produced four major earthquakes in recent history: magnitude 8.6 in 1964 (Cohen 1995), magnitude 7.5 in 1979, magnitude 7.8 in 1988, and magnitude 7.9 in 1987 (AEIC 2011). Surface fault rupture is another potential geologic hazard. Surface fault rupture is defined as the dislocation of the surface of the earth related to motion along the fault at depth. Ground cracking related to surface fault rupture can occur along the fault and away from the fault (DGGS 2011).

Glacial Processes

Rocks and sediments are added to glaciers through various processes. Glaciers erode the terrain principally through two methods: abrasion and plucking. As the glacier flows over the bedrock's fractured surface, it softens and lifts blocks of rock that are brought into the ice. This process is known as plucking, and it is produced when subglacial water penetrates the fractures and the subsequent freezing expansion separates them from the bedrock. When the ice expands, it acts as a lever that loosens the rock by lifting it. This way, sediments of all sizes become part of the glacier's load. The rocks frozen into the bottom of the ice then act like grit in sandpaper, which results in landforms such as U-shaped valleys, cirques and moraines, and rivers with high sediment content (NSIDC 2011).

Fluvial Processes

Fluvial processes comprise the motion of sediment and erosion or deposition on a river bed. In addition to the effects of normal mechanical erosion, which includes both bank erosion and stream bottom erosion, running water also has the ability to thaw permafrost. The thawing of permafrost is evidenced by the existence of taliks, or unfrozen zones, beneath the channels of all rivers that do not freeze to their bottoms during winter. Where large river channels are incised within ice-rich and/or relatively unconsolidated sediments, lateral erosion can form thermo-erosional niches, often greater than 30 feet deep. This process can cause bank collapse, which often occurs in large blocks along ice wedges. This process occurs widely along the banks of the Yukon River (French 2007).

5.1.1.3 Paleontological Resources

Paleontological resources are defined as any physical evidence of past life, including fossilized remains, impressions, and traces of plants and animals. Fossils occur throughout Alaska and range from single-celled organisms to large vertebrates, including Mesozoic dinosaurs, marine reptiles, and Pleistocene megafauna. Paleontological evidence in Alaska varies, and with respect to the Project area, can be characterized broadly. Fossilized plants of marine and terrestrial origin, as well as invertebrate and vertebrate animal specimens, have been found in the area of the proposed Project.

The North Slope is particularly rich in paleontological remains. The oldest fossil recovered from the North Slope, a tooth plate from a vertebrate fish found in Middle Devonian strata, was dated at 380 million years ago (Lindsey 1986). Post-Devonian sedimentation on the North Slope has, in some cases, accumulated up to 20,000 feet of fossil-bearing strata. Marine invertebrate fossils include: bryozoans, brachiopods, pelecypods, gastropods, ostracods, cephalopods, crinoids, trilobites, belemnites, ammonites, and corals. By the Middle Jurassic, and continuing up through the Cretaceous (about 160 to 65 million years ago), trees and terrestrial plants appear throughout North Slope fossil assemblages, recording transgressions and regressions of ancient seas. Twelve types of dinosaurs from the Late Cretaceous have been found – primarily along the banks of the Colville River (BLM 2001b). Fewer invertebrate fossils occur in Tertiary beds along the Beaufort Coastal Plain. No fossils are known from rocks of Oligocene or Miocene age.

Marine and terrestrial mammal fossils (such as otter, seal, whale, mammoth, moose, caribou, musk ox, bison, antelope, camel, horse, and steppe lion) and birds have been found in Quaternary glacial deposits along the Colville River. Fossils of Pleistocene voles and megafauna, such as mammoth, mastodon, antelope, musk ox, elk, moose, and saber-toothed cats, , have been found in frozen silts and peat bogs along the South Fork Koyukuk, Yukon, and Tanana rivers in the Ray Mountains. Invertebrate fossils (pelecypods, gastropods, and insects) also occur in a variety of Quaternary deposits (Péwé 1975).

Paleontological resources along the Sagvanirktok River, approximately 7-10 miles away from the Project area, consist of small fossils of invertebrates, shells, and corals found in the metamorphosed rocks of the Brooks Range. The value of these fossils is largely scientific. They have been examined and collected by scientists, particularly by members of the U.S. Geological Survey, over the past 30 years. They provide information useful in dating rocks and establishing the geological sequence related to life forms (Reifenstuhl 1991).

5.1.2 Environmental Consequences

5.1.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed and there would therefore be no effects to soils or geology.

5.1.2.2 Proposed Action

Anticipated impacts to soils and geology as a result of the proposed Project are considered to apply to pipeline segments and alternatives and above ground facilities. General impacts from construction and operation are identified, followed by impacts specific to regional geology and topography, permafrost and soils, material resources, and paleontological resources.

Construction

Open Cut would be the most common method utilized for construction of the pipeline, and is accomplished by excavating a trench and placing the pipe into position. Excavation is classed as stripping, ditching, or trenching of rock or borrows. At the compressor station sites, access roads, and borrow areas, stripping excavation would be used which consists of the excavation, removal, and disposal of all surface organic material, silt, and unsuitable overburden necessary to expose suitable foundation conditions. In situations where topsoil removal is required, it would be segregated and saved when practical to enhance surface rehabilitation and aid in future revegetation of the area.

Within the ROW, trench excavation would utilize conventional excavation equipment, such as mechanical ditchers, draglines, dredgers, clams, or backhoes for the entire length of the project except the first 6 miles. Steeper terrain would require a greater amount of either cut or fill during construction than in flatter terrain, and would therefore have a greater impact on the topography because the excavated slope areas could more easily erode. Normally, the steeper the terrain is, the greater the impact. In these areas, the ROW would be expanded from 100 feet to 230 feet wide to allow for excavation into the side slopes of the surrounding area (Table 5.1-3).

Any action that involves ground disturbance could create a potential for impacts to paleontological resources existing in the proposed Project area. Pleistocene fossils discovered along the TAPS ROW necessitated their removal at the time of discovery, and similar discoveries along the proposed Project ROW are reasonably likely. Given the variability of the scientific importance of these resources, the potential for adverse impacts exists which the AGDC would mitigate, if these resources are discovered as part of the Project.

Short term localized drainage pattern alterations (e.g., diversions) could occur during construction to accommodate pipeline installation and equipment staging. The AGDC proposes to identify measures that would mitigate long-term impacts to local drainage patterns during engineering design.

Some areas could require drilling and blasting that would be controlled and monitored. Blasting could be required to fracture high-density frozen soils or bedrock during trench excavation. Safety-controlled blasting techniques would be used in all situations where blasting is required within proximity to inhabited areas or existing facilities. A Blasting Control Plan would be developed to mitigate health, safety, environmental impacts, and notify residents that may live in the vicinity when blasting activities will occur.

Temporary ice roads and ice pads would be constructed to stage and transport materials and equipment for the proposed Project area which would allow the work to be less disruptive to the project area. Although thaw settlement could result if the ice road compaction of vegetation appreciably decreases the insulating capacity of the active layer (Felix et al. 1992), investigations addressing ice road impacts show impacts are confined to the vegetative layer, thereby limiting impacts to soils containing permafrost (Walker et al. 1987b).

Wintertime construction offers the ability to reduce the work pad thickness or to eliminate gravel pads altogether. Access roads to the pipeline are planned and construction methods to appropriately mitigate these conditions would be defined during detailed engineering. The construction of gravel pads and roads on permafrost requires a thickness of fill equal to or greater than the depth of the summer thaw. The addition of fill effectively increases the insulating capacity of the active layer and prevents destructive thaw settlement (NRC 2003, Klinger et al. 1983).

Sands, gravels, rip rap, and other materials would be required at various locations for infrastructure, pad construction, and production and ancillary facilities along the proposed Project ROW. Local impacts due to the removal of geological material would occur. The AGDC has estimated that approximately 13.1 million cubic yards of material may be required for total Project construction. Of this, approximately 6.18 million cubic yards may be required for side slope cuts and fills – 90 percent (71 aggregate miles) of which will be used in small segmentsbetween MP 142 and MP 429 of the proposed project. Sand and gravel sites along the proposed Project ROW would provide needed borrow material. Geotechnical data regarding material availability is in development; however, a total of 546 existing material sites along the main alignment have been identified using existing ADOT&PF material site information sources. Table 5.1-4 displays material availability along major sections of the route.

TABLE 5.1-4 Material Need and Availability

Location	Length (Miles)	Material Needs (CY)	Available Material (CY)	Number of Material Sites
GCF to Chandalar Shelf	185	2,501,000	31,400,000	49
Chandalar Shelf to Yukon River	177	5,375,000	42,350,000	76
Yukon River to Healy	177	3,410,000	39,923,000	164
Healy to South Terminus	208	1,793,000	80,450,000	257
Mainline Total:	737	13,079,000	194,123,000	546

Source: AGDC Plan of Development Rev. 1 March 2011 Table 7.4-3. Michael Baker Jr., Inc. January 2011.

Impacts associated with obtaining material from these resources would be modifications of local topography, loss of surface vegetation, creation of landscape scars, and a temporary increase of soil erosion and siltation near the operation material sites (OMS). In some OMS, thawing of permafrost could produce ponding. Prior to OMS development, Material Site Mining Plans and Reclamation Plans would be developed to reduce impacts associated with material extraction.

The proposed Project route would cross two seismic zones and five fault lines. Seismic activity can trigger mass wasting processes such as landslides and soil instabilities such as liquefaction. The currently-proposed pipeline is designed to resist seismic activity, but is not capable of withstanding landslide. The proposed Project would be routed so that previous landslide areas are avoided to the extent practicable. Potential landslide areas that cannot be avoided by route selection will be stabilized prior to pipeline construction, and pipeline segments crossing potential liquefaction areas will be ballasted for neutral buoyancy to mitigate these hazards.

Operations

The proposed Project may affect adjacent permafrost by heat transfer. In concept, the pipeline would be operated at below freezing temperatures in predominantly permafrost terrains, and above freezing temperatures in predominantly thawed-ground settings. The operating temperature of the buried pipeline could affect the frozen/thawed nature of the surrounding subsurface which, in turn, could affect the pipeline trench support conditions as well as potentially cause surface expression such as local subsidence or heave. If the pipeline has a higher temperature than the surrounding subsurface environment, it could create thaw bulbs along the proposed ROW. Frost heave and frost bulbs should be mitigated to avoid creating an unstable ground surface that could be prone to impacts such as erosion.

Conversely, permafrost aggradation could occur in areas where the pipeline is operated at below-freezing temperatures. This might occur in the discontinuous permafrost zone wherever the pipeline (operated at or below freezing temperatures) crosses unfrozen ground; there would be moisture migration towards the pipeline and resulting frost heave when the moisture freezes. Even in areas where permafrost is absent, ground ice could grow, producing frost heave in some areas, especially in areas where thawed, fine-grained soils are dominant in the subsurface. Where the pipeline traverses from unfrozen, stable ground to ice-rich, unstable ground, or visa-versa, thaw settlement could occur (French 2007). The AGDC proposes to identify site specific measures to mitigate impacts to permafrost and soils during engineering design with optimization primarily accomplished by constructing facilities in the winter while the ground remains frozen.

During operations, maintenance activities would involve maintaining vegetation along the permanent ROW to a low height to allow for aerial patrol safety inspections. In addition, areas that were unsuccessfully revegetated would be reseeded with native plant species. No further impacts to geology and soils are anticipated from these maintenance activities.

Yukon River Crossing Variations

The Project proposes to cross the Yukon River in one of three ways, via a suspension bridge to be constructed (Option 1), via the existing highway bridge (Option 2), or via horizontal directional drilling (HDD) method (Option 3). Impacts to soil and geological resources from Option 1 would be negligible since there would be no ground disturbance. For Option 2, footings and abutments for a new bridge would be constructed and would require strict adherence to erosion and sediment control measures. The impacts to soils and geology would be from the excavation needed to place the foundations of the bridge. However, no permanent structures, such as footings, would be installed within the Yukon River which would prevent impacts to soil and geological resources within the river such as increased sedimentation and accretion. The feasibility of a HDD crossing is unknown at this time due to the limited soil information. If soils are similar to those found during the geotechnical exploration located 0.6 miles upstream of the existing bridge, the HDD crossing may not be feasible due to the presence of gravel and fractured bedrock. Further study is required to investigate and evaluate the in-situ soils, analyze scour limitations, and address seismic concerns. Nevertheless, gravel pads placed on both sides of the river would require strict adherence to sedimentation and erosion control. A discussion of the potential impacts of using the HDD crossing method on waterbodies and wetlands is provided in Sections 5.2 Water Resources and 5.4 Wetland Resources.

Denali National Park Route Variation

The proposed route involves steep slopes and potential visual impacts when viewed from Denali NPP lands, visual impacts are discussed further in Section 5.11 Visual. The ROW would be expanded in this area from MP 540 to 541 as the steep terrain would require side hill excavations to place the pipeline. As described in other areas where the ROW would be expanded, both environmental conditions and construction methods would require detailed design to mitigate the physical challenges of working along these slopes and ravines.

The proposed Denali National Park Route Variation would follow the Parks Highway corridor through Denali National Park and Preserve primarily from MP 540 to MP 555. The route would typically be placed within the road ditch near the toe of the road slope on the canyon side (east ditch) of the road. However, in a few areas where the canyon walls encroach on the road, the pipeline would be installed beneath or near the road, possibly under the road shoulder. Localized erosion control methods would be required to control erosion along roadside ditches and retaining walls may need to be constructed along portions of the roadway. Work along the route variation would require the disposal of a significant volume of asphalt which would be disposed of in compliance with ADEC regulations.

South of the Canyon commercial area, the pipeline would cross the Nenana River on the pedestrian/bicycle bridge and enter the Denali NPP. During construction asphalt removal only one lane of the traveled roadway would be utilized.

Since the slopes are steep, more localized erosion control methods would be required to control erosion along roadside ditches. The river crossings would not require excavations as the pipeline would be connected to existing bridges.

5.1.3 Mitigation

The proposed pipeline and associated facilities would be designed in accordance with engineering criteria related to permafrost, seismic events, and other geological hazards to comply with applicable design codes.

5.1.3.1 Construction

The proposed Project would be constructed in a 2-year period. Approximately three-quarters of the pipeline would be constructed over two winter construction seasons, since winter construction would limit the impacts of construction activities on the surrounding environment. For example, the use of ice roads would prevent soil erosion and compaction of the ground surface. Winter construction offers the ability to reduce workpad thickness or to eliminate gravel workpads altogether.

In areas where clearing would be necessary, crews would remove brush, timber, and stumps from the construction ROW. Machine clearing would be used in all areas except sensitive slopes to reduce the impacts of erosion. When stripping of topsoil would be required, the topsoil would be segregated and saved when practical to enhance surface rehabilitation. Topsoil stockpiles would have slopes no steeper than 2H:1V to keep localized erosion from impacting the stock piles.

Ditch plugs would be used wherever slope and soil conditions indicate the probability of excessive erosion along the ditch line to aid in keeping water from quickly migrating along the pipeline and causing erosion. Coarse-grained material would be required around and under the pipe to protect the pipeline whenever the ditch passes through material that could damage the pipe coating, to mitigate buoyancy problems (outside of floodplain areas), and to protect against excessive loss of pipe cover due to erosion. In areas where these potential problems do not exist, ditch spoil would be placed into direct contact with the pipe. After placement of weights or plugs (where required), backfill crews would fill the trench with either ditch spoil or imported backfill materials to about one foot over the top of the pipe. The remaining ditch spoil material would be used to complete ditch backfill and crowned over the ditch and left in place. In sensitive stream areas, excess ditch backfill may be removed to designated spoil disposal areas.

In areas of steep and rugged terrain, side hill cuts may be required to allow for construction activities and to decrease the threats of avalanche and landslides while controlling drainage. The two types of side hill cuts that may be used for construction of the proposed Project are shown in Figures 5.1.4 and 5.1.5. Slope Breakers and ditch diversions would be placed where drainage needs to be controlled as shown in Figure 5.1.-6.

Trenchless crossing methods such as HDD may be used in lieu of open cut trenches to avoid direct impacts to sensitive resources such as rivers or wetlands. The use of HDD would result in little or no impact to those areas being crossed. In areas where bore holes are used, the bore hole pits would utilize trench boxes, sheet piling or other shoring methods to reduce the size of required excavations. Bore pit spoils would be compacted on backfilling to minimize settlement.

Numerous river basins are traversed by the proposed Project, and short-term localized drainage pattern alterations (e.g., diversions) may occur during construction to accommodate pipeline installation and equipment staging. The AGDC proposes to identify measures that would mitigate long-term impacts to local drainage patterns during engineering design.

In areas where blasting would be required, a Blasting Control Plan would be prepared. The Blasting Control Plan would be implemented and utilized in all blasting locations, and would adhere to applicable regulatory standards in addressing the following issues:

- Blast hole loading and placement of explosives;
- Timing delays, wiring, and use of detonation systems;
- Training and licensing of personnel performing and supervising blasting activities;
- Technical support, quality control, and compliance supervision;
- Blasting in environmentally-sensitive habitats and during sensitive life stages of wildlife (e.g., Dall sheep lambing, bear denning, raptor nesting); and
- Blasting near existing infrastructure.

Material Site Mining

Prior to site development, during detailed construction and permitting efforts, Material Site Mining Plans and Reclamation Plans would be developed specific to each material site and submitted for agency approval. These plans would include information such as habitat types, access locations, temporary stockpile areas, excavation limits and depths, archaeological and environmental information, and site restoration planning. Reclamation Plans specific to each material site would detail the actions necessary to return the site to a stable condition and would be developed and submitted for agency approval. At this time, material sites are not under consideration as waste disposal sites.

Access roads have a planned ROW of 50 feet including ditches to minimize the footprint of this construction. Geotextile grids/fabrics would be used in lieu of excavation and subgrade compaction for areas with deep organic soils, and weak and/or thaw unstable permafrost soils. The roadside slopes would be 2H:1V or shallower to prevent erosion. Consideration for stabilizing disturbed areas particularly in the steep terrain would be provided to prevent erosion.

Erosion Control Plans and the Stormwater Pollution Prevention Plan (SWPPP) would incorporate Best Management Practices in the use of silt fences, bale checks, swales, root waddles, trench and ditch reinforcement with geotextile fabric or rock, gabions and sedimentation traps.

5.1.3.2 Permafrost and Soil Considerations

Winter construction activities are planned as a method to decrease the impact on frozen soils in the warmer months. Temporary ice roads and ice pads would be constructed to stage, construct and transport the work force, equipment and materials along the proposed route. The depth of frozen soil would be closely inspected to prevent a breakthough below the vegetation. Although thaw settlement could result if the ice road compaction of vegetation appreciably decreases the insulating capacity of the active layer (Felix et al. 1992), investigations addressing ice road impacts show that the impacts are confined to the vegetative layer (Walker et al. 1987b).

Winter tundra travel would occur during construction in order to pre-pack ice roads. Normally, winter tundra travel permits allow for the operation of low-pressure (less than 4 psi) vehicles only and require a 12 inch depth of frost and 6 inches of snow cover. When low-pressure vehicles are used, winter travel does not appear to adversely affect soil or permafrost.

Vertical support members (VSMs) are proposed to carry the pipeline from MP 0 to MP 6 of the Project. The installation of VSMs involve ground disturbance and therefore have similar impacts on soil and permafrost as when the pipeline is trenched along ice roads. Placement of VSMs would likely utilize drilling and slurry backfill techniques. Borings of approximately 20 to 35 feet with an anticipated spacing of 20 feet apart would be drilled directly from the ice road for the installation of the VSMs. Heaving of VSMs due to active layer freeze and ice lens formation has been a reoccurring problem in the northern regions. The integrity of VSMs is affected when heave results in failure of the permafrost soil to adfreeze to the soil (Nottingham and Christopherson 1983).

Prevention of erosion would be critical to maintain an on-schedule construction program and to reduce impacts to the environment. An Erosion Control Plan would be developed before the start of construction and would specifically define erosion control procedures for each area along the ROW. In addition, a SWPPP would be developed as required by the NPDES permit. The SWPPP would address erosion control measures, BMPs, and mitigation measures to control erosion and stormwater runoff. Continued ground surveillance and corrective erosion control and vegetation maintenance would be employed throughout the construction phase of the Project and normal drainage patterns would be maintained where practical.

As designed, the pipeline would operate at below freezing temperatures in predominately permafrost terrains to protect the thermal stability of the surrounding ground. Similarly, the pipeline would operate at above freezing temperatures in predominately thawed settings so as to not create frost bulbs around the pipe that could lead to frost heave displacement of the pipeline or adverse hydraulic impacts on drainages crossed by the pipeline. Pipeline design would use engineering controls such as insulation and strategic use of non-frost-susceptible fill to control the thermal signature of the pipeline in discontinuous permafrost.

In areas bermed because of pipe installation, a 6-inch minimum of bedding thickness would be required when working in areas of frost suseptable soils. Pipe insulation would be utilized to prevent unacceptable heave or maintain frozen soils based on geothermal analysis.

5.1.3.3 Seismic Zones and Fault Considerations

The following design approaches are currently being considered for areas of high seismic activity and/or fault zones:

- Placing the pipeline on aboveground sliding supports;
- Placing the pipeline in an aboveground berm constructed of low-strength soil; and
- Placing the pipeline in an oversized ditch surrounded by low-strength crushable material or loose granular fill.

5.1.3.4 Paleontology

Alaska's Historic Preservation Act 41.35 protects paleontological resources that may be encountered along the ROW. If any known or previously undiscovered paleontological resources are encountered during construction or operation related activities, the Alaska State Historic Preservation Officer and an archeologist would be contacted to determine appropriate methods for planning.

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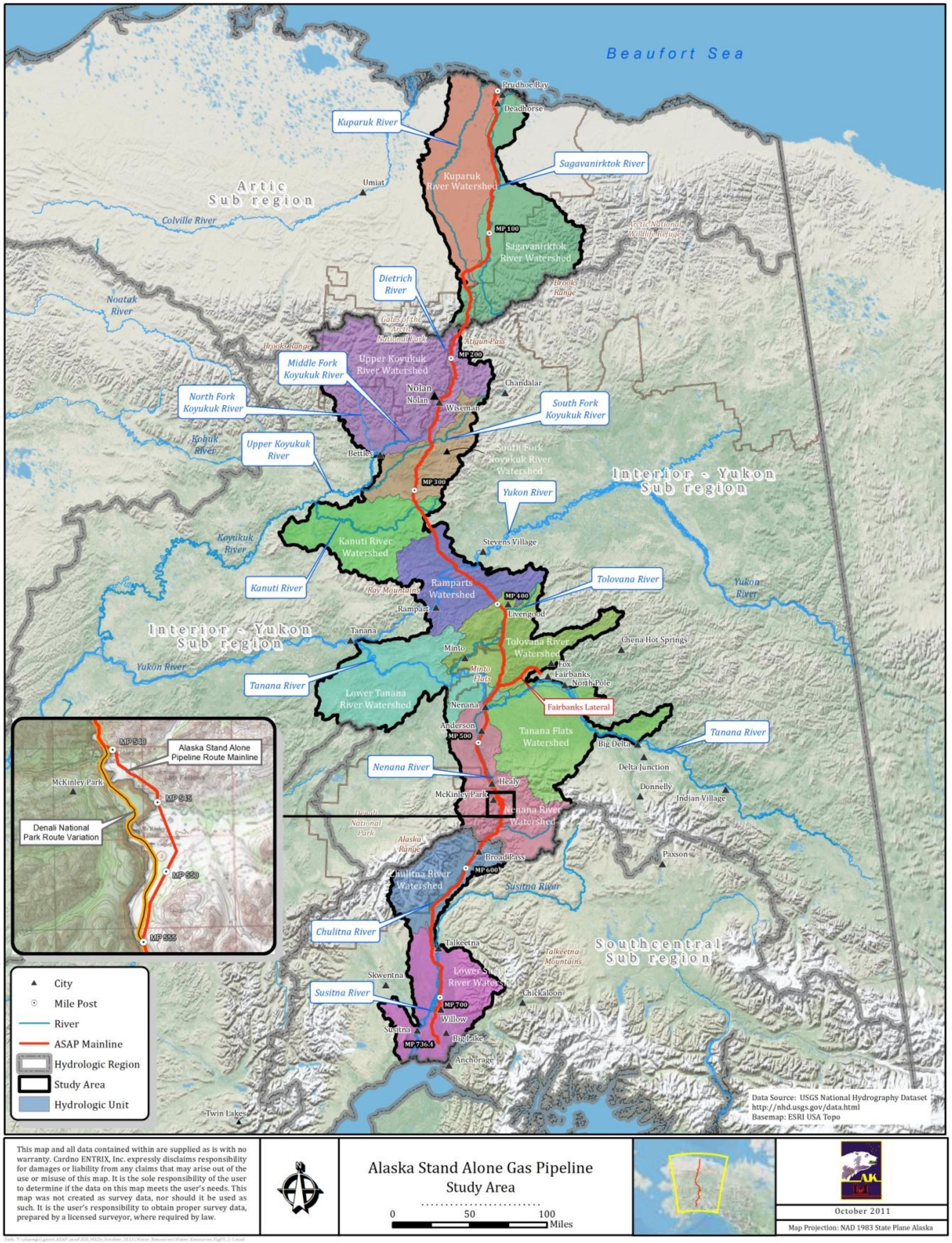
5.2 WATER RESOURCES

This section discusses water resources which include surface water, ground water and floodplains within the proposed Project construction and operational footprint. *The affected environment, environmental consequences of the proposed* Project*, and mitigation measures are discussed in detail below.*

5.2.1 Affected Environment

For the water resources, the Project area includes the group of watersheds that are crossed by the proposed activity and the alternatives. The total drainage area of all the watersheds in the Project area is 47,983.26 sq. miles. The United States Geological Survey (USGS) defines water resources by region (Alaska), subregion (Arctic, Interior-Yukon, and Southcentral), accounting unit, and cataloging unit (or watershed) (USGS 1987). This section describes the water resources by subregion and summarizes the State and Federal rules and regulations for water use. The hydrologic subregions and watersheds in the Project area are shown in Figure 5.2-1.



Source: USGS 2011a.

FIGURE 5.2-1 Hydrological Unit Subregions and Watersheds along the proposed ASAP Project ROW Area

5.2.1.1 Surface Water

Surface water is defined as water that is on the Earth's surface, such as in a stream, river, lake, estuaries or reservoir (USGS 2011b). The Project area includes numerous rivers, lakes, streams, and wetlands. There are no estuaries in the Project area, and wetland resources will be discussed in detail in Section 5.4 (Wetlands).

Types of Surface Water Bodies

Based on a review of USGS maps, there is an abundance of streams, rivers, lakes and ponds in the Project area. Rivers and streams can be complex (braided streams, split channels, or alluvial fans) or single channels (USGS 2010a, BLM 2002).

- Braided stream: A stream characterized by an interlacing or tangled network of several small branching and reuniting shallow channels.
- Split channels: Rivers with more than one main channel.
- Alluvial fans: Refers to fan-shaped sediments of gravel, sand, silt, clay, or other particulate rock material deposited by flowing water, usually in the beds of rivers and streams, on a floodplain, on a delta, or at the base of a mountain.
- Single channels with floodplains: Rivers or streams that exhibit one primary channel.

Surface Water Availability

The USGS National Hydrography Dataset (NHD) is a digital vector dataset used in GIS which includes data on lakes, ponds, streams, rivers, dams and stream gages. Specific data includes flow networks, discharge rates and water quality. The rivers and streams that the Project proposes to cross are shown in Appendix E. The location (latitude/longitude and nearest pipeline milepost), surface area, and type for all lakes and ponds within 1 mile of the Project right of way (ROW) is provided in Appendix F. There also may be data from studies that cover just a specific portion of the Project area. If available, this data is included under the respective hydrologic subregion. The USGS NHD does not provide water depth information.

There may be some data on depth from the Alaska Department of Natural Resources (DNR), Division of Mining, Land and Water on waterbodies for which DNR has issued a Temporary Water Use Authorization (TWUA), but this is not available on-line. There also may be data from studies that cover just a specific portion of the Project area. If available, this data is included under the respective hydrologic subregion.

Surface Water Use

Surface water use is dependent on the surrounding population and activities occurring in that area. The USGS compiles data on water use in the United States at the county (borough or census area) level (USGS 2010b). Table 5.2-1 illustrates the 2005 (most recent) surface water withdrawal data for the boroughs and census areas along the proposed Project ROW, in million gallons per day (Mgal/d). Boroughs and census areas are shown in the FEMA Floodplain Maps provided in Appendix G.

TABLE 5.2-1 2005 Estimated Fresh Surface Water Withdrawals, by Borough or Census Area (Mgal/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power	Total
North Slope	0.36	0.01	unk	0.02	unk	unk	0.65	unk	1.02
Yukon-Koyokuk	0.04	unk	unk	unk	unk	unk	0.41	unk	0.45
Fairbanks North Star Borough	unk	unk	unk	unk	0.02	1.15	10.16	15.80	27.13
Denali	unk	unk	unk	unk	unk	unk	unk	15.00	15.00
Matanuska-Susitna	unk	unk	unk	0.02	0.05	unk	0.86	unk	0.93

unk = unknown value
Source: USGS 2010b.

Descriptions of the types of water uses in Table 5.2-1 are provided below (USGS 2009).

- Public-supply water is water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic (not self-supplied), commercial, industrial (not self-supplied), thermoelectric-power, and public water use.
- Domestic self supplied water use is water used for indoor household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets and outdoor purposes such as watering lawns and gardens. (Self-supplied water use is water withdrawn from a ground-water or surface-water supply source by a user rather than being obtained from a public supply.)
- Industrial self supplied water is water used for fabrication, processing, washing, and cooling.
- Irrigation water is water that is applied by an irrigation system to assist crop and pasture growth, or to maintain vegetation on recreational lands such as parks and golf courses.
- Livestock water is water used for livestock watering, feedlots, dairy operations, and other on-farm needs.
- Aquaculture water is water use associated with the farming of organisms that live in water (such as finfish and shellfish) and off stream water use associated with fish hatcheries.

- Mining water is water used for the extraction of naturally occurring minerals including solids (such as coal, sand, gravel, and other ores), liquids (such as crude petroleum), and gases (such as natural gas).
- Thermoelectric-power water is water used in the process of generating electricity with steam-driven turbine generators. (Refers only to self-supplied thermoelectric-power withdrawals, otherwise included in “public-supply water use” category.)

Surface Water Quality

Surface water quality data are sparse in Alaska. Some sources of surface water quality data are the EPA’s Significant Non-Complier (SNC) list, the USGS, and Alaska Department of Environmental Conservation (ADEC) Division of Water. There also may be data from studies that cover a specific location within the Project area. If available, this data is included under the respective hydrologic subregion.

There are relatively few USGS stream gage sampling sites in Alaska, and the data that is available is often out of date and usually does not cover many water quality parameters. Two or three representative stream gages were identified within each watershed (or Hydrologic Unit Code [HUC]) within or as close as possible to the Project area (USGS 2010d). For the Project area along the existing TAPS ROW, data collected prior to 1977 was generally not considered representative because it pre-dates the TAPS Project development. Otherwise, data was considered to be representative if collected after 1970. Data sites were initially selected based on:

- Collection date (post-1977 or post-1970 as described above);
- Proximity to the Project area (preferably no further than ten miles from Project area);
- Proximity to each other (preferably no further than about 50 miles apart along the Project alignment); and
- Parameters monitored (preferably with data for at least two of the selected parameters, like temperature and color).

If sites could not be found that met all of the criteria listed above, then the gaps were filled in with the next best data found. For instance, if there were no sampling sites within about 50 miles of each other with post-1977 data in an area near the TAPS, then sites with older data were listed. Finally, if two sites that meet all criteria were closer than ten miles apart, the one with the most recent data was selected. A discussion on the representative data for a given watershed is presented in each section.

The surface water and ground water monitoring sites maps presented in Appendix G illustrate locations of the selected USGS surface water quality sampling sites. The ADEC Division of Water does not have a centralized database of surface water quality; however, they do list impaired waterbodies in “Alaska’s Final 2010 Integrated Water Quality Monitoring and

Assessment Report" (ADEC 2010). These are discussed in the following sections under the respective hydrologic subregion.

The ADEC Drinking Water Program requires Public Water Systems (PWS's) (both surface water and groundwater) in the state of Alaska to comply with drinking water regulations in 18 AAC 80 in accordance with the Federal Safe Drinking Water Act (ADEC 2011a). The types of contaminants that are regulated are:

- Bacteria, Viruses (from septic systems, etc.) and parasitic protozoans;
- Lead and Copper;
- Nitrate and Nitrite (commonly from septic systems and manure piles);
- Heavy Metals like Arsenic and Cadmium;
- Volatile Organic Contaminants (VOC) like benzene and gasoline;
- Synthetic Organic Contaminants (SOC) like pesticides and herbicides; and
- Other Organic Compounds (OOC) like Dioxin and polychlorinated biphenyls (PCBs).

The ADEC is not responsible for overseeing private water systems A PWS can be assumed to be generally in compliance with existing standards, unless they are on the EPA's SNC list. A SNC is a system whose serious, frequent, or persistent non-compliance of drinking water regulations has met the SNC criteria as defined by the EPA for a specific rule. Basically, the EPA assigns Public Water Systems (PWSs) a point total based on violations they've received over the past 5 years (unless they have returned to compliance). The EPA assigns a higher weight to violations of a health-based standard. The EPA also adds in the number of years the PWS has been out of compliance to determine the total score. PWSs with a score of 11 or higher are considered a national enforcement priority and included on the SNC list which is published quarterly. The EPA's SNC list as of July 2011 has no PWSs near the Project area that have surface water as a primary source (ADEC 2011b). Sections 5.2.1.5 (Arctic), 5.2.1.6 (Interior-Yukon), and 5.2.1.7 (Southcentral) describes surface water for each hydrologic subregion in the study area.

5.2.1.2 Groundwater

Groundwater is the water that flows or seeps downward and saturates soil or rock, supplying springs and wells (USGS 2011b). Groundwater replenishes streams, rivers, and wetland habitats with fresh water from an aquifer. An aquifer is a geological formation or structure that stores and/or transmits water, such as to wells and springs (USGS 2011b). There are different types of aquifers, characterized based on aquifer composition. Groundwater is protected under ADEC regulation from reported contaminated sites, and thus will be discussed in detail below. Contaminated sites are also pertinent to the affected environment description for soils and geology (Section 5.1 Soils and Geology).

Groundwater Availability

Groundwater is readily available throughout most of Alaska, except in areas of thick permafrost. Most of Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams. The aquifers that produce groundwater are usually unconfined (i.e., not covered by a layer of silt or clay). In permafrost free areas, the groundwater table generally follows surface topography. The depth to groundwater varies from a few feet to over 400 feet across Alaska (ADEC 2008a).

One source of groundwater data is the DNR's Well Log Track System (WELTS) (ADNR 2011). The WELTS provides information on private wells by meridian, township, range, and section. The information includes owner, date of completion, depth, well status, date of entry, and sometimes remarks. The remarks sometimes provide the well yield and depth to groundwater. The WELTS information found within the Project area is discussed under the appropriate hydrologic subregion below.

Groundwater Use

Groundwater use is dependent on the surrounding population and activities in the area similar to surface water uses. As of 2008, groundwater was a source of drinking water for about 50 percent of Alaska's population, and 90 percent of the state's rural residents. Groundwater is a source for 83 percent of Alaska's 1,602 public drinking water systems (ADEC 2008a). In general, groundwater in Alaska is suitable for domestic, agriculture, aquaculture, commercial, and industrial uses with moderate or minimal treatment (ADEC 2010). The USGS provides information on groundwater withdrawals in "Estimated Use of Water in the United States in 2005" (USGS 2010b). Table 5.2-2 illustrates the 2005 USGS data on groundwater withdrawals for the boroughs and census areas in the Project area. The definitions of water use categories are listed previously under surface water.

TABLE 5.2-2 2005 Estimated Fresh Ground Water Withdrawals, by Borough or Census Area (Mgal/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power
North Slope	0.01	unk	0.03	unk	unk	unk	unk	0.04
Yukon-Koyokuk	0.18	0.02	0.01	unk	unk	unk	unk	0.21
Fairbanks North Star Borough	7.10	2.47	unk	0.16	0.02	0.38	1.00	11.13
Denali	0.01	0.11	0.05	0.05	unk	unk	1.00	1.22
Matanuska-Susitna	1.32	3.88	0.16	0.34	0.03	unk	unk	5.73

unk = unknown value
Source: USGS 2010b.

Groundwater Quality

Groundwater quality data is sparse in Alaska. Possible sources of data are the ADNR's WELTS, the ADEC's Drinking Water Watch Program, the EPA's SNC list, and the USGS. The WELTS database does not have water quality data from wells located within the Project area (ADNR 2011). The EPA's SNC list as of July 2011 includes a total of two PWSs near the Project area that has groundwater as a primary source (ADEC 2011b). This information is discussed under the respective hydrologic subregion in the following sections.

The same general criteria described above under surface water was used for representative USGS groundwater quality sites (Appendix G). Sections 5.2.1.5, 5.2.1.6, and 5.2.1.7 describe groundwater (including quantity, use, and quality) for each hydrologic subregion in the Project area. Additional concerns regarding groundwater quality are arsenic, contaminated sites, and groundwater recharge areas (STB 2011).

Arsenic

Arsenic has been documented to occur in groundwater in some areas of the Project footprint. In January 2009, the EPA listed eight water systems in Alaska that were out of compliance with the federal arsenic standard. Most were located in the Matanuska-Susitna Valley. One was located at Willow Elementary, one at the Willow Area Community Center, and one at the Talkeetna Water and Sewer System (White 2009).

Contaminated Sites

As of April 2010, the ADEC listed a total of 33 contaminated sites along the Parks Highway in association with the proposed ROW location. This number was determined by comparing the ADEC contaminated sites database to a 1,000 foot radius from the federal ROW. Of these sites found, 17 have been designated as Cleanup Complete, indicating both soil and groundwater meet the most stringent levels established by state regulations. Four sites are designated as Cleanup Complete with Institutional Controls, indicating there are restrictions in place which apply to site operators, as well as current and future operations. The remaining 12 sites are designated as open, indicating there are ongoing activities to monitor, remediate, or assess site conditions. Site conditions range from disposal locations including unknown quantities released, to historical releases totaling 721 gallons of diesel fuel. These sites are illustrated in Figure 5.2-2.

The ADEC regulates the cleanup of contaminated sites to ensure protection of human health and the environment using a risk-based approach. The ADEC's oversight provides the framework to move sites through a designated process towards cleanup through the steps of: identify, assess, rank, prioritize, track, and monitor. The ADEC also strongly promotes the re-use and redevelopment of contaminated properties. An assortment of corrective action methods are used to progress a site towards Cleanup Complete, including excavation, containment, in-situ remediation, site monitoring, and analysis of risk to ensure no unacceptable human health or environment risk remains.

Groundwater is protected through regulation of contaminated sites, storage tanks, contingency plans, oversight of controlled releases or discharges, and underground injections. Through its Spill Prevention and Response Division and Division of Environmental Health, the ADEC maintains oversight and control to many programs which ensure groundwater protection, including Contaminated Sites, Industry Preparedness, Prevention & Emergency Response, Underground Injection Controls, Drinking Water Program, Pesticide Control, Solid Waste, and Water Quality.

One Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site at BP Prudhoe Bay Drill Site 14 by Deadhorse may come within 1,000 feet of the intended pipeline location. Uncertainty in the exact coordinate of this location leads to difficulty excluding this site. Additionally, Brownfield sites (abandoned or unused industrial and commercial facilities available for reuse) are defined on an annual basis. Future Brownfield sites may come within 1,000 feet of the intended location.

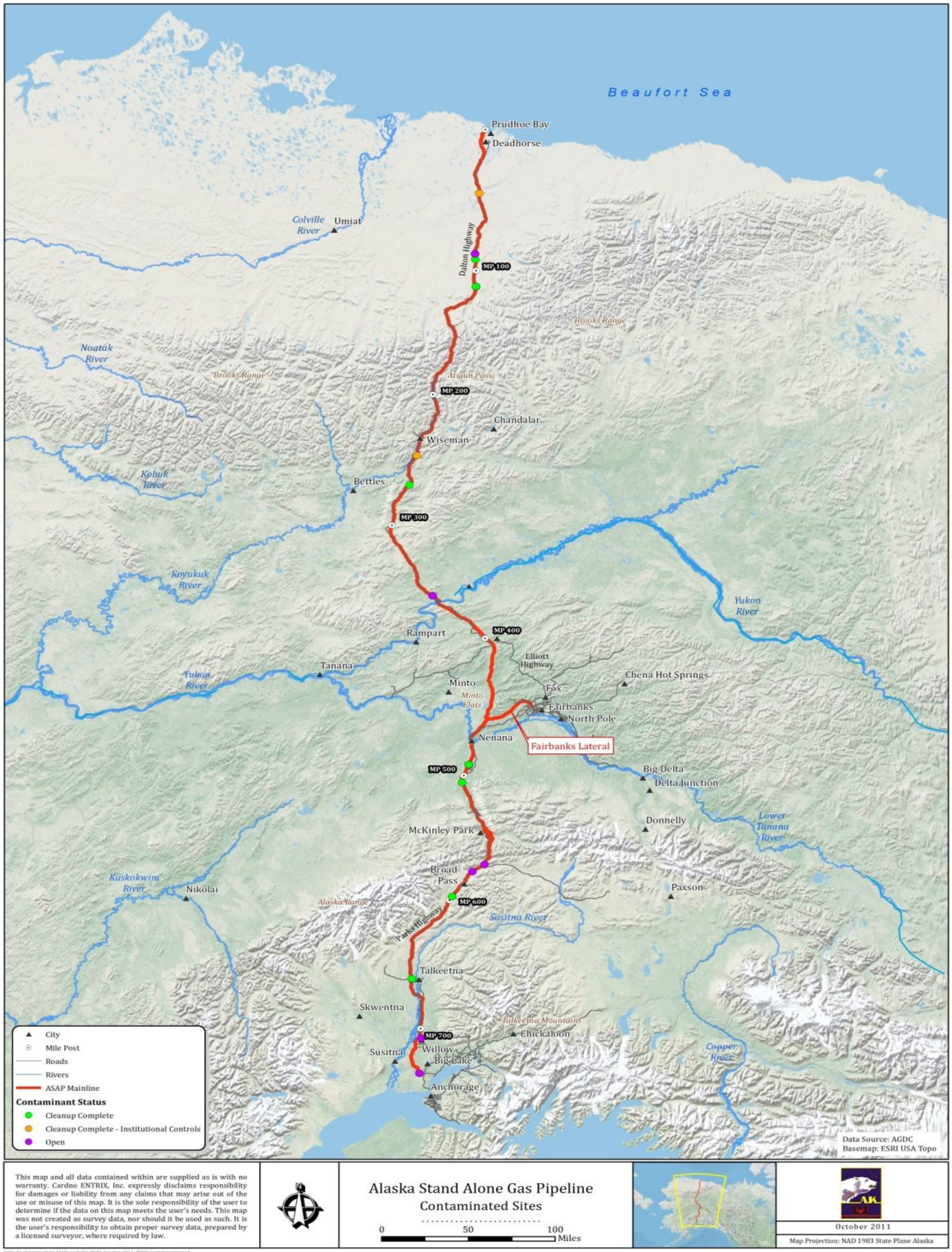


FIGURE 5.2-2 Contaminated Sites

5.2.1.3 Floodplains

Floodplains are the strip of relatively flat land bordering a stream channel that is inundated at times of high water (USGS 2010a). Floodplains are valuable hydrological and ecological resources that serve many functions including: the storage of storm water, erosion and sediment control, and wildlife habitat. Populated areas along floodplains can be considered a hazardous area for property development, since floodplains can become inundated during flooding.

Executive Order 11988 requires federal agencies to avoid to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The magnitude (quantity) and timing of peak flows for rivers and streams are dependent on the amount of precipitation and the characteristics of the watershed.

The most detailed floodplain data is from the Federal Emergency Management Agency (FEMA). The FEMA creates Flood Insurance Rate Maps (FIRMs) based on historic, meteorological, hydrologic, and hydraulic data. These maps can be used to identify special flood hazard areas (SFHAs) and predict 100 year floods. Figure 5.2-3 and Appendix G presents available FEMA Floodplain Maps near the Project area by borough or census area (FEMA 2011). The FEMA mapping data available occurs entirely within the Matanuska-Susitna Borough for the Project area. Areas within the Project footprint that are not mapped by FEMA are designated as having possible but undetermined flood hazard risks. For a number of waterbodies in the Project area for which FEMA maps were not available, USGS gaging station data was used. The gage stations found near the Project area were identified and reviewed for peak stream flow data. The locations of these gaging stations for the Arctic, Interior-Yukon, and Southcentral subregions are shown in Appendix G. For each of these subregions, the peak stream flow for a given range of years is identified and shown on a USGS topographic (topo) map. The data available is varied, and is described for each individual stream gage in the respective hydrologic subregions below.

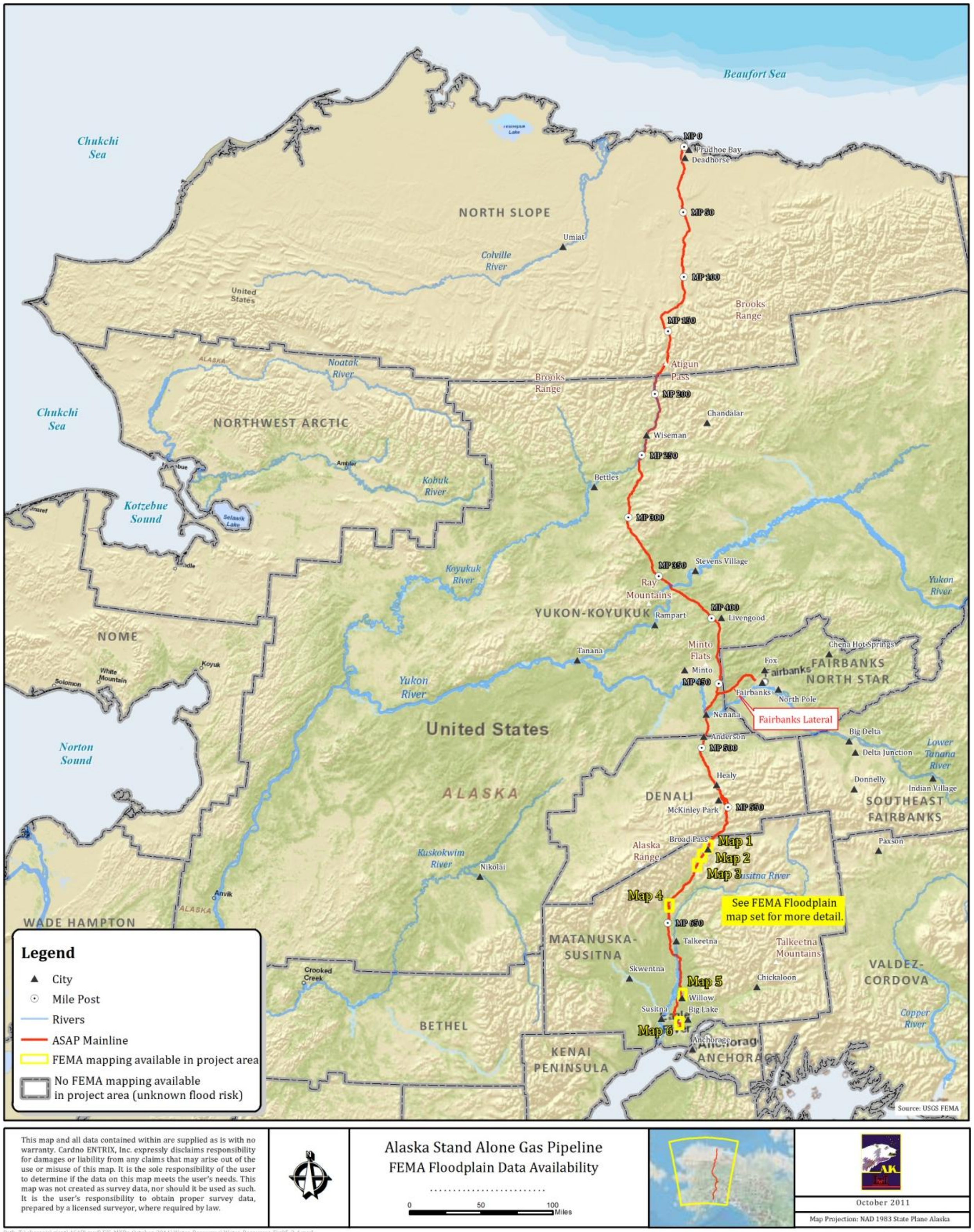


FIGURE 5.2-3 FEMA Floodplains

5.2.1.4 Federal, State, and Local Regulations and Rules

Project construction and operation activities have the potential to impact water resources. Water resources are regulated by federal, state, and local agencies as summarized in Table 5.2-3. The AGDC would complete the necessary permitting requirements in order to comply with regulations for water use and disturbance. The EPA would implement their regulations unless the Project has been delegated to the State of Alaska.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Federal		
All Federal Agencies	Executive Order 11990, Protection of Wetlands	The purpose of this Order is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, federal agencies, in planning their actions, are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The Order applies to: acquisition, management, and disposition of federal lands and facilities construction and improvement projects which are undertaken, financed or assisted by federal agencies; and federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
	Executive Order 11988, Floodplain Management	This Order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities" for the following actions: acquiring, managing, and disposing of federal lands and facilities; providing federally-undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
U.S. Environmental Protection Agency (EPA)	Safe Drinking Water Act (SDWA) (42 U.S.C. [United States Code] Section 300 et seq.) – Sole Source Aquifer Protection Program (Section 1424(e))	The SDWA protects drinking water and its sources (i.e., rivers, lakes, reservoirs, springs, and groundwater wells). This does not include private wells supplying fewer than 25 individuals. Any federally funded or partially federally funded projects with the potential to contaminate designated sole source aquifers require an EPA review. Sole source aquifers are defined as supplying at least 50 percent of the drinking water consumed for the area overlying the aquifer.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
	Section 402, Clean Water Act (CWA) (22 U.S.C. Section 1251 et seq.) – National Pollutant Discharge Elimination System (NPDES): Point Source and Stormwater Discharges	The NPDES program controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either the EPA or an authorized state/tribe contain industry-specific, technology-based and/or water-quality-based limits, and establish pollutant monitoring and reporting requirements. A facility that intends to discharge into the nation's waters must obtain a permit before initiating a discharge. In 1987 the CWA was amended to require the EPA to establish a program to address storm water discharges. In response, the EPA promulgated the NPDES stormwater permit application regulations. Stormwater discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. These regulations require that facilities with the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which the EPA or the state/tribe determines to contribute to a violation of a water quality standard or which is a significant contributor of pollutants to waters of the United States. Through program delegation, the EPA oversees the ADEC's administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction. Authority for Oil and Gas facilities will be delegated on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
	Section 404, CWA: (33 U.S.C. Section 1251 et seq.) – Discharge of Fill Material to Waters of the U.S.	In 1972, Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States. The Rivers and Harbors Act of 1899 defined navigable waters of the United States as "those waters that are subject to the ebb and flow of the tides and/or are presently used, or have been used in the past, or maybe susceptible to use to transport interstate or foreign commerce." The CWA built on this definition and defined waters of the United States to include tributaries to navigable waters, interstate wetlands, wetlands which could affect interstate or foreign commerce, and wetlands adjacent to other waters of the United States. The program is jointly administered by the U.S. Army Corps of Engineers (USACE) and the EPA. The EPA provides program oversight. The fundamental rationale of the program is that no discharge of dredged or fill material should be permitted if there is a practicable alternative that would be less damaging to aquatic resources or if significant degradation would occur to the nation's waters.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Federal Emergency Management Agency (FEMA)	National Flood Insurance Act of 1968	The U.S. Congress established the National Flood Insurance Program with passage of the National Flood Insurance Act of 1968. The Flood Insurance Program is a pre-disaster flood mitigation and insurance program designed to reduce the exorbitant cost of disasters. It is a voluntary program that provides a *quid pro quo* approach to floodplain management and makes federally backed flood insurance available to residents and business owners in communities that agree to adopt and adhere to sound flood mitigation measures that guide development in their floodplains. FEMA is responsible for administering the National Flood Insurance Program and programs that provide assistance for mitigating future damages from natural hazards. In addition, FEMA is required by statute to identify and map the Nation's flood-prone areas and to establish flood-risk zones in such areas.
U.S. Army Corps of Engineers (USACE)	Section 404, CWA (33 U.S.C. Section 1251 et seq.) – Discharge of Fill Material to Waters of the U.S.	The USACE is responsible for the day-to-day administration and permit review. Permit review and issuance follows a sequence process that encourages avoidance of impacts, followed by minimizing impacts and, finally, requiring compensatory mitigation for unavoidable impacts to the aquatic environment.
	Section 10 of the Rivers and Harbors Act (33 U.S.C. Section 403) – Navigable Waters of U.S. Dredge and Fill Permit	Section 10 requires authorization from the USACE for the construction of any structure in or over any navigable water of the United States, the excavation/dredging or deposition of material in this water, or any obstruction or alteration in navigable water. Structure or work outside the limits defined for navigable waters of the U.S. requires a permit if the structure or work affects the course, location, condition, or capacity of the waterbody.
U.S. Coast Guard (USCG)	Section 9 of the Rivers and Harbors Act (22 U.S.C. Section 403) – Bridge Permit	Section 9 requires authorization from the USACE to construct any dam or dike in a navigable water of the United States. The construction of bridges and causeways requires permits under Section 9, but the authority to issue permits with respect bridges and causeways was transferred to the USCG in 1966 when the U.S. Department of Transportation was created. However, USACE authorization is required for the discharge of dredged or fill material into waters of the United States associated with dams, dikes, bridges, and causeways under Section 404 of the CWA.
State		
	Temporary Water Use Permit (AS 46.15)	Permit may be issued if the amount of water to be used is significant, the use continues for less than five consecutive years, and the water to be used is not appropriated. A significant amount of water is defined by 11 AAC 93.035(a) and (b) as the consumptive use of more than 5,000 gallons of water from a single source in a single day; the regular daily or recurring consumptive use of more than 500 gpd from a single source for more than 10 days per calendar year; the non-consumptive use of more than 30,000 gpd (0.05 cubic feet per second) from a single source; or any water use that may adversely affect the water rights of other appropriators or the public interest.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Alaska Department of Environmental Conservation (ADEC)	Section 401 of CWA – Section 401 Certification	Pursuant to Section 401 of the CWA the State of Alaska certifies that the project complies with State water quality standards. This is commonly known as the 401 Certification. This review typically results in conditions placed on either or both the Section 404 permit and Coastal Consistency Determination. The 401 Certification is initiated by the ADEC as part of the 404 permitting process. The ADEC issues the certification.
	Water Quality Standards, 18 AAC 70	This regulation specifies water quality standards (see Table 5.2-4).
	Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances	This manual contains specific water quality criteria and standard for toxic and other deleterious organic and inorganic substances
	Drinking Water Program, 18 AAC 80	Requires Public Water Systems be in compliance with the state drinking water regulations, in accordance with the Federal Safe Drinking Water Act and Amendments, for the public health protection of the residents and visitors to the State of Alaska
	Alaska Pollutant Discharge Elimination System (APDES): Point Source and Stormwater Discharges	On October 31, 2008, the EPA formally approved the state's NPDES Program application. The state's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting and compliance and enforcement programs is being transferred to the ADEC over four years. Oil and Gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to DEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
Local		
Fairbanks North Star Borough (FNSB)	Flood Management Regulations (FNSB Code Chapter 15.04)	Applies to special flood hazard areas in the Fairbanks North Star Borough that are subject to periodic inundation of floodwaters which can cause loss of life or property, health or safety hazards, the disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the local tax base, all of which adversely affect the public health, safety and welfare.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Matanuska Susitna (Mat-Su) Borough	Flood Plain Development Permit, including both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate (MSB 17.29)	A Flood Plain Development Permit is required before any development within a Federally Designated Flood Hazard Area. A Flood Plain Development Permit (issued by Mat-Su Borough) must include both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate. An Alaska registered Architect or Engineer must certify the Development Permit Application and either a Registered Engineer or Surveyor must complete the elevation certificate
North Slope Borough (NSB)	Coastal Management Plan (NSB Code 19.70.050)	Policies that identify general and specific courses of action to achieve region wide goals and the implementation of incremental activities and organizations for the coastal management program. Subject uses include location and construction of pipelines.

The State of Alaska water quality criteria is contained within the Water Quality Standards (WQS) 18 AAC 70 ADEC (2009) and the Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances in 18 AAC 70.020(b) (ADEC 2008b). These documents constitute the WQSs for a particular waterbody. These standards regulate human activities that result in alterations to waters within the State of Alaska's jurisdiction (ADEC 2011c). The criteria includes the fresh WQSs for color; fecal coliform bacteria; dissolved gas; dissolved inorganic substances; petroleum hydrocarbons, oils and grease; pH; radioactivity; residues; sediment; temperature; toxic and other deleterious organic and inorganic substances; and turbidity (Table 5.2-4). The Water Quality Criteria Manual for Toxics contains the numeric water quality criteria adopted into the WQS in 18 AAC 70.020(b). These criteria were taken from the EPA criteria documents cited in the references and Alaska Drinking Water Regulations in 18 AAC 80 (ADEC 2008b). In general, the standards and criteria are the same for surface water and ground water.

TABLE 5.2-4 Selected State Water Quality Standards for Fresh Water

Pollutant	Description	Water Use & Criteria
Temperature	Temperature	Water Supply: drinking, culinary, and food processing – May not exceed 15°C.
		Water Supply: agriculture, including irrigation and stock watering – May not exceed 30°C.
		Water Supply: aquaculture – May not exceed 20°C at any time. (Refer to 18 AAC 70.020(b)(10)(A)(iii) for additional criteria.)
		Water Supply: industrial – May not exceed 25°C.
		Water Recreation: contact recreation – Same as Water Supply: agriculture
		Water Recreation: secondary recreation – Not applicable.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – Same as Water Supply: aquaculture.
Turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample	Water Supply: drinking, culinary, and food processing – May not exceed 5 Nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.
		Water Supply: agriculture, including irrigation and stock watering – May not cause detrimental effects on indicated use.
		Water Supply: aquaculture – May not exceed 25 NTU above natural conditions. For all lake waters, may not exceed 5 NTU above natural conditions.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – May not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. For all lake waters, turbidity may not exceed 5 NTU above natural conditions.
		Water Recreation: secondary recreation – May not exceed 10 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 20% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. For all lake waters, turbidity may not exceed 5 NTU above natural conditions.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – Same as Water Supply: aquaculture.
Color	The condition that results in the visual sensations of hue and intensity as measured	Water Supply: drinking, culinary, and food processing – May not exceed 15 color units or the natural condition, whichever is greater
		Water Supply: agriculture, including irrigation and stock watering – Not applicable

TABLE 5.2-4 Selected State Water Quality Standards for Fresh Water

Pollutant	Description	Water Use & Criteria
	after turbidity is removed	Water Supply: aquaculture – May not exceed 50 color units or the natural condition, whichever is greater.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – May not exceed 15 color units or the natural condition, whichever is greater.
		Water Recreation: secondary recreation – May not interfere with or make the water unfit or unsafe for the use.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife - Color or apparent color may not reduce the depth of the compensation for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life. For all waters, without a seasonally established norm for aquatic life, color or apparent color may not exceed 50 color units or the natural condition, whichever is greater.
Dissolved Gas	Dissolved oxygen is the concentration of oxygen in water	Water Supply: drinking, culinary, and food processing – Dissolved Oxygen (D.O.) must be greater than or equal to 4 mg/l (this does not apply to lakes or reservoirs in which supplies are taken from below the thermocline, or to groundwater).
		Water Supply: agriculture, including irrigation and stock watering – D.O. must be greater than 3 mg/l in surface waters.
		Water Supply: aquaculture – D.O. must be greater than 7 mg/l in surface waters. The concentration of dissolved gas may not exceed 110% of saturation at any point of sample collection.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – D.O. must be greater than or equal to 4 mg/l.
		Water Recreation: secondary recreation – D.O. must be greater than or equal to 4 mg/l.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – D.O. must be greater than 7 mg/l in waters used by anadromous fish. In no case may D.O. be less than 5 mg/l to a depth of 20 cm in the interstitial waters of gravel used by anadromous fish or resident fish for spawning. For waters not used by anadromous or resident fish, D.O. must be greater than or equal to 5 mg/l. In no case may D.O. be greater than 17 mg/l. The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection.
Dissolved Inorganic Substances	Total dissolved solids (TDS)	Water Supply: drinking, culinary, and food processing – TDS from all sources may not exceed 500 mg/l. Neither chlorides nor sulfates may exceed 250 mg/l.
		Water Supply: agriculture, including irrigation and stock watering – TDS may not exceed 1,000 mg/l. Sodium adsorption ratio must be less than 2.5, sodium percentage less than 60 percent, and residual carbonate less than 1.25 milli-equivalents/liter.

TABLE 5.2-4 Selected State Water Quality Standards for Fresh Water

Pollutant	Description	Water Use & Criteria
		Water Supply: aquaculture – TDS may not exceed 1,000 mg/l.
		Water Supply: industrial – No amounts above natural conditions that can cause corrosion, scaling, or process problems.
		Water Recreation: contact recreation – Not applicable.
		Water Recreation: secondary recreation – Not applicable.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – same as water supply: aquaculture.
pH	Negative logarithm of the hydrogen-ion concentration	Water Supply: drinking, culinary, and food processing – May not be less than 6.0 or greater than 8.5.
		Water Supply: agriculture, including irrigation and stock watering – May not be less than 5.0 or greater than 9.0.
		Water Supply: aquaculture – May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
		Water Supply: industrial – May not be less than 5.0 or greater than 9.0.
		Water Recreation: contact recreation – May not be less than 6.5 or greater than 8.5. If the natural condition pH is outside this range, substances may not be added that cause an increase in the buffering capacity of the water.
		Water Recreation: secondary recreation Same as Water Supply: industrial.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
Fecal Coliform	Those bacteria that can ferment lactose at 44.5° ± 0.2° C to produce gas in a multiple tube procedure	Water Supply: drinking, culinary, and food processing – In a 30 day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC /100 ml. For groundwater, the FC concentration must be less than 1 FC/100 ml, using the fecal coliform Membrane Filter Technique, or less than 3 FC/100 ml, using the fecal coliform most probable number (MPN) technique.
		Water Supply: agriculture, including irrigation and stock watering – In a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC /100 ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply apply.
		Water Supply: aquaculture – For products normally cooked, in a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC /100 ml. For products not normally cooked, the criteria for drinking water supply apply.

TABLE 5.2-4 Selected State Water Quality Standards for Fresh Water

Pollutant	Description	Water Use & Criteria
		Water Supply: industrial – Where a worker contact is present, in a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
		Water Recreation: contact recreation – In a 30 day period, the geometric mean may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC /100 ml.
		Water Recreation: secondary recreation – In a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples, may exceed 400 FC /100 ml.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – not applicable.
Sediment	Solid material of organic or mineral origin that is transported by, suspended in, or deposited from water	Water Supply: drinking, culinary, and food processing – No measurable increase in concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method.
		Water Supply: agriculture, including irrigation and stock watering – For sprinkler irrigations, water must be free of particles of 0.074 mm or coarser. For irrigation or water spreading, may not exceed 200 mg/l for an extended period of time.
		Water Supply: aquaculture – No imposed loads that will interfere with established water supply treatment levels.
		Water Supply: industrial – Same as water supply: aquaculture.
		Water Recreation: contact recreation – Same as Water Supply: drinking.
		Water Recreation: secondary recreation May not pose hazards to incidental human contact or cause interference with use.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – The percent accumulation of fine sediment in the range of 0.1 mm to 4.0 mm in the gravel bed of waters used by anadromous or resident fish for spawning may not be increased by more than 5% by weight above natural conditions (as shown from grain size accumulation graph). (Refer to 18 AAC 70.020(b)(9)(C) for additional criteria.)
Toxics.	Strontium-90	Drinking Water – 8 picoCuries per liter (pCi/l)

Sources: ADEC 2008b, 2009.

The WQS for temperature, turbidity, color, dissolved oxygen, pH, dissolved solids, and suspended sediments are the most common data collected. Strontium was selected as an example of a standard from the Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances. Some of the WQS are based on a comparison to natural conditions (for instance "no measureable increase over natural conditions") or on a comparison to an external criterion (for instance "may not cause detrimental effects on established water supply treatment levels"). In these cases, it is not possible to compare the water quality data to the WQS without more baseline information.

The Clean Water Act section 305(b) requires the State of Alaska to monitor and report on surface and groundwater quality of all waterbodies to be characterized; and to list the ones that do not meet WQS under section 303(d). The ADEC solicits water quality data and information for waterbodies in accordance with EPA guidance (ADEC 2010). The ADEC evaluates the data and information available and assigns each waterbody into one of five categories as follows:

- Category 1. All WQS for all designated uses are attained.
- Category 2. Some WQS for the designated uses are attained, but data and information to determine whether the WQS for the remaining uses are attained are insufficient or absent.
- Category 3. Data or information is insufficient to determine whether the WQS for any designated uses are attained.
- Category 4. The waterbody is determined to be impaired but does not need a total maximum daily load (TMDL).
  - Category 4a. An established and EPA–approved TMDL exists for the impaired water.
  - Category 4b. Requirements from other pollution controls have been identified to meet WQS for the impaired water.
  - Category 4c. Failure to meet a water quality standard for the impaired water not caused by a pollutant; instead the impairment is caused by a source of pollution such as nuisance aquatic plant, degraded habitat, or a dam that affects flow.
- Category 5. WQS for one or more designated uses are not attained and the waterbody requires a TMDL or recovery plan. Category 5 waters are identified on the section 303(d) list of impaired waters.

The most current data is available in Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report (ADEC 2010), which does not contain groundwater information.

5.2.1.5 Arctic Hydrologic Subregion

The Arctic hydrologic subregion includes the area from the Arctic Coastal Plain, the Arctic Foothills to the north side of the Brooks Range ending at Atigun Pass (the continental divide) (TAPs Owners 2001).

The Arctic Hydrologic Subregion has continuous permafrost (Exxon 1982). The surficial geology of the Arctic Coastal Plain consists of coastal deposits of inter-stratified alluvial and marine sediments, as well as local areas of geologic drift. The elevations of the Coastal Plain vary from sea level to about 600 feet. This area is poorly drained due to permafrost and flat terrain, and has many lakes. Low mountains, rolling plateaus, and tundra plains characterize the Arctic Foothills. In the north, the Foothills have ridge elevations that range from 600 to 1,200 feet. The Foothills consist of undifferentiated glacial and glacio-fluvial deposits. The surficial geology is mostly fine grained quaternary deposits associated with sloping hills. There are few bedrock exposures and few lakes. The Brooks Range is rugged with peak elevations ranging from 6,000 to 8,000 feet. Slope deposits consist of dominantly coarse rubble deposits with a high percentage of bedrock exposure undifferentiated alluvium (Exxon 1982).

The proposed Project area starts at Prudhoe Bay located in the Kuparuk River watershed on the tundra coastal plain. It crosses into the Sagavanirktok (Sag) River watershed and generally follows through the coastal plain to the foothills. In the Arctic foothills, the Project area veers away from the Sag River and crosses through the upper reaches of the Kuparuk River watershed, and then very briefly through the upper reaches of the Lower Colville River watershed[1]. The Project area enters the Brooks Range near Galbraith Lake (headwaters of the Sag River), and continues to Atigun Pass.

Watershed Characteristics

The Project area in the Arctic Hydrologic Subregion consists of the Sag River watershed and Kuparuk River watershed. The Project ROW is located primarily in the Sag River watershed, with small areas extending into the Kuparuk River watershed, as shown in Figure 5.2-1. The watersheds contain numerous ponds, lakes, and streams. Ponds include flooded tundra ponds, shallow and deep water ponds with varying depths and presence and type of aquatic vegetation (Truett and Johnson 2000). Lakes found on the coastal plain vary in depth where they are shallowest near the coast and get deeper near the foothills of the Brooks Range (Truett and Johnson 2000). Three lake types have been described by Bendock and Burr (1985), as oxbow, thaw and deflation; and five lake types by Moulton and George (2000): tapped, low perched, high perched, drainage and tundra lakes. The lakes were classified by origin under Bendock and Burr (1985) and by fish access by Moulton and George (2000).

Three main types of streams occur in the subregion: mountain streams, spring streams and tundra streams (Truett and Johnson 2000). Mountain streams are the streams that originate from the Brooks Range, and include braided and interconnected channels. Spring streams are spring fed tributaries that feed upper reaches of mountain streams and are not present in the coastal plain. Tundra streams drain the Brooks Range, foothills and coastal plain. Beaded streams are tundra streams characteristic of permafrost underlain areas which are small pools or ponds linked by stream channels (Truett and Johnson 2000).

[1] The portion in the Lower Colville River watershed is so small that it is not discussed as part of the study area.

Sag River Watershed (HUC 19060402 -5,279.63 sq. miles)

The Sag River originates in the Brooks Range, and its headwaters are characterized by steep slopes and stream channel braiding from high velocity flows. The gradient decreases northbound from the Arctic Foothills to the Coastal Plain towards the Beaufort Sea, causing deposition of sediments and the formation of alluvial fans (BP 1995, p 4-11 and 4-13). Besides the Sag River, the watershed contains numerous ponds, lakes, and streams as noted and described above.

Kuparuk River Watershed (HUC 19060401 -4,295.93 sq. miles)

The Kuparuk River Watershed characteristics are similar to the Sag River watershed.

Surface Water

Surface Water Availability

As mentioned previously, the state of Alaska has an abundance of surface water. According to the DNR, very little data has been collected on this resource on a state-wide basis. The rivers and streams that cross the proposed Project area are shown in Appendix E arranged from north to south. Appendix F shows the location, surface area, and type of lake or pond located within 1 mile of either side of the Project ROW in the Arctic Hydrologic Subregion.

Additional lake and pond characteristic data is available for selected lakes in the Arctic Subregion. The AGDC's contractor preselected 44 lakes to survey for water withdrawal uses based on proximity to the Project area and presumed size and depth. Lake area and depth were collected for 30 of the preselected lakes. This data is shown in Table 5.2-5 below. The locations of these lakes are shown on Figure 5.6-2 (see Section 5.6 Fisheries).

TABLE 5.2-5 Summary of Surface Area and Depth for Lakes in the Arctic Hydrologic Subregion

Lake Name	Surface Area	Max. Depth (feet)
DNR001	240.28	-4.00
DNR003	269.84	-2.75
DNR004	536.71	-6.00
DNR005	137.38	-10.50
DNR006	28.93	-8.50
DNR007	46.75	-7.25
DNR009	181.39	-3.75
DNR013	62.18	-4.75
DNR016	259.82	-7.75
DNR019	120.25	-5.25

TABLE 5.2-5 Summary of Surface Area and Depth for Lakes in the Arctic Hydrologic Subregion

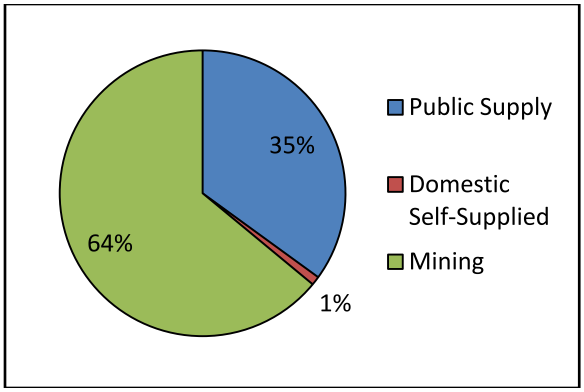
Lake Name	Surface Area	Max. Depth (feet)
DNR020	15.94	-12.00
DNR021	37.56	-3.50
DNR022	28.71	-6.75
DNR024	33.13	-20.00
DNR025	67.02	-8.25
DNR028	67.00	-37.00
DNR029	56.50	-20.00
DNR030	17.52	-10.50
DNR031	20.85	-13.50
DNR033	17.91	-9.50
DNR034	8.00	-24.00
DNR035	13.88	-64.00
DNR036	27.06	-44.00
DNR037	20.84	-9.50
DNR038	19.86	-23.00
DNR039	22.63	-64.00
DNR040	87.80	-55.00
DNR042	15.19	-27.00
DNR044	10.51	-43.00
DNR045	44.89	-26.00

Source: AGDC 2011a.

Surface Water Use

As previously mentioned, surface water use data is available by borough or census area. Borough and census area boundaries are shown on Figure 5.2-3. The water use for the Sag and Kuparuk River watersheds[2] is reflected by the North Slope Borough water use shown in Table 5.2-1. As shown in Figure 5.2-4, the 2005 fresh surface water use for the North Slope Borough was 64 percent for mining, and 35 percent for public supply. Domestic self supplied water accounts for one percent of the surface water use.

[2] A very small portion of the Sag River Watershed and Kuparuk River watershed is in the Yukon-Koyukuk census area.



Source: USGS 2010b.

FIGURE 5.2-4 Sag River and Kuparuk River Watersheds – 2005 Fresh Surface Water Use (Percent)

Surface Water Quality

The Arctic Hydrologic Subregion has no PWS's with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are located within the proposed Project area (ROW). The Project area in both the Kuparuk and Sag River watersheds generally follows the existing TAPS ROW. For the Kuparuk River watershed, one site (Ku-S1) was found that met the criteria listed in Section 5.2.1. Data was collected at Site Ku-S1 in 1986. The Sag River watershed also had only one site (Sag-S4) that met the selection criteria described in Section 5.2.1. The data for Sag-S4 was collected in 1979 (post 1977), after the TAPS Project was completed.

Although there has been localized population growth in certain areas of the Kuparuk and Sag River watersheds since this data was collected, there has not been any major population growth or other major construction projects near these sites. Although Ku-S1 is 10 miles from the Project area, the land use activity is likely similar (barring a potential oil spill) to the majority of the Project area in the Kuparuk River watershed. The Sag-S4 site is within ½ mile of the Project area, and is likely representative of present surface water quality for the majority of the watershed (except where population growth has occurred near Prudhoe Bay).

The data from Ku-S1 indicates that the fresh surface water in the Kuparuk River watershed met WQSs for temperature, turbidity, dissolved oxygen, pH, fecal coliform, total dissolved solids and suspended sediment (Table 5.2-6). The data from Sag-S4 shows that the fresh surface water in the Sag River watershed met WQS for temperature and pH. Note that a given sampling site may have data for other WQS or criteria (for example, sulfate, nitrates, or iron), but only data for the selected WQS and criteria are shown. The Ku-S1 site and Sag-S4 sites are far apart; therefore, pre-1977 data is included in Table 5.2-6 for additional sites Sag-S1, Sag-S2, and Sag-S3.

TABLE 5.2-6 Summary of Surface Water Quality – Arctic Hydrologic Subregion

Watershed and Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Kuparuk River (19060401)											
15896000	Ku-S1	8/21/1986	7.4	0.60	--	12.7	6.9	39.0	0.0	54	8
Sag River (19060402)											
694943148451300	Sag-S1	9/21/1975	0.5	--	3	14.3	7.6	--	--	133	--
692200148433000	Sag-S2	5/2/1975	0.0	--	5	--	8.0	--	--	563	--
15910200	Sag-S3	9/16/1975	2.5	--	--	--	--	--	--	--	--
15904900	Sag-S4	5/23/1979	6.5	--	--	--	7.8	--	--	--	--

°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available
Representative data sites are bolded, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c. (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

Table 5.2-7 indicates the ADEC's classification of waterbodies in the Arctic Hydrologic Subregion. There are no waterbodies listed in Category 5, which includes impaired waters identified under section 303(d) of the CWA. Most of the waterbodies remain unclassified, but it is expected that they would fall under Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

TABLE 5.2-7 ADEC Waterbody Classification – Arctic Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Kuparuk River	0	0	Kuparuk River	0	0
Sag River	0	Sag River to Simpson Lagoon	Colleen Lake, Lake McDermott, and Sag River	0	0

Source: ADEC 2010.

Additional water chemistry data is available for selected lakes in the Arctic Subregion. The AGDC preselected 44 lakes to survey based on the proximity to the Project area and presumed size and depth. Water chemistry data were collected for 32 of the preselected lakes in July of 2010, and 30 of these lakes were measured for depth. This data is shown in Table 5.2-8 below, and their location is shown on Figure 5.6-2 (Section 5.6, Fisheries).

Groundwater

Groundwater Availability

Groundwater availability is limited in the Arctic Hydrologic Subregion due to permafrost; however, groundwater occurs above, below and locally within permafrost (Williams 2007). At temperatures ranging from 32 to 40 degrees Fahrenheit, groundwater is more viscous and moves more slowly than in temperate regions (Williams 2007). Table 5.2-9 presents data on private wells in the Arctic Hydrologic Subregion from WELTS (ADNR 2011).

Groundwater Use

As with surface water, for the purpose of affected environment, the water use for the Arctic Hydrologic Subregion is reflected by the North Slope Borough groundwater use provided in Table 5.2-2. As shown in Figure 5.2-5, 2005 fresh groundwater use for the North Slope Borough was 75 percent industrial self-supplied and 25 percent public supply.

TABLE 5.2-8 Summary of Water Quality Data for 32 Lakes in the Arctic Hydrologic Subregion

Lake Name	Sample Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH metered	pH Litmus Paper	Color: Clarity/Visibility
DNR001	7/8/2010	14.7	13.05	380		7.57	6.5	Hummic Muddy
DNR002	7/9/2010	16.59	0.29	244		7.82		Muddy
DNR003	7/9/2010	13.97	12.43	296	0.18	7.42		Muddy
DNR004	7/9/2010	17.78	11.67	327	0.18	7.5		Clear
DNR005	7/9/2010	14.76	14.8	191		8.64		
DNR006	7/10/2010	13.8	13.4	147		7.8		Clear
DNR007	7/10/2010	13.9	11.82	142	0.09	7.83		Hummic
DNR009	7/11/2010	12.37	10.11	183	0.11	6.84		
DNR013	7/12/2010	15.58	10.84	159	0.09	7.56		Clear
DNR016	7/12/2010	13.94	20.6	90	0.05	6.89		Hummic
DNR019	7/13/2010	14.5	12.38	114	0.07	6.76		Hummic
DNR020	7/17/2010	14.48	11.2	51		6.89		Muddy
DNR021	7/17/2010	14.18	11.72	3	0	6.84		Muddy
DNR022	7/13/2010	12.8	10.81	29	0.02	6.08		Hummic
DNR024	7/14/2010	16.14	10.54	44	0.01	7.29		Clear
DNR025	7/14/2010	12.8	16	27		6.33		Muddy
DNR028	7/15/2010	13.97	20	62		7.08		Clear
DNR029	7/17/2010	13.83	20.26	46	0.03	6.36		Clear
DNR030	7/14/2010	13.18	11.07	25	0.01	6.86		Muddy
DNR031	7/13/2010	12.69	9.58	101	0.06	6.45		Hummic
DNR033	7/14/2010	15.77	10.68	133	0.08	6.64		Hummic
DNR034	7/16/2010	13.27	10.78	84	0.05	7.12		Hummic

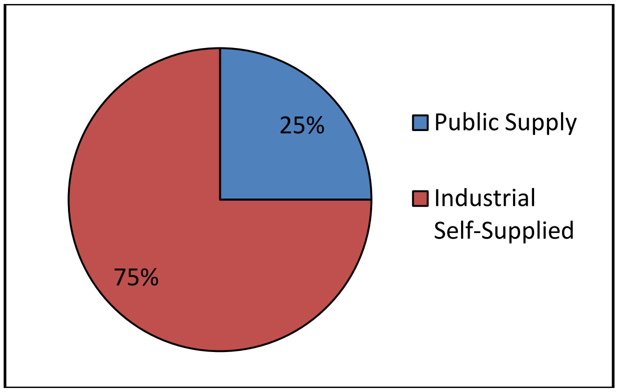
TABLE 5.2-8 Summary of Water Quality Data for 32 Lakes in the Arctic Hydrologic Subregion

Lake Name	Sample Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH metered	pH Litmus Paper	Color: Clarity/Visibility
DNR035	7/16/2010	13.27	15.4	113	0.07	7.06		Clear
DNR036	7/15/2010	12.3	11.71	10	0.01	6.51		Clear
DNR037	7/15/2010	11.1	11.52	18	0.01	5.81		Hummic
DNR038	7/16/2010	13.58	13.4	20	0.01	6.97		Clear
DNR039	7/17/2010	12.53	10.53	19	0.01	5.91		Clear
DNR040	7/16/2010	11.39	9.61	25	0.02	5.95		Hummic
DNR042	7/17/2010	12.39	10.81	146	0.09	7.28		Hummic
DNR044	7/16/2010	13.04	11.37	194	0.12	8.13		Clear
DNR045	7/16/2010	7.55	12.47	78	0.05	7.12		Hummic
Galbraith	7/16/2010	11.64	9.91	138	0.09	7.1		Clear

[1] Source: AGDC 2011c.

TABLE 5.2-9 Well Data from WELTS – Arctic Hydrologic Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (Ft. below GL)	Static H2O Level (Ft. below GL)	Flow Rate (GPM)	Date Well Completed
Fairbanks	1N	2W	16	1	R1 (TAPS PS3)	40	5.5	4.5	5/12/1990
Fairbanks	12S	8W	9	3	R1 (TAPS PS3, PIPE M104)	30 - 39	3 - 5	40	1983 - 1982



Source: USGS 2010b.

FIGURE 5.2-5 Sag River and Kuparuk River Watersheds – 2005 Fresh Ground Water Use (Percent)

Groundwater Quality

The Arctic Hydrologic Subregion does not have PWSs with groundwater as the primary source listed on the EPA's SNC List (ADEC 2011b). Water is brackish or saline in bedrock beneath permafrost in much of the continuous permafrost zone draining to the Arctic Ocean, although fresh water is discharged from springs along faults bounding the limestone of the Lisburne Group of the Brooks Range (Williams 2007). Little information exists on the quality of ground water from permafrost and low temperatures. The restricted circulation of ground water may result in higher concentrations of dissolved solids (Williams 2007). The surface water and groundwater monitoring sites maps presented in Appendix G illustrate the locations of selected USGS groundwater quality sampling sites relative to the Project area.

No USGS groundwater quality sites with water quality data were found in the Arctic Hydrologic Subregion of the Project area. The closest USGS groundwater sampling site in the Arctic Hydrologic Subregion was located in the Northwest Coast Hydrologic Unit. This site is about 197 miles away from the Project area; therefore, is not considered representative and is not included in this analysis.

Floodplains

The Sag River floodplain spans four miles wide in its northern most reaches before it feeds the Beaufort Sea (BLM 2002). It is characterized by a meandering river that becomes braided due to low discharge from the flat Arctic Coastal terrain (BLM 2002). Other smaller streams in the Arctic Subregion drain thermokarst[3] lakes. The Sag River floodplain possess characteristic tundra ponds, lakes and streams as discussed in the watershed characteristics section noted above.

Peak surface water flows usually occur in July and August. There is minimal stream flow during the winter, which can result in aufeis[4] formation. Maximum water levels often occur during

[3] A thermokarst is a "lake formed in a depression by the thawing of ground ice in soil above permafrost" (BLM 2002).
[4] Aufeis forms when low flow (often groundwater) freezes in layers over frozen ground.

spring runoff from snow melt, and from aufeis which can back up stream flow (BLM 2002). Permafrost allows little surface water storage capacity in the watershed resulting in peak pulse flows which tend to increase and decrease rapidly (BLM 2002). The rivers experience high erosion in the summer, due to flooding when the streambed and banks thaw (BP 1995).

The Project area for the Sag River floodplain is located entirely in the North Slope Borough, and there are no available FEMA floodplain maps for the borough (FEMA 2011). However, flooding is identified as a hazard with a moderate probability of occurrence in the North Slope Borough (NSB 2005). The Arctic Coastal Plain is known for its cold and desert-like conditions with precipitation ranging between 5 and 7 inches, which are primarily in the form of snow (Truett and Johnson 2000). In the North Slope Borough, flooding can be caused by runoff events, snow melt floods, groundwater flooding, ice jam floods, flash floods, fluctuating lake levels, alluvial fan floods, and glacial outburst floods (depending on the topography, location and bodies of water, streams or rivers). For the North Slope Borough as a whole, the risk of a flood from runoff events, snowmelt, ice jams, flash floods, and alluvial fan floods are categorized as "low level" hazards. Groundwater flooding is possible, but risk is minimized by construction of elevated structures. The risk of lake level fluctuation is little or none (NSB 2005). Specific communities (for instance Barrow and Anaktuvuk Pass) are identified as potentially subject to floods, but the Sag and Kuparuk rivers are not mentioned (NSB 2005).

There are five gaging stations in the Sag River with peak stream flow data near the Project area. Table 5.2-10 summarizes the peak streamflow elevations at these gaging stations. The Arctic Hydrologic Subregion High Water Mark Maps presented in Appendix G show the maximum elevation of record (or high water mark) about two miles upstream of gaging stations on major rivers and about one mile upstream of gaging stations on tributaries. The high water mark represents from 11 to 34 years of data, but probably do not reflect a 100-year flood (a flood that has a one percent chance of occurring in any year).

TABLE 5.2-10 Peak Streamflow Elevation Data Near Project – Arctic Hydrologic Subregion

Watershed and Site ID	Map ID	Water Years of Record[1]	Length of Record (years)[2]	Number of Missing Years	Maximum Known Elevation over Length of Record (High Water Mark) (feet above sea level)
Kuparuk River (19060401)					
n/a	n/a	n/a	n/a	n/a	n/a
Sag River (19060402)					
15910300	Sag River Trib near Happy Valley Camp	1997-2009	13	0	974 (2000)
15910000	Sag River River near Sagwon	1969-1979	11	0	1018 (1969)
15908000	Sag River near Pump Station 3	1983-2009	27	0	1,173[3,4] (2000)
15904900	Atigun River Tributary near Pump Station 4	1976-2009	34	0	2806 (1999)
15904800	Atigun River near Pump Station 4	1992-2008	17	0	3175 (2003)

[1] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.

[2] Length of record is the number of years between the first and last year of record. The number of missing years is shown in column 5.

[3] Gage height affected by backwater.

[4] Gage height not the maximum for the year.

Source: USGS 2010e. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

5.2.1.6 Interior-Yukon Hydrologic Subregion

This hydrologic subregion consists of the Yukon River Drainage, which flows into the Bering Sea. The region includes the south side of the Brooks Range, the Yukon-Tanana Uplands, the Tanana River Valley, and the north side of the Alaska Range (TAPS Owners 2001). Similar to the north side of the Brooks Range, the south side of the Brooks Range is rugged with continuous permafrost. Slopes are steep through the lower reaches of the Dietrich River, where valleys widen and become U-shaped. The Dietrich River floodplain is wide and braided. The Yukon–Tanana Uplands consist of rounded hills and ridges at elevations of 2,000 to 4,000 feet. The Tanana River Valley is a wide, lowland depression, with discontinuous permafrost. The north side of the Alaska Range rises to peaks of 6,000 to 9,000 feet. The Alaska Range has discontinuous permafrost (TAPS Owners 2001).

Watershed Characteristics

The Project area includes the Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, Tolovana River, Lower Tanana River, Nenana River, and Tanana Flats Watersheds[5] (Figure 5.2-1).

Upper Koyukuk River Watershed – HUC 19040601 (6,927.10 sq. miles): The Dietrich River originates in the Brooks Range near Atigun Pass. The Dietrich River flows south to join the Middle Fork Koyukuk. The South Fork Koyukuk joins the Middle Fork Koyukuk and becomes the Upper Koyukuk west of the Project (southwest of Bettles). The Upper Koyukuk River flows west to join the Yukon River. The towns of Wiseman, and Bettles are located within this watershed. The Project area crosses the Middle Fork Koyukuk River in this watershed.

South Fork Koyukuk River Watershed – HUC 19040602 (2,313.29 sq. miles): The South Fork of the Koyukuk originates in the foothills of the south side of the Brooks Range, at Twin Lakes just east of Wiseman. The South Fork of the Koyukuk flows west to join the Middle Koyukuk and eventually the Yukon River well west of the Project. The Project area crosses the South Fork Koyukuk River in this watershed.

Kanuti River Watershed – HUC 19040604 (3,353.66 sq. miles): The Kanuti River flows west to join the Koyokuk and then the Yukon River west of the Project. Only a small portion of Project area crosses through upper reaches of this watershed. The Project area crosses the Kanuti River in this watershed.

[5] The Project area also briefly crosses headwaters of the Middle Fork-North Fork Chandalar River, Yukon Flats, and Chena River (Fairbanks Lateral) watersheds. Because so brief, these watersheds are not considered part of the study area.

Yukon Flats Watershed – HUC 19040403 (7,479.09 sq. miles): The southwest corner of the Yukon Flats watershed is briefly crossed by the proposed Project. This watershed will not be discussed in detail further due to the small area proposed for use by the proposed Project.

Ramparts Watershed – HUC 19040404 (3,106 sq. miles): This watershed includes the Yukon River from east of Stevens Village to west of Rampart. The terrain is not as steep as the Brooks or Alaska Range. The Project area crosses the Yukon River in this watershed.

Tolovana River Watershed – HUC 19040509 3,361.59 sq. miles): The Tolovana River originates outside of the Minto Flats Game Refuge near Minto, and flows south to join the Tanana River, which flows west and north to the Yukon River well west of the Project area. The Project area crosses the Tolovana River in this watershed.

Lower Tanana River Watershed HUC 19040511 (4,684.76 sq. miles): A small portion of the Project area crosses the very upper reaches of this watershed. The Project area crosses the Tanana River.

Tanana Flats Watershed – HUC 19040507 4,470.87 sq. miles): The watershed includes the Tanana River from about the village of Tanana to Nenana. Many watersheds contribute to the Tanana Flats watershed. The Project area crosses this watershed on the very west edge of the watershed near Nenana. Portions of the watershed are in the Alaska Range.

Nenana River Watershed – HUC 19040508 (3,896.17 sq. miles): The Nenana River originates in the Alaska Range in Denali National Park. It flows west, then north along the highway (and Project area) starting at Cantwell then through McKinley Village, Lignite, Healy and Anderson. It joins the Tanana River at Nenana. The Project area crosses the Nenana River.

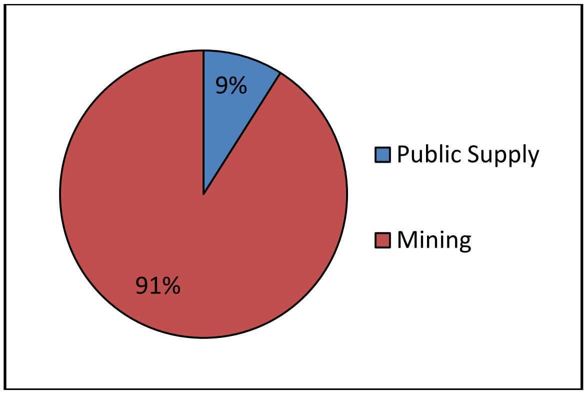
Surface Water

Surface Water Availability

The rivers and streams that cross the Project area are shown in Appendix E arranged from north to south. Appendix F shows the location, surface area, and type of lake or pond located within 1 mile on either side of the Project ROW in the Interior-Yukon Hydrologic Subregion.

Surface Water Use

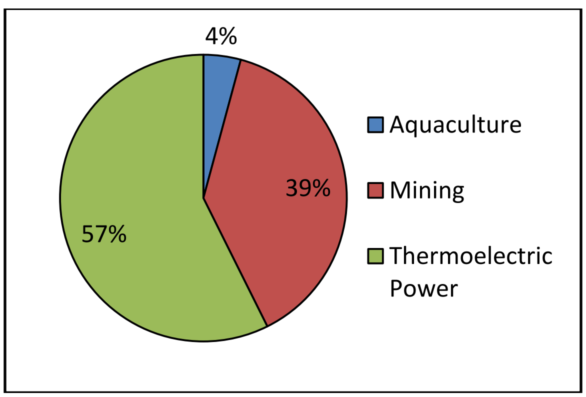
Borough and census area boundaries are shown in Figure 5.2-3 and Appendix G. Unlike the Arctic Hydrologic Subregion, the Project area in the Interior-Yukon Hydrologic Subregion consists of several different boroughs and census areas. The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River watersheds are all within the Yukon-Koyukuk Census Area. Based on data provided previously in Table 5.2-1, surface water use is primarily for mining (91 percent) with the remaining 9 percent for PWS as shown in Figure 5.2-6.



Source: USGS 2010b.

FIGURE 5.2-6 Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River Watersheds – 2005 Fresh Surface Water Use (Percent)

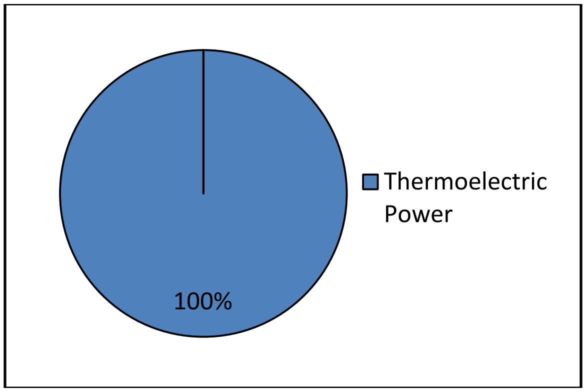
The Tolovana River Watershed is situated half in the Yukon-Koyokuk Census Area and half in the Fairbanks North Star Borough. Water use in the Fairbanks North Star Borough is much greater than the total water use in the Yukon-Koyukuk River watershed; therefore, the average water use for the Tolovana River Watershed would be represented by the Fairbanks North Star Borough water use estimates. The Tanana Flats Watershed is also represented by the Fairbanks North Star Borough estimates. As shown in Figure 5.2-7, over half (57 percent) of the water use for these watersheds is for thermoelectric power, and just over a third (39 percent) for mining. A small portion (four percent) is used for aquaculture.



Source: USGS 2010b.

FIGURE 5.2-7 Tolovana River and Tanana Flats Watersheds – 2005 Fresh Surface Water Use (Percent)

The Nenana River Watershed is located in the Denali Borough. As shown in Figure 5.2-8, the surface water use in this watershed is exclusively for thermoelectric power.



Source: USGS 2010b.

FIGURE 5.2-8 Nenana River Watershed – 2005 Fresh Surface Water Use (Percent)

<u>Surface Water Quality</u>

The Interior-Yukon Hydrologic Subregion has no PWSs with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are within the Project area footprint (Appendix G). The Project area that crosses the Upper Koyukuk, South Fork Koyukuk, Kanuti, Ramparts, and part of the Tolovana watersheds generally follows the existing TAPS ROW. The following brief discussions for water quality criteria in each watershed within the Interior Yukon Hydrologic Subregion are included in Table 5.2-11 below.

The Upper Koyukuk River watershed had one site (UK-S2) that met the selection criteria listed in Section 5.2.1, this data was collected in 1978. There has not been any major population growth or other major construction projects in the watershed since the data was collected, and the site is very close to the Project area; therefore, it is reasonable to assume the data is representative of current surface water quality in the Project area. Based on this data, the fresh surface water in the Upper Koyukuk River watershed met the WQS for temperature and pH for all water uses. Table 5.2-11 includes two sites (UK-S1 and UK-S3) with data collected before 1977, which may not be representative because the TAPS was built in 1977.

The South Fork Koyukuk River and Kanuti River watersheds had no sites that met the selection criteria listed in Section 5.2.1. Table 5.2-11 includes one site (SFK-S1) with data collected in 1975, and (Ka-S1) with data collected in 1972 which may not be representative of current water quality because the TAPS was built in 1977.

The Ramparts watershed had one site (Ra-S1) that met the selection criteria listed in Section 5.2.1, this data was collected in 2005. There has not been any major population growth or other major construction projects in the watershed since the data was collected, and the site is close to the Project area; therefore, it is reasonable to assume the data is representative of current surface water quality in the Project area. Based on this data, the fresh surface water in the Ramparts watershed met WQS for temperature, dissolved oxygen, pH, and total dissolved solids for all water uses. However, it may not meet the suspended sediment criteria for one or more water uses.

The Tolovana River watershed had no sites that met the selection criteria listed in Section 5.2.1. One site (To-S1) near the TAPS had data collected in 1972, which may not be representative because TAPS was built in 1977. Note that Goldstream Creek in this watershed is on the ADEC list for impaired waters, as shown in Table 5.2-11.) No sites were available near the Project area in the Lower Tanana River watershed.

The Nenana River watershed includes three sites (Ne-S1, Ne-S2, and Ne-S3) that met the selection criteria listed in Section 5.2.1, and this data was collected in 1972, 1991, and 1972 respectively. The proposed Project area is not adjacent to the TAPS ROW in this watershed. Although it is not associated with the TAPS, there has been population growth in this corridor since 1972, the 1991 data collected at Ne-S2 is potentially the only representative data. Based on the data from Ne-S2, the fresh surface water in the Nenana River watershed met the WQS for temperature, dissolved oxygen, pH, and total dissolved solids for all water uses, but it did not meet the WQS for turbidity or color for at least some water uses (Table 5.2-11).

The Tanana Flats watershed had one site (TF-S1) that met the selection criteria and the data was collected in 2005. The land use has not changed significantly since this time; therefore, it is likely representative of current conditions. This data shows that the surface water quality met WQS for temperature, dissolved oxygen, pH, and dissolved solids for all water uses near the Project area. However, the level of suspended sediment may exceed the WQS for at least some water uses (Table 5.2-11).

TABLE 5.2-11 Summary of Surface Water Quality – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Upper Koyukuk River (19040601)											
675538149511100	UK-S1	3/15/1972	1.5	--	--	11.6	7.9	--	--	--	--
15564875	UK-S2	3/16/1978	2.0	--	--	--	7.3	--	--	--	--
671546150121600	UK-S3	6/20/1972	8.0	--	10	10.4	8.4	--	--	116	--
South Fork Koyukuk (19040602)											
15564887	SFK-S1	5/18/1975	0.0	--	--	--	<5.5	--	--	--	--
Kanuti River (19040604)											
662603150380700	Ka-S1	3/14/1972	0.0	--	5	7.8	7.2	--	--	82	--
Ramparts (19040404)											
15453500	Ra-S1	8/22/2005	13.4	--	--	11.6	7.9	148	--	140	616
Tolovana (19040509)											
652753148374900	To-S1	3/14/1972	0.5	--	20	0.4	7.6	--	--	184	--
Lower Tanana (19040511)											
N/A – see TF-S1											
Nenana River (19040508)											
15518250	Ne-S1	8/25/1972	11.5	--	130	--	7.0	--	--	48	--
15518040	Ne-S2	7/31/1991	7.3	85	80	11.0	7.8	170	--	148	--
15516200	Ne-S3	9/27/1972	1.0	--	0.0	--	7.6	--	--	95	--
Tanana Flats (19040507)											
15515500	TF-S1	8/30/2005	10.9	--	--	10.7	7.9	182	--	E 167	1090

°C = degrees Celsius; NTU = nephelometric turbidity units; Pt-Co = Platinum Cobalt units mg/L = milligrams per liter; pH = measure of the acidity or alkalinity of a solution s.u. = standard units µg/L = micrograms/liter E means estimated, N/A means not available

Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.

Source: USGS 2010c (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

Table 5.2-12 illustrates the ADEC's classification of waterbodies in the Interior-Yukon Hydrologic Subregion. There is one waterbody in Category 5, which lists impaired waters identified under section 303(d) of the CWA. Most of the waterbodies remain unclassified, but it is likely that they would be placed in Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

TABLE 5.2-12 ADEC Waterbody Classification – Interior-Yukon Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Upper Koyukuk River	0	0	0	0	0
South Fork Koyukuk River	0	0	0	0	0
Kanuti River	0	0	0	0	0
Ramparts	0	0	Minook Creek	0	0
Tolovana River	0	0	Chatanika River	0	Goldstream Creek
Lower Tanana River	0	0	0	0	0
Nenana River	0	0	Lignite Creek	0	0
Tanana Flats	0	0	Bear Creek Birch Lake McDonald Creek Pile Driver Slough Quartz Lake Shaw Creek	0	0

Source: ADEC 2010.

Goldstream Creek in the Tolovana River Watershed is listed in Category 5 as impaired by the ADEC as described below.

Tolovana River Watershed

Goldstream Creek was first listed in 1992, and does not meet the WQS for turbidity. The area of concern is 70 miles up river near Fairbanks. The ADEC determined that existing controls were sufficient to address the issue, and a formal TMDL was not prepared. Sampling was not conducted from 1996 through 2010 (ADEC 2010).

Groundwater

Groundwater Availability

Groundwater is available in the Interior-Yukon Hydrologic Subregion because permafrost is not continuous. Table 5.2-13 presents WELTS data on private wells in the Interior-Yukon Hydrologic Subregion.

TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Umiat	7S	14E	3	1	DENALI NATIONAL PARK HOTEL & RILEY CREEK & TOKLAT CAMPS	404, 158, 130	UNKNOWN	UNKNOWN	1963
Umiat	7S	14E	25	10	R23B&C (Various)	74 - 141	37 - 99	5 - 55	1982 - 2006
Fairbanks	29N	12W	1	1	R7 (SOUTH OF CLEAR, AK - 388 PIT (M388 OF RAILROAD?))	180	110	50	4/16/1998
Fairbanks	19N	4W	19	2		420, 180	6, 2	10, 8	1974
Fairbanks	13N	11W	36	2	R7 (MCKINLEY CREEKSIDE CABINS)	97 , 120	42, 55	70, 100	2003, 2005
Fairbanks	1N	1W	35	1	DENALI GRIZZLY BEAR PARK 3	165	82	19.5	4/26/1993
Fairbanks	1N	1W	36	9	8 in R7, 1 in R10	47 - 440	40 - 258	2 - 300	1983 - 2004
Fairbanks	1N	2W	5	1	MCKINLEY VILLAGE, DENALI HOMESTEAD L5B	190	135	20	6/23/2001
Fairbanks	1N	2W	6	15	14 in R7, 1 in R8	180 - 440	38 - 228	3 - 20	1983 - 2003
Fairbanks	1N	2W	7	35	R10 (Spinach Creek, Frenchman Dr., Foxfire Subd.)	150 - 400	45 - 268	0.5 - 18	1974 - 2000
Fairbanks	1N	3W	8	4	R10 (Various)	59 - 247	8 - 180	10 - 15	1954 - 1982
Fairbanks	4S	8W	7	6	Region 7	180 - 394	90 - 170	2.5 - 30	1983 - 1997
Fairbanks	8S	9W	16	1	R10 (TL1607, TRILBY AVENUE)	233	83	4-5	4/19/2001
Fairbanks	8S	9W	18	2	PARKS HIGHWAY M227.2 & M227.4	249, 158	195, 115	30, 25	11/3&6/98
Fairbanks	8S	9W	21	2	R10 (Fairbanks)	164, 252	UNKNOWN	UNKNOWN	UNKNOWN
Fairbanks	8S	9W	22	2	R10 (SHEEP CREEK ROAD #830, TL2210; Fairbanks)	322	DRY?		
Fairbanks	10S	8W	19	1	PARKS HIGHWAY M227.8, DENALI PARK	186	132	5	10/12/1999

TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

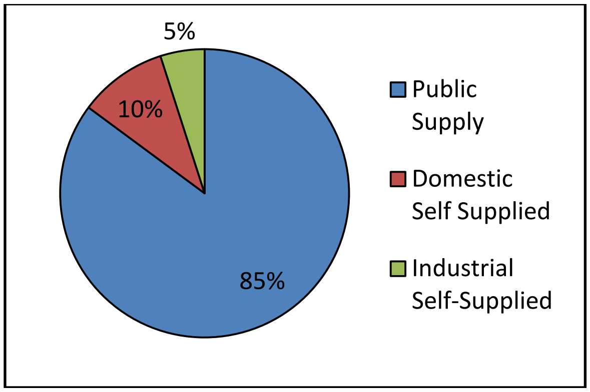
Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Fairbanks	12S	8W	26	7	R10 (Various)	150 - 400	91 - 150	3 - 12	1954 - 1997
Fairbanks	13S	7W	1	1	LITTLE COAL CREEK	225	Dry	Dry	11/11/1983
Fairbanks	13S	7W	27	7	R10 (Sheep Ck; Happy Ck; NINE MHILL ROAD 688, TL2732)	196 - 300	80 - 110	9 - 25	1979 -1984
Fairbanks	14S	7W	35	9	R10 (Various)	85 - 200	50 - 134	5 - 18	1963 - 2010
Fairbanks	14S	7W	36	4	R10 (Various)	124 - 233	56 - 80	1 - 2.5	1961 - 1974
Fairbanks	15S	6W	11	9	R10 (Murphy Dome Rd; Drouin Spring)	92 - 270	71 - 234	4 - 15	1975 - 1989
Fairbanks	15S	6W	14	1	R7 (Cantwell)	40	4	40	2002
Fairbanks	15S	6W	16	1	R10 (SKYLINE HEIGHTS 1 L11 B2)	365	300	10	7/9/2007
Fairbanks	15S	7W	33	2	R7 (Cantwell)	40, 40	12, 10	25, 40	1996
Fairbanks	20S	10W	14	2	OLD WOOD ROAD 1069 / OLD NENANA HIGHWAY	380	210	8	8/1/1998
Seward	32N	3W	34	18	R7	43 - 760	12 - 116	1.5 - 150	1984 - 2000
Seward	26N	5W	26	2	R6 (TAPS 06, PIPE M355, ELEV 877 FT, NEAR YUKON RIVER)	800, 275	606, flowing	30, 20	1976, 1975
Seward	26N	5W	21	1	DENALI RIVERSIDE RV PARK	160	80	60	6/23/1996
Seward	24N	5W	24	4	R7	138 - 480	127 - 270	0.5 - 20	1998 - 2004
Seward	22N	4W	23	1	MARION CREEK CAMPGROUND 1	50	18.5	90	7/31/1993
Seward	21N	4W	2	1	M25.5 PARKS HIGHWAY, HEALY	280	155	7	3/31/1981
Seward	21N	4W	12	3	Healy Area	100, 80, 73	73, 53, 63	15, 30, 15	1995 - 1998
Seward	21N	4W	13	26	R7, R8, R10	60 - 360	39 - 238	2 - 70	1984 - 2005
Seward	20N	5W	7	1	YUKON RIVER BRIDGE	240	142	21.4	6/17/1974

TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Seward	20N	4W	20	1	PARKS HIGHWAY M260.0 ROCK CREEK	40	9	7	6/24/2001
Seward	16N	4W	7	2	R7 (ASLS 85-237 Tr A; PARKS HIGHWAY M264.5, HEALY - No well data)	400	265	250	6/9/2000
Seward	16N	4W	15	1	R7 (QUOTA L20 B13)	220	190	10	1985
Seward	15N	4W	12	1	R7 (REX TRAIL)	515	426	6	8/27/2000
Seward	15N	4W	14	2	R7 (PARKS HIGHWAY M278 & M276)	229, 216	190, 192	10, 10	1986, 2001

Groundwater Use

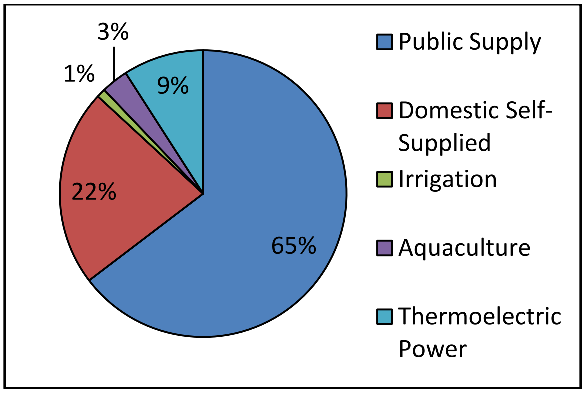
The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River watersheds are all located entirely within the Yukon-Koyukuk Census Area. Based on data provided previously in Table 5.2-2, the groundwater use is (85 percent) public supply, with 10 percent and five percent used for domestic self-supplied, and industrial self-supplied respectively (Figure 5.2-9).



Source: USGS 2010b.

FIGURE 5.2-9 Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River Watersheds – 2005 Fresh Ground Water Use (Percent)

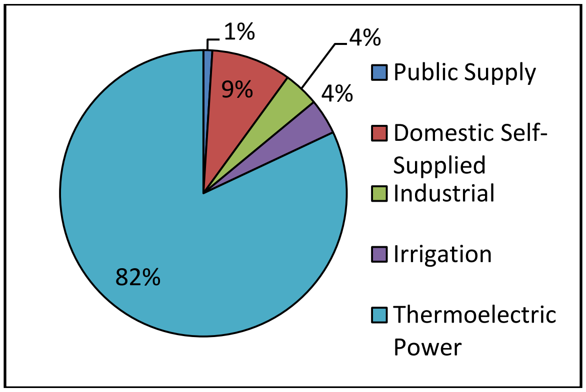
The Tolovana and Tanana Flats Watersheds are represented by the Fairbanks North Star Borough estimates. As shown in Figure 5.2-10, well over half (65 percent) is used for public supply, about a quarter (22 percent) for domestic self-supplied, and 9 percent for thermoelectric power with lesser amounts 3 percent and 1 percent for aquaculture and irrigation uses respectively.



Source: USGS 2010b.

FIGURE 5.2-10 Tolovana River and Tanana Flats Watersheds – 2005 Fresh Ground Water Use (Percent)

The Nenana River Watershed is entirely in the Denali Borough. As shown in Figure 5.2-11, the groundwater use in this watershed is 82 percent thermoelectric power, 9 percent domestic self-supplied, 4 percent industrial, 4 percent irrigation, and 1 percent use for public supply.



Source: USGS 2010b.

FIGURE 5.2-11 Nenana River Watershed – 2005 Fresh Ground Water Use (Percent)

Groundwater Quality

The Interior-Yukon Hydrologic Subregion has no PWSs with groundwater as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS groundwater quality sites in the Yukon-Koyukuk Hydrologic Subregion are located within the proposed Project area (Appendix G). The Project ROW in this subregion generally follows the TAPS ROW.

The data available in the Upper Koyukuk River watershed (UK-G1, not shown in Appendix G) is relatively recent (2003), but data collected only covers a few parameters. It is located at Anakutuvuk Pass (which is not in the Project area) and may not be representative because it does not represent effects from the development of the TAPS. There were no USGS groundwater monitoring sites with water quality data found in the South Fork Koyukuk or Ramparts watersheds. The Kanuti River watershed had data (Ka-G1) near the TAPS but was collected before the TAPS was constructed so again it may not be representative.

The Tolovana River watershed had no sites that met the selection criteria; however, Site To-G1, near Minto, is likely representative because most of Project area in this watershed was not affected by the development of the TAPS. The data was collected in 1971, this site is more than ten miles from the Project area. Site To-G1 met the WQS for color, pH, and total dissolved solids for all water uses (Table 5.2-14).

The Lower Tanana River watershed had no sites that met the selection criteria (Table 5.2-14). However, Site LT-G1 is likely representative because most of Project area in this watershed is not affected by the TAPS. The data is from 1971 and the site is more than ten miles from the Project area. Site LT-G1 shows groundwater quality in the watershed met WQS for color, pH, and total dissolved solids for all water uses. There is no groundwater quality data in the Nenana River watershed after 1970.

The Tanana Flats watershed had no sites that met the selection criteria (Table 5.2-14). Site TF-G1 is listed but is fairly distant from the Project area and the data was collected in 1979. Although there has likely been some population growth in this corridor since 1979, this is the most representative data for this watershed (Table 5.2-14). The data from TF-G1 shows the groundwater quality in this area met the WQS for temperature and pH for all water uses.

TABLE 5.2-14 Summary of Groundwater Quality – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Upper Koyukuk River (19040601)											
680805151443001	UK-G1	9/10/2003	1.7	--	--	12.0	7.8	--	--	E-143	--
South Fork Koyukuk (19040602)											
N/A - see Ka-G1											
Kanuti River (19040604)											
66273410383601	Ka-G1	5/2/1974	3.0	--	6	--	8.3	--	--	--	--
Ramparts (19040404)											
N/A - see Ka-G1											
Tolovana (19040509)											
650920149202501	To-G1	5/10/1971	--	--	5	--	7.2	--	--	366	--
Lower Tanana (19040511)											
645320149105501	LT-G1	5/10/1975	--	--	5	--	7.2	--	--	366	--
Nenana River (19040508)											
N/A											
Tanana Flats (19040507)											
644235147090001	TF-G1	8/30/1979	9.0	--	--	--	7.2	--	--	--	--

°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

Floodplains

Peak flows from rivers that originate on the south side of the Brooks Range (Upper Koyukuk) are triggered by intense rainfall (BLM 2002). The rivers originating in the Alaska Range (Nenana) are characterized by low winter flows and wide braided channels with aufeis. The headwaters of the other rivers exist either in the area between the Brooks Range and the Alaska Range (South Fork Koyokuk, Kanuti, Tolovana, Tanana Flats, and Lower Tanana); or the watershed does not include the headwaters of the associated river (Yukon River in the Ramparts watershed).

The Project area in the Interior Hydrologic Subregion is in the Yukon-Koyukuk Census Area and the Denali Borough. There are no available FEMA floodplain maps for either of these areas (FEMA 2011). There are 16 gaging stations with peak streamflow data available near the Project area in the Interior Yukon Hydrologic Subregion. Table 5.2-15 summarizes the peak streamflow elevations at these gaging stations. The Stream High Water Marks Maps presented in Appendix G show the maximum elevation of record (or high water mark) about two miles upstream of gaging stations on major rivers and about one mile upstream of gaging stations on tributaries. The high water marks represent from four to 48 years of data, but probably do not reflect a 100-year flood.

TABLE 5.2-15 Peak Streamflow Elevation Data Near Project – Interior-Yukon Hydrologic Subregion

Watershed and Site ID	Name	Water Years of Record[1]	Length of Record (years)[2]	Number of Missing Years[2]	Maximum Known Elevation over Length of Record (feet above sea level) and Year Occurred
Upper Koyokuk (19040601)					
15564864	Dietrich River Trib near Wiseman	2004-2009	6	0	2,146[3] (2009)
15564868	Snowden Creek near Wiseman	1977-2004	28	0	1,678[5] (1991)
15564875	Koyukuk River near Wiseman	1968-1994	27	11	1,114[5] (1973)
15564877	Wiseman Creek at Wiseman	1971-1994	24	13	1,140[4,5] (1994)
15564879	Slate Creek at Coldfoot	1981-2009	29	0	1,070[5] 1984)
South Fork Koyukuk (19040602)					
15564887	Bonanza Creek Trib near Prospect Camp	1975-2009	35	0	1066 (2009)
Kanuti (19040604)					
n/a	n/a	n/a	n/a	n/a	n/a
Ramparts (19040404)					
15453610	Ray River Trib near Stevens Village	1977-2009	33	0	622[5] (1994)
15453500	Yukin River near	1977-2009	33	0	300 (1992)

TABLE 5.2-15 Peak Streamflow Elevation Data Near Project – Interior-Yukon Hydrologic Subregion

Watershed and Site ID	Name	Water Years of Record[1]	Length of Record (years)[2]	Number of Missing Years[2]	Maximum Known Elevation over Length of Record (feet above sea level) and Year Occurred
	Stevens Village				
15457800	Hess Creek near Livengood	1971-2009	39	25	518 (2009)
Tolovana (19040509)					
n/a	n/a	n/a	n/a	n/a	n/a
Lower Tanana (19040511)					
n/a	n/a	n/a	n/a	n/a	n/a
Tanana Flats (19040507)					
15515500	Tanana River at Nenana	1962-2009	48	0	357[5] (1967)
Nenana (19040508)					
15518300	Nenana River near Rex	1965-1968	4	0	702[4] (1968)
15518080	Lignite Creek near Healy	1986-2009	24	0	1,311[5] (1986)
15518000	Nenana River near Healy	1951-1979	29	0	1,284[5] (1967)
15517980	Dragonfly Creek near Healy	1990-2008	19	1	1517 (2007)
15516198	Slime Creek at Intertie near Cantwell	1990-1995	6	0	2,206[4] (2007)
15516000	Nenana River near Windy	1951-1981	31	0	2,110[5] (1962)

[1] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.

[2] Length of record is the number of years between the first and last year of record. The number of missing years is shown in column 5.

[3] Gage height affected by backwater.

[4] Gage height not the maximum for the year.

[5] Gage height at different site and (or) datum.

Source: USGS 2010e. (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

5.2.1.7 Southcentral Hydrologic Subregion

This hydrologic subregion includes the south side of the Alaska Range and the Matanuska-Susitna Valley (TAPS Owners 2001). The south side of the Alaska Range descends into the Matanuska-Susitna Basin. The Alaska Range trends east-west and possesses discontinuous permafrost (TAPS Owners 2001). The Project area includes the Chulitna River and Lower Susitna River watersheds.

Chulitna River Watershed – HUC 19020502 (2,590.87 sq. miles): The Chulitna River originates in the Alaska Range south of Broad Pass on the Parks Highway. The headwaters are glacier-fed and flow south along the Parks Highway to Talkeetna, where it joins the Susitna River and discharges into the Lower Susitna River watershed. The Project area generally follows the Parks Highway.

Lower Susitna River Watershed – HUC 19020505 (3,703.25 sq. miles): The Lower Susitna River originates in the Talkeetna Mountains (in the Upper Susitna watershed) which joins with the Chulitna River and flows south through the Lower Susitna watershed and into the Cook Inlet. Much of the Upper and Lower Susitna River watersheds are low-lying, low gradient areas that moderate the influence of the mountainous terrain (STB 2011). The Project area intersects the Lower Susitna watershed, starting at Talkeetna and ending at the Project terminus.

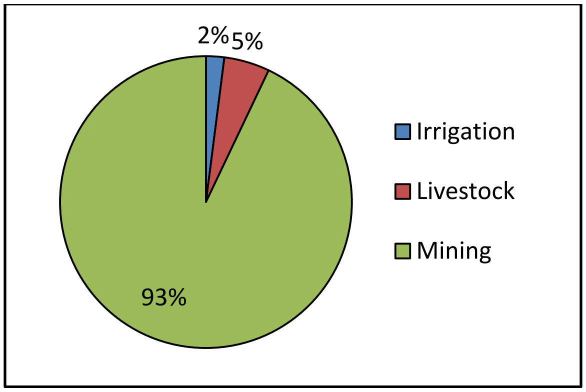
Surface Water

Surface Water Availability

The rivers and streams that cross the proposed Project are shown in Appendix E arranged from north to south. Appendix F illustrates the location, surface area, and type of lake or pond located within 1 mile on either side of the Project ROW in the Southcentral Hydrologic Subregion.

Surface Water Use

The Southcentral Hydrologic Subregion consists of a couple different boroughs and census areas (Figure 5.2-4 and Appendix G). The Chulitna and Lower Susitna River watersheds are entirely encompassed within the Matanuska-Susitna (Mat-Su) Borough. Based on data provided previously in Table 5.2-1, surface water is used primarily for mining (93 percent) with five percent for livestock and 2 percent for irrigation as shown in Figure 5.2-12.



Source: USGS 2010b.

FIGURE 5.2-12 Chulitna and Lower Susitna River Watersheds – 2005 Fresh Surface Water Use (Percent)

Surface Water Quality

The Southcentral Hydrologic Subregion has no PWSs with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are located within the proposed Project area (Appendix G) and this segment of the Project is not associated with the TAPS ROW. The Chulitna River watershed has three sites (Chu-S1, Chu-S2, and Chu-S3) that met the selection criteria listed in Section 5.2.1; this data was collected in 2000, 1974, and 1985 respectively. There has been population growth in this corridor since 1985, so the 2000 data collected at Chu-S1 is probably the only representative data available. Based on the data from Chu-S1, the fresh surface water in the Chulitna River watershed met the WQS for temperature, dissolved oxygen, pH, total dissolved solids, and suspended sediments for all water uses (Table 5.2-16).

The Lower Susitna River watershed has three sites (LS-S1, LS-S2, and LS-S3) that met the selection criteria listed in Section 5.2.1; this data was collected in 1985, 1983, and 1973 respectively (Table 5.2-16). The Project area is not associated with the TAPS ROW. There has been population growth in this corridor since 1985, so it is questionable whether any of these sites show representative data. Note that Big Lake and Cottonwood Creek are on the ADEC list for impaired waters, as described in Section 5.2.1.

In 2008, the State Transportation Board Section of Environmental Analysis collected surface water quality data at selected streams near the Port MacKenzie Rail Line Extension (STB 2011). This data is presented in Table 5.2-17.

TABLE 5.2-16 Summary of Surface Water Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment mg/L)
Chulitna River (19020502)											
15292302	Chu-S1	9/7/2000	5.3	--	--	13.2	7.5	67.3	--	E 35	<1
624431150070600	Chu-S2	6/11/1974	14.0	--	3	--	--	--	--	30	--
15292410	Chu-S3	9/17/1985	3	--	--	--	--	--	--	--	544
Lower Susitna River (19020505)											
15292780	LS-S1	6/25/1985	9.2	190	--	10.5	8.2	--	--	73	488
15294012	LS-S2	7/26/1983	14.0	--	--	9.7	7.0	--	--	--	--
614300150064900	LS-S3	6/19/1973	15.5	--	4	--	7.6	--	--	78	--

°C = degrees Celsius.
NTU = nephelometric turbidity units.
Pt-Co = Platinum Cobalt units.
mg/L = milligrams per liter.
pH = measure of the acidity or alkalinity of a solution.
s.u. = standard units.
µg/L = micrograms/liter.
E means estimated, N/A means not available.
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

TABLE 5.2-17 Surface Water Quality Data Collected by SEA for Port MacKenzie Rail Extension Project

Longitude	Latitude	Map ID	Dissolved Oxygen (mg/L)	Temperature (°C)	Turbidity (NTUs)	Total Dissolved Solids (mg/L)	pH (s.u.)	Conductivity (µS/cm)	Port Mackenzie Segment and MP
-150.137363000	61.441757000	STB-S1	9.9	13.8	4	130	7.6	201	C1-2.6
-150.114200000	61.472380000	STB-S2	11.9	16.7	120	120	7.5	179	H-0.8
-150.153980000	61.377590000	STB-S3	10.0	14.7	92	140	7.1	200	MW-11.0
-150.136320000	61.368830000	STB-S4	12.3	6.2	15	160	6.9	240	MW-10.1
-150.072770000	61.306850000	STB-S5	9.7	12.8	4	100	7.5	160	MW-4.6
-150.063967000	61.810311000	STB-S6	11.9	15.6	64	80	7.2	127	MP-190.3
-150.063740000	61.791420000	STB-S7	10.1	13.6	27	60	6.8	80	MP-189
-150.124950000	61.778160000	STB-S8	11.8	11.4	12	50	6.2	70	W-24.0
-150.148625000	61.735021000	STB-S9	11.5	11.9	27	80	7.3	118	W-20.9
-150.158330000	61.678370000	STB-S10	7.2	13.7	9	80	6.9	120	W-16.7
-150.211930000	61.592310000	STB-S11	10.7	18.9	54	60	7.1	90	W-10.0
-150.138240000	61.472220000	STB-S12	12.3	14.1	5	70	7.6	110	W-0.6

mg/L = milligrams per liter; °C = degrees Celsius; NTU = nephalometric turbidity units; pH = measure of acidity or alkilinity of a solution; s.u. = standard units; µS/cm = micro-siemens per centimeter

Source: STB 2011.

Table 5.2-18 shows the ADEC's classification of waterbodies in the Southcentral Hydrologic Subregion. There are two waterbodies included in Category 5, which are impaired waters identified under section 303(d) of the CWA. Most of the waterbodies remain unclassified, but the ADEC expects that most would be in Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

TABLE 5.2-18 ADEC Waterbody Classification – Southcentral Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Chulitna River	0	0	0	0	0
Lower Susitna River	0	Cottonwood Creek	Birch Creek Canoe Lake Cottonwood Lake Deshka River Finger Lake Goose Bay Goose Creek Kalmbach Lake Little Susitna River Meadow Creek Memory Lake Montana Creek (Talkeetna) Nancy Lake Susitna River Wasilla Creek Wasilla Lake Willow Creek	Lake Lucille	Big Lake Cottonwood Creek

The Category 5 waterbodies listed as impaired by the ADEC are Big Lake and Cottonwood Creek in the Lower Susitna River watershed. The Category 4a waterbody listed as having an EPA-approved TMDL is Lake Lucille in the Lower Susitina River watershed. The Category 5 listings are described below.

Lower Susitna River Watershed

Big Lake - the area of concern is 1,250 acres located in Wasilla for the Petroleum Hydrocarbon WQS. The ADEC states: "Big Lake was Section 303(d) listed in 2006 for non-attainment of the petroleum hydrocarbon (TAH) water quality standard. DEC collected water quality information at Big Lake in the open water months in 2004, 2005 and 2009. Petroleum hydrocarbon (TAH) sampling was conducted in the water column at multiple sites, depths, and degrees of motorized watercraft activity throughout the lake. Sampling sites in areas that received heavier use by motorized watercraft consistently exceeded the WQS for TAH and the concentrations are likely influenced by a combination of good weather and time of season. The sample events that coincided with the higher mean temperatures are likely also prime recreational dates based on the increased motorized watercraft usage at these times. Specifically, the areas of impairment together equal an estimated 1,250 acres and are seasonal in nature, from May 15 to September 15 with particular impairment issues on two holiday weekends (Memorial Day and Independence Day). The following specific areas in the east basin are the areas of impairment: harbors and marinas, launch areas, and traffic lanes. Sampling was conducted outside these specific areas and exceedances were not identified. Although no water quality samples were collected below five meters, it is considered unlikely that petroleum contaminated sediment is a concern. The source of petroleum is from motorized watercraft. Management measures will focus on reducing petroleum hydrocarbon inputs at harbors and marinas, launch areas, and traffic lanes of the east basin on busy holiday weekends." (ADEC 2010).

Cottonwood Creek – the area of concern is 7 miles of Cottonwood Creek located in Wasilla for the Fecal Coliform Bacteria WQS. The Alaska Department of Environmental Conservation states: "Cottonwood Creek (13 miles) was Section 303(d) listed in non-attainment of the residues standard for foam and debris in 2002/2003. DEC has received numerous complaints about foam in Cottonwood Creek and foam was observed in the creek in 1998, 2000, 2001, and 2002. Through grant funds, an intensive water quality evaluation was conducted on Cottonwood Creek beginning in September 2004 and continuing through June 2006 for a TMDL assessment. Water quality sampling conducted in 2004 and 2005 indicated that the foam present in Cottonwood Creek is most likely naturally occurring. However, hydrologic changes within the watershed may be influencing the amount and timing of the foam. Continued water quality sampling in 2006 focused on determining the extent of FC bacteria and temperature exceedances discovered during the sampling for foam, as well as further investigation of the foam. Foam and temperature were determined to be naturally occurring hence meeting WQS. FC bacteria exceeded WQS, and the source(s) is unknown. Cottonwood Creek is now in Category 2 for attainment of the residues (foam) standard and impaired for FC bacteria." (ADEC 2010).

Groundwater

Groundwater Availability

Groundwater is available in the Southcentral Hydrologic Subregion because permafrost is not continuous. Table 5.2-19 presents data on private wells in the Southcentral Hydrologic Subregion from WELTS (ADNR 2011).

TABLE 5.2-19 Well Data from WELTS – Southcentral Subregion

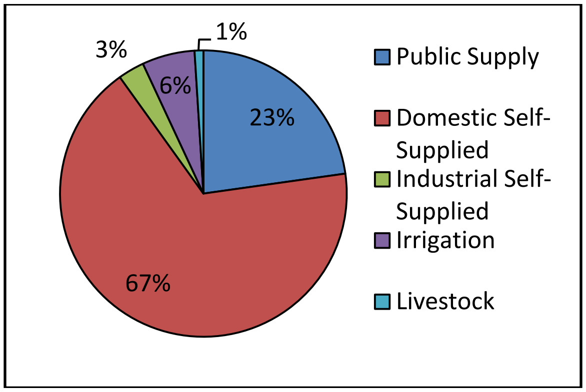
Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Fairbanks	1N	2W	18	1	R23C (SUSITNA LANDING L05 PLAT80)	219	19	60	9/20/2000
Fairbanks	15S	6W	20	4	R23C (McKinley View Estates; PARKS HIGHWAY M135.0)	60 - 260	42 - 65	0.7 - 200	1970 - 2004
Fairbanks	2N	1E	3	5	R23C (PARKS HIGHWAY M147.0, BYERS LAKE; Byers Creek Landing)	59 - 259	24.5 - 108	2.83 - 20	1995 - 1996
Fairbanks	1N	2W	19	1	R23C (CASWELL AREA)	145	24	40	7/27/2001
Fairbanks	12S	8W	30	1	R23B (SPACIOUS KASWITNA ES L6 B1)	61	35	600	9/28/1985
Fairbanks	15S	6W	31	4	R23C (PARKS HIGHWAY M191)	70 - 100	40 - 53	6 - 40	1988 -1997
	19N	4W	32	5	R23C (Timber Park)	37 - 60	10.1	40	1984 - 1998
Fairbanks	1N	2W	29	5	R23C (SUNSHINE AREA)	38 - 96	18 - 65	7.5 - 40	1984 - 1987
Fairbanks	1N	2W	32	3	R23A&C (Matsu HS; Sunshine HS; Montana Cr, Talkeetna)	60 - 120	38	50	1972 - 1991
Fairbanks	1N	2W	13	3	R23C (MATSU SUNSHINE Landfill)	33, 70, 42	no wells	no wells	no wells
Fairbanks	1N	3W	14	2	R23C (PARKS HIGHWAY M102.8, SUNSHINE)	146, 174	80, 67	10, 40	1985, 1997
Fairbanks	1N	2W	20	1	R23C (Trapper Creek)	40	29	24	5/22/1996
Fairbanks	14N	4W	13	1	PARKS HIGHWAY M188.5	285	127	45	5/21/1973
Fairbanks	14S	7W	15	1	R23C (WHEATLEY L01 B2, SUSITNA RIVER RD)	89	75	10	10/18/2007
Fairbanks	17S	7W	4	1	DENALI HIGHWAY M133.5, CANTWELL	50	14	50	5/15/1992
Seward	30N	5W	29	2	R23A (GOOSE CRK ESTATES L02	60, 65	22.25	40	1999

TABLE 5.2-19 Well Data from WELTS – Southcentral Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
					B1&B3)				
Seward	29N	5W	32	2	R23C (PARKS HWY M 84.5 & 85.0)	87	30	10, 65	1974, 2003
Seward	26N	5W	32	1	R23C (PARKS HIGHWAY M114.2)	40	6	40	6/7/1991
Seward	24N	4W	17	3	R23C (PARKS HIGHWAY M094.5)	60 - 82	44	12, 36	1983, 2002
Seward	24N	4W	30	3	R23B (Various)	60, 61, 85	32, 36, 50	7, 20, 18	1991 - 2004
Seward	24N	5W	13	1	R23B (L012, 4500 E WILLOW CIRCLE)	100	26	16	10/24/2007
Seward	23N	4W	7	1	R23C (L009, KASHWITNA AREA)	128	18	20	8/28/1991
Seward	23N	4W	8	4	R23C (Montana Creek)	40 - 75	15 - 21	4, 40	2000 - 2003
Seward	23N	4W	17	2	R23C (SHEEP CREEK AREA; Willow)	50, 80	42, 20	20	1984, 1996
Seward	23N	4W	29	2	R22C & R23B (Willow);	55, 112	10, 38	33, 38	1965, 2007
Seward	22N	4W	4	2	R23C (TROUBLESOME CREEK)	64, 101	9.5, 77	50, 10	1983
Seward	20N	4W	6	6	R23B (Willow Area)	69 - 191	3' above - 50' below GL	25 - 126	1979 - 1988
Seward	20N	5W	29	11	R23C (Trapper Creek)	34 - 250	6 - 37	6 - 75	1973 - 1996
Seward	16N	5W	35	3	R23A (PT. MACKENZIE AGRICULTURAL PROJECT)	40 - 241	40 - 239	2 - 28	1982, 1984
Seward	14N	4W	6	13					

Groundwater Use

The Southcentral Hydrologic Subregion consists of a couple boroughs and census areas. Well over half (67 percent) of the groundwater is used for domestic self-supplied, about a quarter (23 percent) for public supply, 6 percent for irrigation, 3 percent for industrial self-supplied, and 1 percent for livestock use as shown in Figure 5.2-13.



Source: USGS 2010b.

FIGURE 5.2-13 Chulitna and Lower Susitna River Watersheds – 2005 Fresh Groundwater Use (Percent)

Groundwater Quality

The Southcentral Hydrologic Subregion has two PWSs with groundwater as a primary source listed on the EPA's SNC List with a score of 11 or higher (ADEC 2011b). These include:

- Bluffview Acres Water System (AK2223624) (Community Water System) for arsenic, located in Wasilla; and
- East Big Lake Water System (AK2224581) (Non Transient Non Community System) for arsenic and LCR, located in Big Lake.

None of the selected USGS groundwater quality sites in the Southcentral Hydrologic Subregion are within the proposed Project area (Appendix G). The USGS groundwater monitoring sites did not have water quality data for the Chulitna River watershed. See the Lower Susitna for representative groundwater quality sites.

The Lower Susitna River watershed has three sites (LS-G1, LS-G2, and LS-G3) that met the selection criteria; however, there has been substantial population growth since 1977 when LS-G2 data was collected. Only LS-G1 and G3 are considered representative of the Project area. At LS-G1, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature and pH for all water uses. At LS-G3, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature, pH, and total dissolved solids for all water uses (Table 5.2-20).

TABLE 5.2-20 Summary of Groundwater Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Chulitna River (19020502)											
N/A											
Lower Susitna River (19020505)											
621019150070401	LS-G1	6/13/1991	5.5	--	--	--	6.6	--	--	--	--
615937150025001	LS-G2	6/2/1977	--	--	11	--	--	--	--	98	--
61391014949301	LS-G3	7/12/2000	5.0	--	--	--	7.5	--	--	E 182	--

°C = degrees Celsius.
NTU = nephelometric turbidity units.
Pt-Co = Platinum Cobalt units.
mg/L = milligrams per liter.
pH = measure of the acidity or alkalinity of a solution.
s.u. = standard units.
µg/L = micrograms/liter.
E means estimated, N/A means not available.
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

Floodplains

The timing of peak flow of rivers in this region depends largely on the gradient of the watershed and is reflected in annual rainfall-runoff hydrographs. The Project area in the Southcentral Hydrologic Subregion is located within the Mat-Su Borough, and there are no available FEMA floodplain maps for the specific area of the proposed Project ROW (FEMA 2011). Areas within the Project footprint that are not mapped by FEMA are designated as having possible but undetermined flood hazard risks.

There are 5 gaging stations with peak stream flow data available near the Project area in the Southcentral Hydrologic Subregion. Table 5.2-21 summarizes the peak streamflow elevations at these gaging stations. The Stream High Water Marks Near Project Map for the Southcentral Hydrologic Subregion presented in Appendix G shows the maximum elevation of record (or high water mark) about two miles upstream of gaging stations on major rivers and about one mile upstream of gaging stations on tributaries. The high water marks represent from four to 49 years of data, but probably do not reflect a 100-year flood.

TABLE 5.2-21 Peak Streamflow Elevation Data Near Project – Southcentral Hydrologic Subregion

Watershed and Site ID	Name	Water Years of Record[a]	Length of Record (years)[b]	Number of Missing Years[b]	Maximum Known Elevation over Length of Record (feet above sea level) and Year Occurred
Chulitna (19020502)					
15292400	Chulitna River near Talkeetna	1958-2006	49	17	547 (2006)
Lower Susitna (19020505)					
15292800	Montana Creek near Montana	1963-2009	47	17	270[c] (1986)
15292990	Sheep Creek near Willow	1984-1987	4	0	230 (1986)
15293000	Caswell Creek near Caswell	1963-1987	25	0	199 (1986)

[a] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.

[b] Length of record is the number of years between the first and last year of record. The number of missing years is shown in column 5.

[c] Discharge is an historic peak.

Source: USGS 2010e. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

5.2.2 Environmental Consequences

This section describes the temporary (construction) and permanent (operation and maintenance) activities; and direct and indirect potential impacts of the proposed Project on surface water, groundwater, and floodplains. Other sections address potential impacts to other resources associated with water resources, such as 5.4 (Wetlands), 5.6 (Fisheries), 5.14 (Subsistence), and 5.17 (Navigation).

5.2.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed, and there would be no surface water, groundwater, or floodplain impacts.

5.2.2.2 Proposed Action

Preconstruction Activities

Water Requirements

Substantial water quantities would be required for Project development. Water would be withdrawn from permitted lakes and reservoirs for ice road and pad construction and for temporary work camps. A minimum of 1,007 million gallons of water would be required to support construction activities for the proposed Project (AGDC 2011d). Details on proposed water requirements are included in Table 5.2-22. Impacts to water resources would include altered water quality from water withdrawals including decreased oxygen concentrations, increased organic matter, turbidity and changes to pH (AGDC 2011c). Additional impacts would occur to other resources that rely on water, which would include fisheries resources (Section 5.6).

Ice Roads

Ice roads would be developed in the Arctic region over the two winter construction seasons to access waterbodies, and to construct the ROW. Ice chips and unfrozen water would be used to build and maintain ice roads throughout the construction season. Proper ice road development would not adversely affect surrounding water resources. Ice bridges may form and persist across rivers and streams where ice roads were developed. Ice roads and potential bridges would melt slower than the surrounding ice in the stream; however, standard ice road mitigation includes slotting the ice at stream crossings and outlets before breakup to allow streams to flow as the snow pack melts. The primary impact from ice bridging across streams would include flooding during spring break up resulting in increased sedimentation loads which is also natural during spring break up from floods. This would be expected to be a temporary and local impact to water resources; however, would also impact fisheries resources as noted in Section 5.6 Fisheries.

TABLE 5.2-22 Water Requirements (Million Gallons)

	Ice Workpads	Ice Access Roads	Hydrotesting	Earthwork	Total
Spread 1 - GCF (MP-0) to Chandalar Shelf (MP-183)	394.94	0.10	15.50	24.50	435.04
Spread 2 - Chandalar Shelf (MP-183) to Yukon River (MP-360)	0.00	0.00	20.18	187.65	207.83
Spread 3 - Yukon River(MP-360) to Healy (MP-529)	155.51	0.00	19.27	100.94	275.72
Spread 4 - Healy (MP-529) to Beluga South Terminus ((MP-737)	69.39	0.00	23.71	73.45	166.55
Fairbanks Lateral (MP-459) to Fairbanks	0.00	0.00	0.88	2.00	2.89
Total					1,088.02

Source: AGDC 2011d.

Pipeline Facilities

<u>Mainline</u>

Construction

The Project ROW would be 737 miles in length and extend from Prudhoe Bay to an area near the Upper Cook Inlet. The water resources potentially impacted within the proposed Project area are included in Figure 5.2-1. The proposed ROW would generally follow the TAPS ROW and the Dalton Highway corridors from Prudhoe Bay to Livengood. At Livengood the ROW would follow a southerly route through Minto Flats, joining the George Parks highway near Nenana. The ROW would cross approximately 495 waterways and drainages, of which 27 are major streams, 75 have been confirmed as anadromous streams and an additional 7 have been nominated for inclusion in the Anadromous Waters Catalog (AGDC 2011d). The pipeline would be buried approximately five feet deep throughout the entire length of the ROW except for the first six miles and at elevated pipeline bridge and highway stream crossings, compressor stations, possible fault crossings, pigging facilities, and off-take valve locations.

Construction activities for the ROW would include clearing vegetation, grading over the centerline and excavating a trench within the proposed ROW for pipeline installation. The primary construction impacts to surface waters would be from excavation in waterbodies at stream crossings. Disturbance to ground cover in relation to streams would occur within the 100-foot construction ROW by one of four methods noted below. Table 5.2-23 provides a summary of the number of waterbody crossings for each segment of the mainline pipeline by watershed, waterbody type, and crossing method. Wetland resource impacts would occur in addition to the water resources included in Table 5.2-23, and is included in the Section 5.4 - Wetlands. Note that construction methodology analysis has not been completed (AGDC 2010a).

Stream Crossing Methods

Section 2.2.3.2 and Section 5.6 (Fisheries) include detailed descriptions of the four waterbody crossing methods: Open-Cut, Open-Cut Isolation, Horizontal Directional Drilling (HDD), and bridge crossings as follows:

- Open-Cut Method – Excavating a trench across a stream or river bed and pulling or carrying the pipe into position. There is no effort to isolate flow.
- Open-Cut Isolation Method – Flow is isolated from excavation using a flume or dam and pump.
- HDD – Pilot hole drilled under riverbed and to the surface on the other bank. No disruption to banks or streambed. Method requires water supply for drilling fluid for entire drilling process and for pre-testing of pipe string.
- Bridge Crossings – Pipeline attached to existing bridge or a new bridge constructed.

The Open-Cut Method is the most common method proposed for use on this Project, although the Open-Cut Isolation Method would be used in some instances based on presence of overwintering fish or other considerations (AGDC 2011d). The Open-Cut Method would be used to cross: 336 perennial streams, 93 intermittent streams, and 22 artificial paths (Table 5.2-23). Three existing bridges would be used and 41 HDD crossings (Table 5.2-23). The AGDC would use HDD in instances where disruption of the streambed is not permitted (AGDC 2011d).

The Open-Cut Method and Open-Cut Isolation Method would impact surface water quality downstream temporarily because of excavating a trench through the stream beds and banks. Sedimentation would increase resulting in increased turbidity reducing water quality. Permanent impacts could include changes to the stream profile and structure (bed and hyporheic zone) at crossing locations. The substrate could be altered in composition and quality for spawning fish. Streambed scour is not expected to occur due to burial of the pipeline five feet below the surface of the ground. In areas of the ROW where the proposed Project is associated with existing utility corridors and ROWs, drainage structures already in place would be utilized. Table 5.2-27 includes the potential impacts from all Project related activities to water resources.

Changes to the hyporheic zone and substrate composition and quality could occur from installation of the pipeline. Impacts also include the loss of riparian habitat at stream crossings. Riparian vegetation plays many important functions in stream health, including erosion and flood control, thermal control, water quality and acts as a filter reducing sedimentation. Forested riparian vegetation would be lost permanently; however, the area would be maintained to a non-forested vegetation state. Because of the number of open cut stream crossings, potential impacts are considerable but temporary. The AGDC would minimize impacts by performing the majority of open-cut trench crossings in the winter, and minimizing duration of in-stream construction in the summer. Bank and bed scour protection would be installed after pipeline installation using Best Management Practices (BMPs) (AGDC 2011a).

HDD and Horizontal Bore locations could impact water resources from a spill of drilling mud or may result in increased sediment in surface waterways, or contamination of ground or surface water with toxic drilling additives (if present). Proper drilling procedures would contain the mud and prevent releases into surface waters. The minimum required setback between bore and waterbody is 50 feet; however physical constraints will often result in setbacks of 200 feet or more for this Project (AGDC 2011a). The drilling mud would be composed of bentonite clay, inert solids, and water. The applicant is not planning to use any synthetic additives at this time.

TABLE 5.2-23 Mainline Pipeline Water Crossing Summary Table

Mainline Pipeline – Original Route		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	New Bridge
GCF to Mile 540	Kuparuk River	6	0	2	9	0	0	0	0	1	0
	Sag River	63	0	2	27	0	0	3	0	1	0
	Upper Koyukuk River	68	0	0	30	0	0	11	0	0	0
	South Fork Koyukuk River	22	0	0	9	0	0	1	0	1	0
	Kanuti River	4	0	0	3	0	0	1	0	0	0
	Ramparts	31	0	0	5	0	0	1	0	0	1
	Tolovana	41	0	1	0	0	0	0	0	1	0
	Lower Tanana	3	0	0	0	0	0	0	0	1	0
	Lower Colville River	0	0	0	2	0	0	0	0	0	0
	Yukon Flats	4	0	0	7	0	0	0	0	0	0
	Middle Fork-North Fork Ch	5	0	0	1	0	0	0	0	0	0
	Nenana River	28	0	1	0	0	0	3	0	0	0
Mile 540 to Mile 555	Nenana River	5	0	0	0	0	0	1	0	0	0
Mile 555 to Cook Inlet NGL Facility	Nenana River	8	0	3	0	0	0	1	0	0	0
	Chulitna river	22	2	9	0	0	0	0	1	1	0
	Lower Susitna River	26	0	13	0	0	0	0	0	4	0
Total		336	2	31	93	0	0	22	1	10	1

[a] According to the USGS National Hydrological Dataset Metadata, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

TT means trenchless technology, such as HDD or Horizontal Bore. As the POD does not mention Horizontal Bore, for this table it is assumed that all TT means HDD.

Source: AGDC 2010.

Operations and Maintenance

The short term impacts to water resources during the operation and maintenance of the proposed Project for the mainline ROW could include alteration of stream flow, and increased sedimentation and turbidity reducing water quality. These impacts would occur immediately after construction activities; however, they would be expected to improve over time as conditions from stream disturbance subside. The stream bank at crossing locations would be susceptible to erosion from wind, rain, runoff, and high water events for several years. Streambanks would be recontoured to preconstruction conditions and revegetated; however, it will take time for the natural vegetation to reestablish without high water events (flooding) or the invasion of non-native invasive plants to impede establishment. A Non-native Invasive Plants (NIP) Plan would be implemented to mitigate for this potential impact along stream crossings. Riparian forest vegetation would be a permanent loss, due to the AGDC requirement of mowing the ROW to a non-forested state.

The potential exists for the thermal regime of streams to become altered due to the chilled pipeline. This may result in creating ice dams and aufeis where the ground (stream bottom) over the buried pipe is cooler than the surrounding stream flow. The ice bridges and damming could reduce stream flow downstream altering water quality and reducing fish habitat (Section 5.6, Fisheries). In areas such as the Arctic Coastal Plain, a warmer pipe temperature compared to the surrounding ambient ground temperature (permafrost) may result in melting of the permafrost. The AGDC plans to mitigate for this by operating the pipe at a temperature that would match the surrounding ground maintaining the thermal regime. Table 5.2-26 summarizes the expected potential water resource impacts after mitigation measures are complete.

Contamination may also occur in the surface water or groundwater due to equipment leaks or fueling activities. The AGDC would conduct all refueling of excavation equipment at least 100 feet from any surface waterbody as a mitigation measure. Groundwater contamination may occur from a refueling spill, but it is considered unlikely and therefore negligible. The AGDC would be required to follow an Erosion Control Plan during construction for all sections of development.

Project Segments

<u>GCF to MP 540</u>

Construction

Four hundred streams would be crossed in this segment of the proposed Project ROW (Table 5.2-23). The majority (97 percent) would be constructed via open-cut methods, and the remaining 3 percent would be HDD. Twelve watersheds would be potentially impacted by Project construction within their associated drainages. The majority of stream crossings (109) would occur in the Upper Koyukuk River and 96 in the Sag River (Table 5.2-23). Thus half (51 percent) of the crossings proposed for the GCF to MP 540 segment would occur in these two drainages.

Impacts expected from construction of the ROW would include the impacts noted above under construction of the mainline ROW. Impacts are expected to be temporary during the short (3 day maximum in-stream) construction process per crossing. Sedimentation, and turbidity would increase downstream, and riparian habitat would be removed. Riparian habitat in this segment of the Project is primarily tundra; therefore, should not be reduced as drastically as it would in a forested vegetation type. The potential for stream bank erosion could still occur for a period of time after construction activities or spring break up if constructed during winter.

Operations and Maintenance

Impacts to water resources from operations and maintenance of the ROW from the GCF to MP 540 would be the same as what is noted above under mainline pipeline operations and maintenance.   Maintaining the thermal regime of the pipeline to prevent ice damming in streams would be required to prevent additional impacts to surface waters.

Yukon River Crossing Options

Three options have been proposed to cross the Yukon River: (Option 1) construct a new pipeline suspension bridge; (Option 2) utilize the existing E. L. Patton Bridge on the Dalton Highway; or (Option 3) cross underneath the Yukon River using HDD. The proposed suspension bridge for the Yukon River would be the only bridge constructed for the proposed Project.

New Bridge

Construction of a suspension bridge would not place any structure below the ordinary high water mark (AGDC 2011a); therefore, anticipated impacts to water resources would be expected to be negligible. However, riparian habitat would be impacted along the river banks which play an important role in erosion control and therefore sedimentation affecting water quality. These impacts would not cause adverse impact to water resources in the Yukon River.

The impacts to water resources from operations and maintenance of an existing bridge would be similar to those of a new bridge and would be negligible. If a leak occurred in the pipeline segment that aerially crosses the Yukon River, the natural gas would not be expected to cause additional impacts to the water quality of the Yukon River because it would be release into the air as gas. The pipeline would be carefully monitored from facilities to determine the location of leaks due to pressure loss and would be repaired quickly. Regular mowing of the riparian vegetation along either side of the Yukon River crossing could cause additional erosion or sedimentation into the Yukon River due to bank instability. This could affect water quality, but would not adversely affect water resources in the Yukon River.

Existing Bridge

To utilize the existing E.L. Patton Yukon River bridge option, the pipeline infrastructure would hang below the bridge surface and there would be a negligible effect on water resources due to construction of this option. The work areas and structures that would be required for development of the suspension bridge would not be required for this option.

HDD Crossing

The HDD option consists of crossing underneath the river, and staying out of the stream completely. The construction impacts to water resources would be similar to HDD crossings discussed later in this document.

<u>MP 540 to MP 555</u>

Construction

The proposed Project would construct open-cut crossings across five perennial streams in this segment of the ROW, and one in an artificial path (Table 5.2-19). Open-Cut methods noted above would have the same impacts to water resources for this segment of the ROW. These crossings exist all within the Nenana River watershed.

Operations and Maintenance

Operations and maintenance of the pipeline would not produce impacts to water resources other than what is noted above under mainline pipeline ROW operations and maintenance.

Denali National Park Route Variation

The Denali National Park Route Variation would be located to the west of the mainline pipeline route starting at MP 534, approximately 5 miles south of Healy passing through Denali National Park and Preserve. The Denali National Park Route Variation is shown in Figure 1.1-1 and in Figure 5.2-1 with the water resources for the Project area. There are two major river crossings proposed for this route variation: an existing pedestrian/bike bridge south of the Canyon commercial area and a buried crossing in the Nenana River south of the McKinley Village (ENSTAR 2008).

<u>Construction</u>

The Denali National Park Route Variation construction impacts would include crossing the Nenana River two times (Table 5.2-24). It would utilize the existing pedestrian bridge at the upper crossing and HDD to bury the pipeline at the south end. HDD methods would potentially cause impacts as noted above under HDD, which would be minimal and unlikely. Aerially stringing the pipeline across the Nenana River at upper crossing would not be expected to cause additional impacts to water resources because of the existing pedestrian bridge. Removal of vegetation along steep slopes for ROW construction may have the potential to increase sedimentation into waterways from erosion. This ROW would be associated with existing utility corridors and thus impacts would be substantially reduced. Overall, impacts to water resources would be minimal, temporary and localized for the Denali National Park Route Variation.

The Mainline pipeline route from MP 540 to MP 555 proposes to cross six streams (Montana, Yanert, Carlo and three other unnamed streams) via open cut methods (AGDC 2011d) (Table 5.2-24). Construction in these streams would result in additional short term and long-term impacts to water quality, sedimentation, streambank erosion, and fish habitat. Riverine and wetland impacts would be higher for the mainline proposed pipeline route by affecting a larger area of land and removal of more vegetation (Section 5.3, Vegetation). Vegetation removal often results in increased sedimentation reducing water quality in the drainage.

Operations and Maintenance

It is unlikely that adverse impacts would occur to water resources from operation and maintenance of the Denali National Park Route Variation.

The mainline pipeline route would produce longer term potential impacts to water resources which could result from not maintaining the thermal regime of the pipe from operation activity. As mentioned earlier, if the buried pipe is chilled at temperatures below the ambient ground and stream temperature, ice damming could occur. Water flow could be reduced altering fish behavior and habitat. Considerably more impacts would exist to water resources if the proposed mainline route is developed versus the Denali National Park Route Variation.

MP 555 to End

Construction

Construction of the ROW would occur in three watersheds for this segment of the pipeline: the Nenana River, Chulitna and Susitna watersheds. Ninety streams would be crossed and of these streams, 57 would be open-cut, three under existing bridges and 30 would be HDD (Table 5.2-23). Construction impacts to water resources for the crossing methods noted above would apply to MP 555 to the End segment of the ROW.

Operations and Maintenance

Operations and maintenance of the pipeline would not produce impacts to water resources other than what is noted above under mainline pipeline ROW operations and maintenance.

Fairbanks Lateral

The Fairbanks Lateral would extend east 35 miles from the mainline pipeline through the Yukon-Koyukuk and Fairbanks North Star Boroughs, crossing 20 streams along its route (Table 5.2-25).

Construction

All twenty stream crossings would be open-cut methods (Table 5.2-25). Impacts noted above under open cut construction impacts to streams would apply to the Fairbanks Lateral. Excavation would impact fisheries resources, riparian vegetation and water quality temporarily and locally. Although groundwater drainage pattern alteration from heavy equipment may occur; however, impacts should also be temporary and localized.

Operations and Maintenance

Potential impacts noted above under mainline operations and maintenance would also apply to the Fairbanks Lateral.

TABLE 5.2-24 Denali National Park Route Variation Water Crossing Summary Table

Denali National Park Route Variation		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	New Bridge
Mile 540 to Mile 555 – Original Route	Nenana River	5	0	0	0	0	0	1	0	0	0
Denali National Park Route Variation[b]	Nenana River	0	1	1	0	0	0	0	0	0	0

[a] According to the USGS National Hydrological Dataset Metadata,, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

[b] One crossing on the Denali National Park Route Variation will be either Open Cut or Trenchless Technology.

TT means trenchless technology, such as HDD or Horizontal Bore. As AGDC does not mention Horizontal Bore in the POD, it is assumed that all TT means HDD in this table.

Source: AGDC 2010.

TABLE 5.2-25 Fairbanks Lateral Pipeline Water Crossing Summary Table

Fairbanks Lateral		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	Open Cut	Existing Bridge	TT	New Bridge
Fairbanks Lateral	Tolovana	20	0	0	0	0	0	0	0	0	0
Grand Total		20	0	0	0	0	0	0	0	0	0

[a] According to the USGS National Hydrological Dataset Metadata, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

TT means trenchless technology, such as HDD or Horizontal Bore. As the POD does not mention Horizontal Bore, for this table it is assumed that all TT means HDD.

Source: AGDC 2010.

Aboveground Facilities

Gas Conditioning Facility

The Gas Conditioning Facility (GCF) and new permanent access roads would be located at MP 0.0 on a 70-acre gravel pad. The potential impacts to water resources that could occur when constructing the GCF are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, use of water for construction activities and facility consumption.

Construction

Construction of the GCF would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific locations of waterbody crossings for the access road development to the GCF[6] have not been determined. The area is primarily wetland habitat within the Arctic Coastal Plain and is discussed in detail in Section 5.4 (Wetlands). The expected effect of the GCF facility on flood storage capacity would be negligible. Water use from local reservoirs for construction of the facility would occur, but would not likely cause adverse effects and would require permitting. The construction activities are not expected to cause adverse impacts to water resources beyond what is mentioned in Section 5.4 (Wetlands).

Operations and Maintenance

The GCF would have onsite hazardous substances such as lubricants, cleaners, and fuels. There is a potential for spills and leaks to occur on the roads and pads (including NGLs and H_2S) which could runoff into the surface or groundwater. Risk would be mitigated by preparing and following the Spill Prevention Control and Countermeasure (SPCC) Plan. Regular vehicle use on roads and pads could potentially leak lubricants and toxic substances over the long term which could contaminate the surrounding surface waters. This would be incremental contaminant exposure over time which would accumulate in surrounding waterbodies. In addition, it is unknown what amount of water would be required for regular operations of the GCF. New reservoirs and lakes in the area may be utilized for additional consumption of existing water sources.

The GCF would be located in the Arctic Coastal Plain, where permafrost is continuous, and may cause thawing of the permafrost. In addition, warming of the ground may alter groundwater and surface water flow characteristics (IPCC 1997). These facilities would be built on gravel pads that will help insulate the permafrost and minimize thawing.

Compressor Stations

Besides the compressor facilities that will be collocated with other aboveground facilities, there would be either one additional compressor station (CS) located at about MP 285.6, or two

[6] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

additional compressor stations, one at MP 225.1 and one at MP 458.1. The compressor station locations are shown in Figure 2.1-1. The compressor stations would each be constructed on a gravel pad. The design would be site-specific, but is anticipated to be 1.5 acres minimum. The AGDC intends to request 20 acres of ROW each to accommodate variations from typical layout (except for compressor station that would be collocated with the straddle and off-take facility). A new permanent gravel access road would be needed for each station.

Construction

Construction of a compressor station at CS-4 would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific information on waterbody crossings is not available for the access roads to the CS-4[7]. The station would be located near the Middle Fork Koyukuk River in between the Wolf Pup and Sheep Creek Drainages. There is no high flow data from any USGS stream gage nearby. However, based on a review of a USGS map, the station would be well above the normal stages of the Middle Fork Koyukuk River, and does not appear to be encroaching on Wolf Pup or Sheep Creek, so there is no reason to believe it would affect flood storage or be in a floodplain.

Based on available data, construction of a compressor station at CS-5 would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific information on waterbody crossings for the access road to the CS-5 is unavailable. The station would be located near Jim River and an unnamed drainage flowing into Jim River, north of Prospect Creek. There is no high water information from a USGS stream gage nearby. However, based on a review of a USGS map, the station would be about a mile away from the Jim River and over one half mile from Prospect Creek, and does not appear to be encroaching on unnamed drainages, so there is no reason to believe it would affect flood storage or be in a floodplain.

Construction of a compressor station at CS-8 (collocated with straddle and off-take facility) would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. The AGDC did not provide specific GIS data on waterbody crossings for the access road to the CS-8. The station would be located near Goldstream Creek. There is no high flow information from a USGS stream gage nearby. However, based on a review of a USGS map, the station would be a quarter of a mile away from and well above the normal stage of Goldstream Creek, so there is no reason to believe it would affect flood storage or be in a floodplain.

The potential impacts to water resources that may occur when constructing the CSs are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities. None of the construction activities are expected to cause long term adverse impacts to water resources.

[7] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

Operations and Maintenance

The compressor stations would have onsite hazardous substances such as lubricants, cleaners, and fuels. There is a possibility of spills or leakage of hazardous substances into the surface or groundwater; however, risk would be mitigated by preparing and following the SPCC plan. Impacts noted above under the GCF would apply to operations and maintenance activities of the compressor stations.

Straddle and Off-Take Facility

The straddle and off-take facility and new permanent gravel access road would be located on a 35-acre gravel pad at between MP 461.0 and 466.5. The straddle and off-take facility location is shown in Figure 2.1-4.

Construction

Based on available data, construction of the straddle and off-take facility (collocated with CS-8 if CS-8 is built) would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific stream crossings for the access road to the straddle and off-take facility[8] is not been provided. The facility would be located near Goldstream Creek, and there is no high flow water information from any USGS stream gage nearby. However, based on a review of a USGS map, the facility would be a quarter of a mile away from and well above normal stage of Goldstream Creek, so there is no reason to believe it would affect flood storage or be in a floodplain.

The potential impacts to water resources that may occur when constructing the straddle and off-take facility are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities. None of the construction activities are expected to cause substantial impacts, and would be temporary and localized. Disturbance to ground cover would occur within the construction ROW and is expected to be negligible since the AGDC would be required to follow an Erosion Control Plan.

Operations and Maintenance

The straddle and off-take facility would produce similar potential impacts as what would be expected for the GCF and CS noted above.

Cook Inlet NGLEP Facility

The Cook Inlet NGL Extraction Plant (NGLEP) Facility and Pipeline Terminus would be located at the south terminus of the pipeline, at MP 737, on a 70-acre gravel pad. The Cook Inlet NGLEP Facility and Pipeline Terminus location is shown in Figure 2.1-5.

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[8] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

Construction

Construction of the Cook Inlet NGLEP Facility and Pipeline Terminus, would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific GIS data on waterbody crossings for the access road to the Cook Inlet NGLEP Facility and Pipeline Terminus[9] have not been provided. The station would be located south of an unnamed stream contributing to the Little Susitna River. There is no high flow information from a USGS stream gage nearby. However, based on a review of a USGS map, the location is low-lying and marshy. Therefore, it is possible it is in the 100-year floodplain.

The potential impacts to water resources that may occur when constructing the Cook Inlet NGLEP Facility are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities.

Operations and Maintenance

The Cook Inlet NGLEP Facility would have onsite hazardous substances such as lubricants, cleaners, and fuels. There is a possibility of spills or leakage of hazardous substances into the surface or groundwater; however, risk would be mitigated by preparing and following the SPCC plan. Impacts noted above under the GCF, CS and straddle and off-take facility would apply to operations and maintenance activities of the Cook Inlet NGLEP Facility.

Mainline Valves and Pig Launcher/Receivers

Mainline valves (MLVs) would be located every 20 miles along the mainline pipeline, for a total of about 37 block valves on the mainline and two on the Fairbanks lateral for a total of 32 (AGDC 2010). The purpose of the block valves is to restrict or stop flow for safety, maintenance, or operations. They would be installed on reinforced concrete pads on a compacted subgrade. Access would be provided by permanent workpads or construction access roads (AGDC 2010). As described in Section 2, Pig Launcher/Receivers would be located at all major aboveground facilities: the GCF, straddle and off-take facility, Cook Inlet NGLEP Facility, compressor stations, and Fairbanks Lateral.

Construction

Construction of the block valves would not require excavation in a waterway, HDD, or require fill in a FEMA-mapped floodplain. Specific GIS data on waterbody crossings for the access road to the MLVs and pig launcher/receivers[10] has not been provided. No further analysis on potential flood storage capacity or flood risk was conducted, as specific locations were not provided. None of the construction activities noted above are expected to cause adverse impacts to water

[9] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

[10] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

resources. Some of the potential impacts could include: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities.

Operations and Maintenance

The block valves are not expected to have adverse impacts on surface water, groundwater, or floodplains beyond what has been noted above for operational and maintenance activities for compressor stations.

Support Facilities

Operations and Maintenance Buildings

Operational facilities would be located in Prudhoe Bay, Fairbanks, and Wasilla (AGDC 2011d). It is assumed that existing infrastructure would be used to support these operations and additional impacts to water resources would be minimal.

Construction Camps, Pipeline Yards, and Logistics Sites

The proposed Project would require 15 temporary construction camps, pipe laydown yards, the Seward Logistics Site, and the Fairbanks Logistics Site. The total acreage of all construction camps, laydown yards, and logistics sites would be 178 acres. With the exception of two construction camps (one at Chulitna Butte and one at Sunshine), the construction camps would all be located on previously disturbed land. Pipeline laydown yards would be used temporarily to store pipe and materials for the construction phase of the Project. Dimensions of sites would depend on the site and the type and amount of material to be stored (AGDC 2011d). Due to utilizing existing disturbed sites, potential impacts would be minimal and temporary for water resources.

Use and Storage Construction Equipment

Construction

Use and storage of construction equipment may result in small petrochemical leaks that affect surface water quality or groundwater quality. Mitigation measures include developing and following a Spill Prevention and Control Plan (SPCP) that follows all regulations and uses for BMPs; for example, using drip pans under vehicles when parked. The potential impact for contamination to reach surface and ground waters would be temporary and localized during the construction phase of the Project.

Development of construction camps, laydown yards, and logistics sites will not require excavation in a waterway, or HDD. Locations of these waterbody crossings for access road development to the construction camps, laydown yards, and logistics sites[11] have not been

[11] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

provided. None of these activities are expected to cause adverse impacts to water resources; however, as noted above petrochemical leaks would likely occur and runoff into drainages altering water quality. Disturbance to ground cover outside the construction ROW may occur for these uses. An Erosion Control Plan would be adhered to in order to comply with mitigation measures.

Operations and Maintenance

Water resources would be required to operate the construction camps as living facilities for construction workers and logistics centers. Water use at these facilities would not be expected to adversely affect water resources; however would be site dependant on available sources and consumption dependant.

Material Sites

Construction of the pipeline would require sand and gravel for construction activities from borrow areas. Existing material sites are distributed along the pipeline route from the TAPS development (AGDC 2010). Approximately 546 existing sites have been identified by the AGDC, but there are a few areas (Minto Flats and south of Willow) which have no developed sites (AGDC 2011d), new sites may be developed. New material sites may require new access roads - plans will be developed for agency approval prior to development. Excavation of borrow material may result in increased sediment loading of surface water due to erosion during runoff events if the borrow pit was near the waterbody. A borrow pit can also become a new source of groundwater recharge during ice break-up or groundwater discharge during the summer through evaporation, as it fills with water over time.

Storage of Sand and Gravel Materials

Construction

Construction activities may potentially impact water resources that may occur where new material sites are developed. Impacts include: temporary and permanent disturbance of ground cover, use of heavy equipment, excavation of borrow areas, use and storage of construction equipment, storage of sand and gravel, and use of water for construction activities (dust control). Storage of sand and gravel materials may result in increased sedimentation of surface water or a reduction in flood storage capacity, if located within a floodplain. These affects would be minimal, localized and temporary during the construction phase of the Project.

Operations and Maintenance

The sand and gravel storage sites are not expected to have any operational and maintenance impacts to surface water, ground water, or floodplains.

Stream Crossing and Associated Impacts to Water Resources

Disturbance of Ground Cover

Disturbance to ground cover may result in increased sediment loading in surface water due to erosion during runoff events; or from soil exposure from wind processes. The AGDC would use erosion control procedures as provided in their Sediment and Erosion Control Plan and SWPPP. Normal drainage would be maintained where practical (ADGC 2011). Areas sensitive to erosion would be identified during detailed engineering (ADGC 2011). With mitigation measures in place, the effect from disturbance to ground cover impacting surface waters is expected to be negligible and temporary (Table 5.2-27). During the post-construction phase, revegetation of the disturbed areas would reduce sedimentation into surface waters as plants become established (Section 5.3, Vegetation).

Use of Heavy Construction Equipment

Heavy equipment use at pipeline installation locations and staging areas may result in altered surface water flow and availability due to soil compaction. This may also result in increased surface water runoff and the potential for flooding due to reduced soil permeability. Surface water drainage patterns should return to pre-Project patterns, but there is a possibility that soil compaction could permanently alter surface water flow in the footprint of the Project (Table 5.2-27). There could be permanent alterations to surface water runoff characteristics at permanent aboveground facilities; this is discussed under Operational Impacts.

Buried Pipeline

The burial of the pipeline would primarily include trenches or berms (AGDC 2011d). If the pipeline is placed in an aboveground berm, located within a floodplain, this may result in a reduction in flood storage capacity or restrict flow causing backwater effects upstream. Streambeds, streambanks, and riparian areas would be restored to pre-Project contours and configurations to the maximum extent possible. Streambanks and riparian area would be re-vegetated to prevent erosion and to maintain streambank stability (AGDC 2011d). Therefore, the buried pipeline would not be expected to cause long-term effects on stream flow, stream profile, or structural components of streams or surface waterbodies (AGDC 2011d) (Table 5.2-27).

Unburied Pipeline

The unburied pipeline segments would not likely have adverse impacts on surface water, groundwater, or floodplains (Table 5.2-27). However, in the first 6 miles of the pipeline in Prudhoe Bay, the vertical support members (VSMs) may cause surface water to accumulate and pool due to the potential for permafrost to melt around the VSMs. This can be observed around some of the existing VSMs supporting pipelines within the Prudhoe Bay area.

Placement of Fill in Floodplain for Pipeline or Aboveground Facility Installation

Placement of fill for the pipeline trench or aboveground facility installation may result in a reduction in flood storage capacity (if within a floodplain). This may cause increased upstream sedimentation due to backwater effects. Short term disturbance will be limited to construction impacts (AGDC 2010). Construction of the Project is not expected to cause long-term effects on stream flow, stream profile, or structural components of streams or waterbodies (AGDC 2010) (Table 5.2-27).

Permanent Aboveground Facilities

Aboveground facilities may store hazardous substances that could contaminate surface water or groundwater from a spill. The AGDC would be required to develop and follow a Spill Prevention Control and Countermeasure Plans to minimize spill potential. If aboveground facilities were located within a floodplain, the result could reduce flood storage capacity, or flow restriction causing increased upstream stages due to backwater effects. Contamination from hazardous liquids from vehicle use on facility pads could contaminate surface waters from run-off. Surface water runoff may increase due to reduced permeability from soil compaction and impermeable surfaces.

Surface and Ground Water Use

Surface water will be used for hydrostatic testing to test the pipeline for leaks (Table 5.2-22). Surface water use for operation and maintenance activities may result in alteration of surface water quantity, quality and hydraulics for fluvial systems. Water use from lakes, may result in reduced water volumes which may impact fish and aquatic species (Table 5.2-22). Ground water use may result in similar results in reduced water quality from sedimentation, quantity from lack of recharge or production of a new ground water discharge area.

TABLE 5.2-26 Water Resources Impacts for the Project with Mitigation Measures in Place

Activity	Surface Water	Ground Water	Floodplain	Considerable	Negligible
Buried Pipeline		●	●		●
Unburied Pipeline					●
New Bridges					●
Permanent Aboveground Facilities	●	●	●		●
Surface and Ground Water Use	●	●			●

Disturbance of Contaminated Sites

Construction of the pipeline or associated facilities may cause disturbance of contaminated sites, which could result in additional groundwater and soil contamination. The AGDC has committed to avoiding known contaminated site areas for construction purposes. Additional mitigation requirements include investigating the contaminated sites further to determine full extent and type of contamination and either cleaning them up or avoid them altogether. With the additional mitigation measure, the impact on soils and groundwater would be negligible (Table 5.2-27).

TABLE 5.2-27 Water Resources Construction Impacts for Project with Mitigation Measures in Place

Activity	Surface Water	Ground water	Floodplain	Temporary	Permanent	Considerable	Negligible
Excavation in Water Body	●	●		●		●	
Temporary Restrictions to Flow	●		●	●			●
Disturbance of Ground Cover	●			●			●
HDD	●	●		●			●
Use of Heavy Equipment	●	●	●	●	●		●
Excavation of Borrow Areas	●	●	●	●	●		●
Use and Storage of Construction Equipment	●	●		●			●
Storage of Sand and Gravel Materials	●		●	●			●
Placement of Fill for Pipeline or Aboveground Facility	●		●	●	●		●
Use of Surface Water for Construction Activities	●	●		●			●
Disturbance of Contaminated Sites	●	●		●	●		●

5.2.3 Mitigation

The AGDC has committed to the following measures for mitigating the potential impacts to water resources (AGDC 2011d, p 1 and 3 - 4).

- Minimize the number of river and stream crossings.
  - Use existing bridges where feasible.
  - Use horizontal directional drilling (HDD) or other trenchless technology to minimize disturbance to waterbodies as proposed in Attachment 4 of the POD, Rev 1.
- Maintain, to maximum extent practicable, the existing surface water hydrology at all waterbody crossings.
  - Prevent discharges that have the potential to adversely affect waterbodies.
  - Stabilize cut slopes immediately when the designed grade is obtained.
  - Initiate reclamation of disturbed areas as soon as practicable.
  - Ensure water withdrawals meet federal and state standards and guidelines.

- Keep construction activities within the footprint of the pipeline ROW and the disturbed area of the adjacent construction zone to the maximum extent practicable.
- Minimize the construction of new permanent access roads by emphasizing winter construction using snow-ice roads.
- Perform water crossings in a manner that minimizes effects on water quality.
  - Use materials for dam construction that do not introduce sediment or other harmful substances into waters when using open-cut isolation method.
  - Use materials for flume pipe systems that do not introduce sediment or other harmful substances into waters when using open-cut isolation method.
  - Position flume pipe system discharges to prevent erosion or scouring.
- Minimize the effect of the pipeline on the existing thermal regime.
  - Design the pipeline and components to take into account the thermal regime, including placement and size of compressor stations and chillers.
  - Use engineering controls such as insulation and non-frost susceptible fill to control the thermal signature of the pipeline.
- Implement dewatering practices that avoid adverse effects to vegetation and to existing quality of surface waters, including erosion and scouring.
- Locate fuel storage, equipment refueling, and equipment maintenance operations at least 100 feet from surface waters.
- Avoid contaminated sites.
- Use temporary bridges for transportation of construction equipment and materials.

Additional recommended mitigation measures (ARMs) are as follows:

- ARM-1: Prior to construction, prepare a detailed erosion control plan that includes silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching as appropriate and uses erosion control BMPs.
- ARM-2: If possible crossed waterbodies in winter after freeze up to avoid in-stream work of an active channel. Conduct construction in winter construction using ice roads and ice pads where feasible to avoid building permanent roads and pads.
- ARM-3: During drilling activities, use a minimum setback of 50 feet between bore and any surface waterbody.
- ARM 4: Design borrow areas such that they drain inward towards the center, not outward offsite.
- ARM 5: Store sand and gravel within borrow areas or in bermed areas designed to contain runoff.

- ARM 6: Develop and follow a plan to that describes measures to ensure Goldstream Creek, Big Lake, and Cottonwood Creek (listed on Section 303(d) list) are not further degraded, and coordinate with existing protection efforts to ensure that the waterbody will attain water quality standards.
- ARM 7: Investigate listed contaminated sites further to determine full extent and type of contamination, and either clean them up or avoid them altogether.
- ARM 8: Ensure mechanisms to allow water movement across overfilled backfill are employed.
- ARM 9: Develop and follow a SPCP that describes BMPs to prevent and minimize spills of hazardous substances.

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5.3 TERRESTRIAL VEGETATION

This section describes the ecoregions and vegetation communities identified along the proposed 737 mile proposed Project right-of-way (ROW), Fairbanks Lateral, aboveground facilities, and other work areas outside the ROW. The affected environment, environmental consequences and mitigation are discussed in detail below.

5.3.1 Affected Environment

The proposed Project would cross a diverse array of vegetation communities extending from the Arctic coastal plain to the Cook Inlet Basin in Southcentral Alaska. The following discussion includes a broad perspective based on the ecoregions present along the proposed route, with detailed descriptions of the vegetation communities (land cover types) within a 10-mile-wide corridor.

5.3.1.1 Ecoregions

Each ecoregion includes a complex of terrestrial and wetland vegetation types. The distribution and extent of which are strongly influenced by elevation, soil characteristics, temperature, and moisture. General descriptions of the vegetation and wetland communities within each ecoregion crossed by the proposed Project are derived from Nowacki et al. (2001), Viereck et al. (1992), and the Trans-Alaska Pipeline System (TAPS) ROW Renewal FEIS (BLM 2002).

Nine ecoregions would be crossed by the proposed Project. Table 5.3-1 includes the ecoregion traversed by each segment of the ROW. A description of each ecoregion is included below.

TABLE 5.3-1 Ecoregions Crossed by Project Segment

Project Segment	Unified Ecoregion of Alaska	Level II Ecoregion[a]	Mainline MP Start	Mainline MP End
GCF to MP 540	Beaufort Coastal Plain	Arctic Tundra	0.0	63.7
	Brooks Foothills	Arctic Tundra	63.7	147.8
	Brooks Range	Arctic Tundra	147.8	256.3
	Kobuk Ridges and Valleys	Intermontane Boreal	256.3	261.4
	Ray Mountains	Intermontane Boreal	261.4	432.7
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	432.7	446.2
	Yukon-Tanana Uplands	Intermontane Boreal	446.2	450
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	450.0	452.2
	Yukon-Tanana Uplands	Intermontane Boreal	452.2	462.8
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	462.8	466.2
GCF to MP 540 / Fairbanks Lateral	Yukon-Tanana Uplands	Intermontane Boreal	466.2	466.5
GCF to MP 540	Tanana-Kuskokwim Lowlands	Intermontane Boreal	466.5	519.3
GCF to MP 540 / MP 540 to MP 555 / Denali National Park Route Variation	Alaska Range	Alaska Range Transition	519.3	616.2
MP 555 to End	Cook Inlet Basin	Alaska Range Transition	616.2	736.4

[a] Level II ecoregions in the context of wildlife and habitat are described in Section 5.5.

Beaufort Coastal Plain Ecoregion

The Beaufort Coastal Plain ecoregion is a windy and treeless plain, which progressively ascends from the Beaufort Sea coast southward to the foothills of the Brooks Range. A dry, polar climate dominates this flat to rolling landscape. Permafrost is continuous across the area, except under large rivers and thaw lakes. The prevalence of thaw lakes and saturated soils results in wetland plant communities characterized by sedges, grasses, and mosses as the predominant vegetation features. Small areas of wet tundra occur in shallow water and primarily support wet sedge meadow tundra and wet sedge-grass meadow community types (Walker et al. 1980; Walker and Acevedo 1987). Sites with deeper water (up to 3 feet), typically support grass marsh communities (BLM 2002).

In locations of increased surface elevation, vegetation communities support dwarf shrubs, cushion plants, lichens, and graminoid plants (grasses and grass-like plants) that are adapted to the better-drained soils (Walker 1985). Tussock tundra, characterized by tussock cottongrass *(Eriophorum spp.*), occurs within more moist locations with decreased surface elevation. These sedges are generally 4 to 24 inches tall and often are interspersed with low shrubs much shorter than the sedges (Viereck et al. 1992).

Dry tundra community types occur on well-drained soils such as the margins of old lake basins and rivers, and on soils formed from stream gravel deposits. These communities are predominantly sedge-*Dryas* tundra and *Dryas* dwarf shrub tundra (Walker 1985). The latter community type is characterized by dwarf shrubs less than 8 inches tall, primarily species of *Dryas* (Viereck et al. 1992). *Arctophila fulva* is a common and important wetland species in this ecoregion and will be discussed in detail in the Wetland Section 5.4.

Brooks Foothills Ecoregion

The Brooks Foothills ecoregion primarily consists of broad exposed ridges and gently rolling hills that create the northern flank of the Brooks Range. Within these long linear ridges and buttes are narrow alluvial valleys, glacial moraines, and outwash plains. Most of the surface is covered with colluvial and eolian deposits. The ecoregion has a dry polar climate that is warmer and wetter than the Beaufort Coastal Plain. Continuous permafrost under the surface inhibits drainage, and leads to saturated soils and a predominance of wetland vegetation communities. Vegetation is dominated by vast expanses of mixed shrub-sedge tussock tundra, interspersed with willow thickets along rivers and small drainages and *Dryas* tundra on ridges. Calcareous areas are found along the lower foothills, which support sedge-*Dryas* tundra (Nowacki et al. 2001).

The most common vegetation type of the foothills is tussock tundra, which predominates on old glacial moraines. Dwarf shrub communities occur on rocky moraine ridges. Active floodplains and small drainages support willow and alder shrub communities. Inactive floodplains support extensive wet sedge meadows (Viereck et al. 1992).

Uplands occur on south-facing sandstone outcrops and on exposed till. However, most low-lying areas support wetlands. The valley bottoms and hill slopes have poorly-drained soils with thick organic layers (Walker et al. 1989). Silty soils, particularly on upper slopes, are thick enough to impede surface water drainage and remain saturated. Wetland plant communities of the northern foothills include tussock tundra, open low mixed shrub-sedge tussock tundra, open low mesic shrub birch ericaceous shrub, open low willow shrub, and wet sedge meadow tundra.

Brooks Range Ecoregion

The Brooks Range ecoregion contains the east-west trending Brooks Mountain Range. The high, central component contains steep angular summits covered with rubble and scree, while the east and west sections have less rugged topography with fast-moving streams and rivers. The region has a dry polar climate with short, cool summers and long, cold winters. Alpine tundra is prevalent at higher elevations, while valleys have some needle-leaf and broadleaf forests.

The most common plant communities on the upper slopes and ridges are ericaceous dwarf shrub tundra, *Dryas*-sedge dwarf shrub tundra, and *Dryas* dwarf shrub tundra on the more exposed sites. These communities occur on well-drained soils and are dominated by shrubs less than eight inches tall. Taller shrubs, if present, are relatively sparse, and the herbaceous species typically exceed the shrubs in height (Viereck et al. 1992). Trees are generally absent. Pond margins and stream banks support open low willow-sedge shrub tundra, with shrubs commonly 8 to 20 inches tall and few, if any, trees. Wet sedge meadow tundra communities are generally found within drained lake basins and valley depressions (Cooper 1986).

Much of the vegetation is located in or along floodplains. Floodplain vegetation communities on river terraces are typically open low alder-willow shrub communities and trees are generally absent or scarce (Viereck et al. 1992). On the south side of the Brooks Range, lower mountain slopes and valleys support sedge tussocks and shrubs. The Arctic tree line is restricted to the south side of the range. Here, sparse conifer-birch forests and tall shrublands occur in the larger valleys (Viereck et al. 1992).

Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valley ecoregion is comprised of a series of paralleling ridges and valleys that expand southward from the Brooks Range. Large glacier-carved valleys contain large rivers that begin in the Brooks Range. The broad, U-shaped valleys are lined with both alluvial and glacial sediments, while the ridges are covered with rubble. Most of the area is underlain by thin to moderately thick permafrost. Long, cold winters and short, cool summers make up the dry continental climate that is prevalent in the area.

Vegetation communities include open spruce and closed mixed forest mosaic and open and closed spruce forest. Forests and woodlands largely dominate, with black spruce in wetland bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on well-drained uplands. Tall and short shrublands of willow, birch, and alder communities occur on ridges. Trees become increasingly sparse, less robust, and restricted to lower elevations in the west where forests are slowly invading along rivers and streams (e.g., lower Noatak River) (Nowacki et al. 2001).

Ray Mountains Ecoregion

The Ray Mountains ecoregion comprises an overlapping series of compact ranges in an east-west direction. Bedrock is generally covered in rubble, resulting in shallow and rocky soils. Permafrost is largely discontinuous. The climate is continentally influenced, with dry, cold winters and relatively moist, warm summers.

The distribution of community types is influenced primarily by slope, aspect, elevation, parent material, and succession following wildfire (Viereck et al. 1986). Large differences in the vegetation of north- and south-facing slopes result from the dry continental climate and low sun angle. Vegetation distribution is also affected by the presence or absence of permafrost, which is often related to slope and aspect (Viereck et al. 1986).

The vegetation is dominated by black spruce woodlands, while white spruce, birch, and aspen are restricted to warm, south-facing slopes. Floodplains are dominated by white spruce, balsam poplar, alders, and willows. Shrub birch and *Dryas*-lichen tundra prevail at higher elevations.

Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands ecoregion contains broad, rounded mountains of moderate height. Most surfaces are comprised of bedrock and coarse rubble on ridges, colluvium on lower slopes, and alluvium in the deeply incised, narrow valleys. The climate is strongly influenced by continental forces, generating warm summers and very cold winters. Discontinuous permafrost underlies north-facing slopes and valley bottoms.

Vegetation is dominated by white spruce, birch, and aspen on south-facing slopes, black spruce on north-facing slopes, and black spruce woodlands and tussock and scrub bogs in valley bottoms. Floodplains of headwater streams support white spruce, balsam poplar, alder, and willows. Above the treeline, low birch-ericaceous shrubs and *Dryas*-lichen tundra dominate. Forest fires, which influence vegetation composition and distribution, are frequent due to the high incidence of lightning strikes.

Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands ecoregion is an alluvial plain that slopes gradually northward from the Alaska Range. Soils are composed primarily of sediments of fluvial and glaciofluvial origin that are capped by varying thicknesses of eolian silts and organic soils. The climate is dry continental, characterized by cool summers and cold winters. Permafrost cover is thin and discontinuous.

Boreal forests dominate the landscape, with black spruce in bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on south-facing slopes. The coldest, wettest areas on permafrost flats support birch-ericaceous shrubs and sedge tussocks. Wet lowlands, where permafrost is near the surface, are the principal locations for black spruce forests. Lowland areas with a shallow active layer over permafrost also support open black spruce-tamarack forest (Viereck 1975).

Alaska Range Ecoregion

The Alaska Range ecoregion is a mountain range comprised of a complex mix of folded, faulted, and deformed metamorphic rocks. Avalanches and landslides often move down the steep, scree-covered slopes. Discontinuous permafrost lies under shallow and rocky soils. Vegetation biomass is greatest on lower slopes, valley bottoms, and low elevation drainages.

The distribution of plant communities is primarily determined by slope and aspect. The soils of upper hillsides and ridge tops are shallow and gravelly. Vegetation on these well-drained, windswept, alpine sites consists of dwarf shrub communities. Slopes and drainages that are more protected support communities of dwarf and tall shrubs (BLM 2002). Lower slopes and valleys support open coniferous forests and woodlands consisting primarily of open white spruce forest or open black spruce-white spruce forest communities. Open white spruce forest occurs near the treeline and on inactive floodplains. Open black spruce-white spruce forest is generally restricted to areas near the treeline on north-facing slopes (Viereck et al. 1992).

Cook Inlet Basin Ecoregion

The Cook Inlet Basin ecoregion is a gradually sloping lowland, with fine-textured lacustrine deposits surrounded by lesser amounts of coarse-textured glacial tills and outwash. The basin contains numerous lakes, ponds, wetlands, and several meandering river systems. The area is generally permafrost free and climatically influenced by both maritime and continental forces, providing moderate fluctuations of seasonal temperature and abundant precipitation.

Vegetation communities in this ecoregion support black spruce forests and woodlands. Ericaceous shrubs are dominant in open bogs. Mixed forests of white and Sitka spruce, aspen, and birch grow on better-drained sites and grade into tall shrub communities of willow and alder on slopes along the periphery of the basin (Nowacki et al. 2001).

5.3.1.2 Ten Mile-Wide Corridor

A 10-mile-wide corridor (5 miles on each side of the centerline) was used to provide a more detailed perspective of the vegetation communities present along the proposed Project. This information was derived from the 2001 National Land Cover Data (NLCD) (Homer et al. 2004). Due to the methods used to derive NLCD information, some vegetation characterizations may differ from actual field conditions (i.e., cleared ROW may be depicted as mixed forested areas).

A total of 18 land cover classifications (vegetation communities) are listed in Figure 5.3-1. Seventeen vegetation communities are found along the proposed route; however, 15 are summarized for the route across three pipeline segments (MP 0 to MP 540, MP 540 to MP 555, and MP 555 to End), the Denali National Park Route Variation, and the Fairbanks Lateral. The remaining two vegetation community types (woody wetlands and emergent herbaceous wetlands) are discussed thoroughly in the Section 5.4 (Wetland) and are not discussed further here. Perennial ice and snow is included in the maps for reference, but is not associated with the Project area. Terminology for vegetation follows the 2001 NLCD classification (Homer et al. 2004). Figures 5.3-1 (Maps 1-6) illustrates the 2001 NLCD composition of the 10-mile-wide corridor.

Project Segments

<u>MP 0 to MP 540</u>

The segment from MP 0 to MP 540 begins in the open water and sedge dominated vegetation community of the coastal plain southbound, to the dwarf scrub of the Brooks Range foothills. It then continues into the scrub/shrub and barren land of the Brooks Range before entering the intermontane boreal region of interior Alaska. Within this boreal region, the corridor increases in composition to evergreen forest, deciduous forest, and woody wetlands. This segment transitions into scrub/shrub and barren land of the Alaska Range. The entire corridor along this segment is composed of over 20 percent each of scrub/shrub and evergreen forest vegetation communities, with dwarf scrub and wetland vegetation comprising the lesser predominant vegetation covers (Figure 5.3-1, Maps 1-4). The Yukon River would be included in this segment of the Project.

<u>MP 540 to MP 555</u>

The MP 540 to MP 555 segment is comprised of similar vegetation communities within the Alaska Range (Figure 5.3-1, Map 4). The segment shows a prominence of evergreen forests, scrub/shrub vegetation, and barren land, and has over 30 percent of evergreen forest and scrub/shrub, with barren land and dwarf scrub comprising a lesser quantity of vegetation cover.

MP 555 to the END

The segment from MP 555 to the End traverses the remainder of the Alaska Range ecoregion and is dominated by scrub/shrub before it descends into the Cook Inlet Basin ecoregion (Figure 5.3-1, Maps 5 and 6). Within the Cook Inlet Basin the corridor is composed of increasing amounts of deciduous forest, mixed forest, woody wetlands, and emergent herbaceous wetlands.

Fairbanks Lateral

The Fairbanks Lateral segment closely follows the ARRC ROW along Goldstream Creek (Figure 5.3-1, Map 4). This corridor is dominated by evergreen forests, deciduous forest, woody wetlands, and some mixed forest.

Denali National Park Route Variation

The Denali National Park Route Variation is comprised of similar vegetation communities within the Alaska Range (Figure 5.3-1, Map 4). The route variation shows a prominence of evergreen forests, scrub/shrub vegetation, and barren land, with over 30 percent of evergreen forest and scrub/shrub, with barren land and dwarf scrub comprising a lesser quantity of vegetation cover.

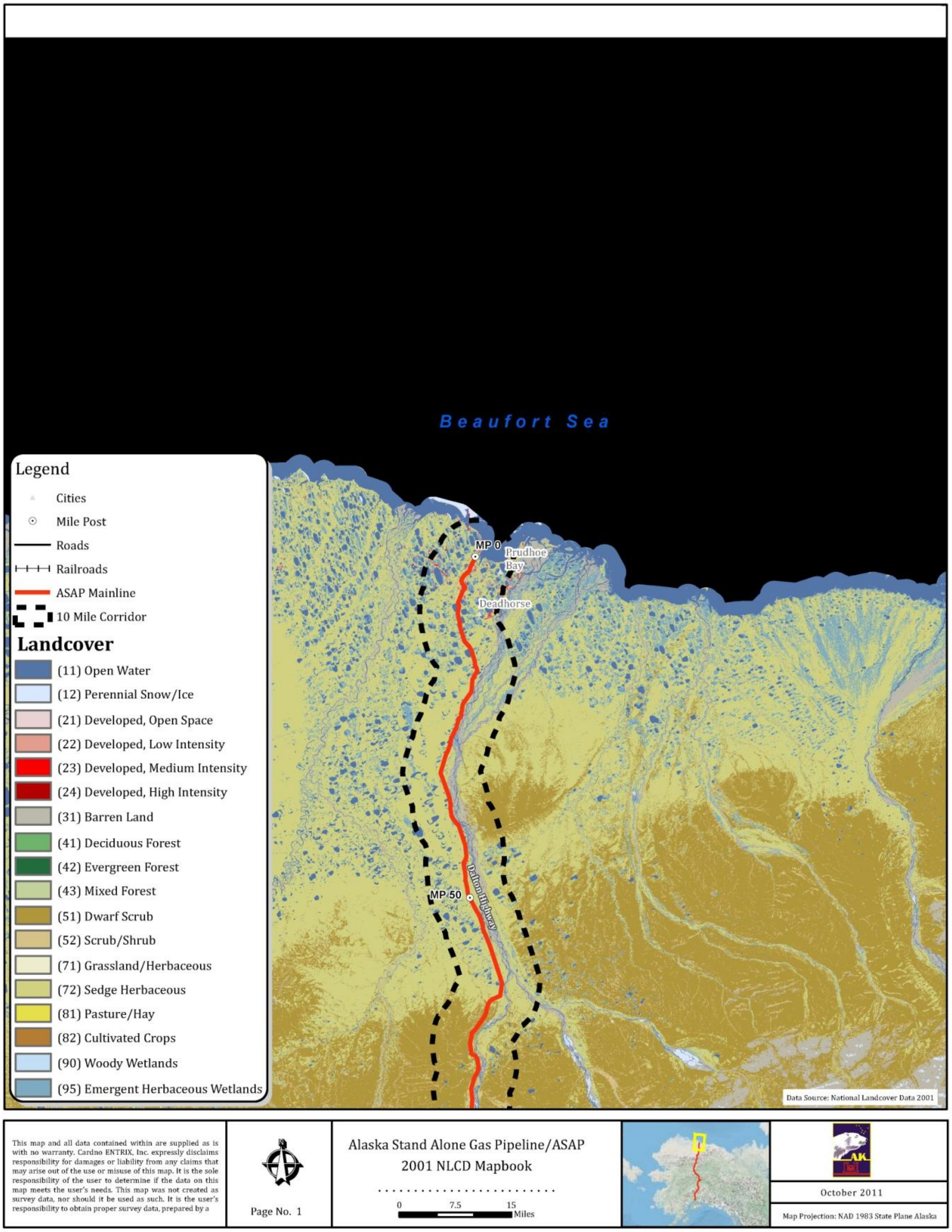

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 1)

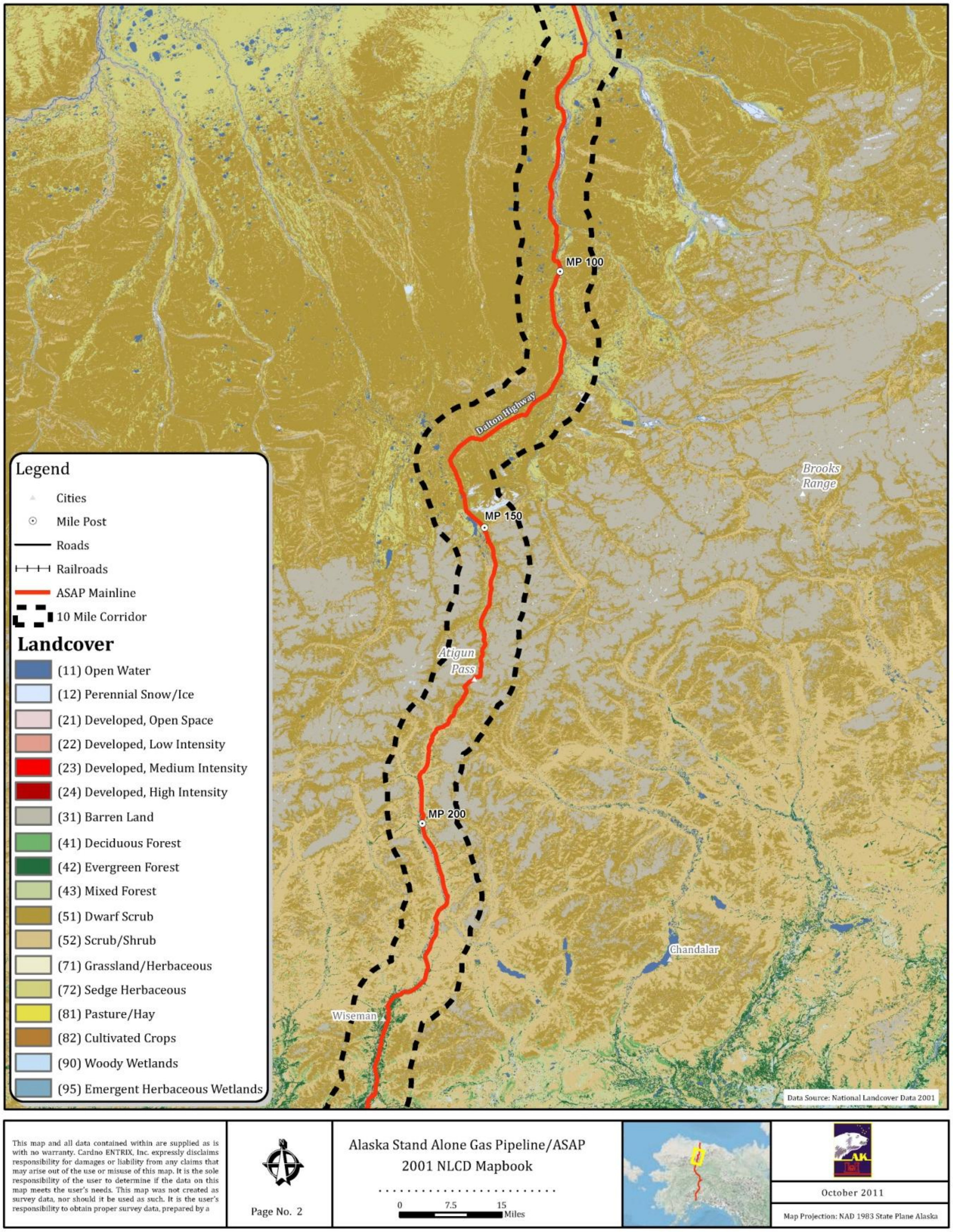

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 2)

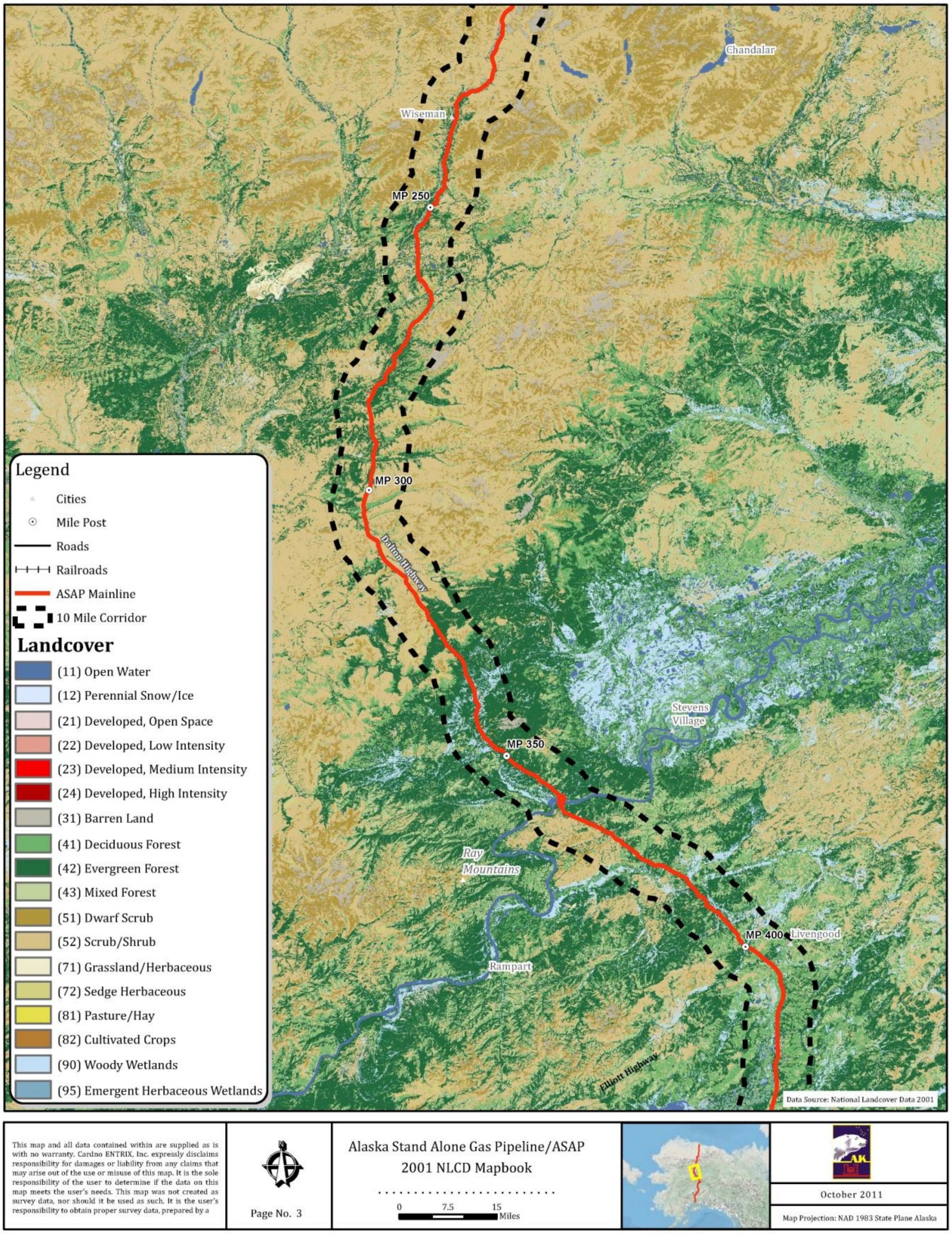

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 3)

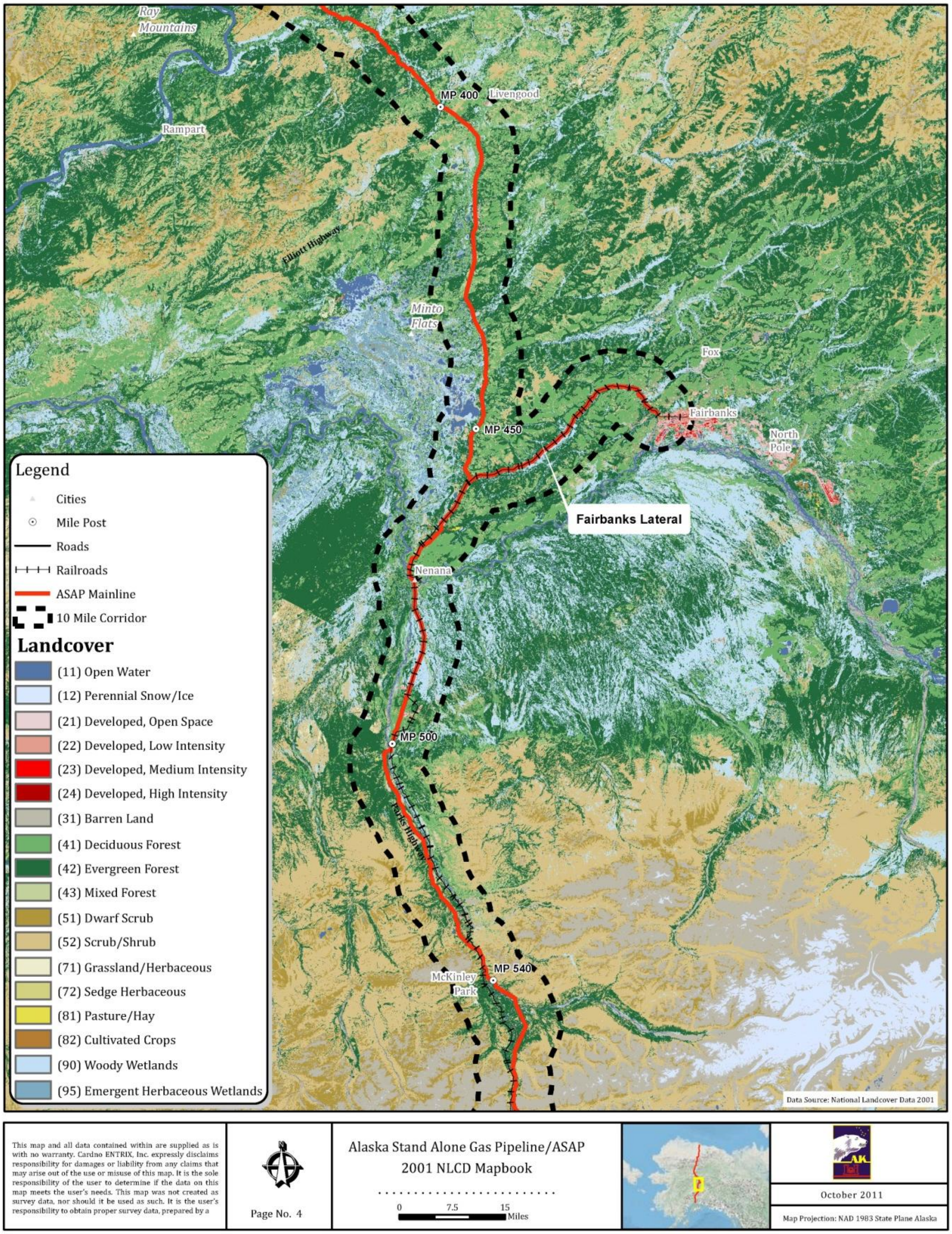

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 4)

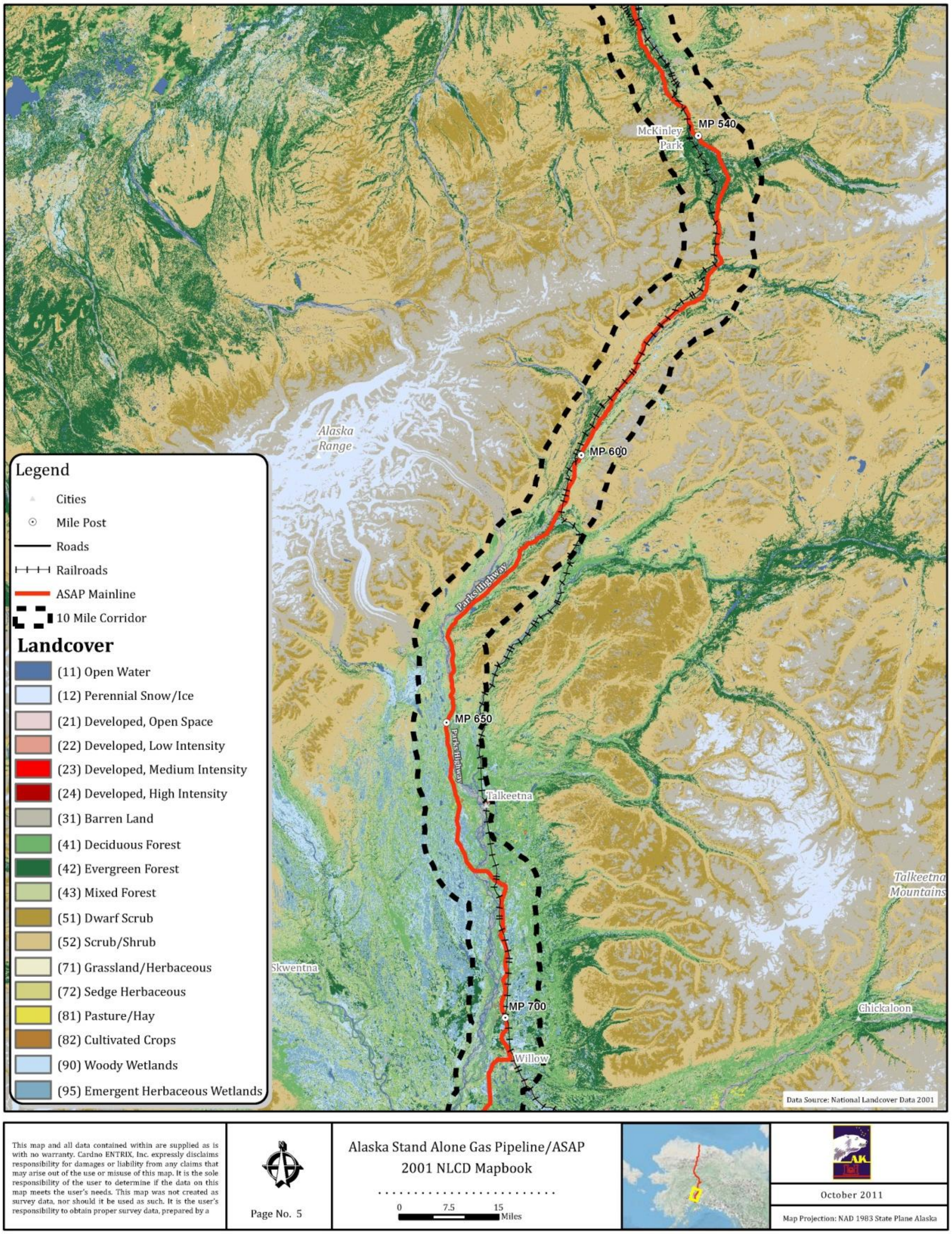

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 5)

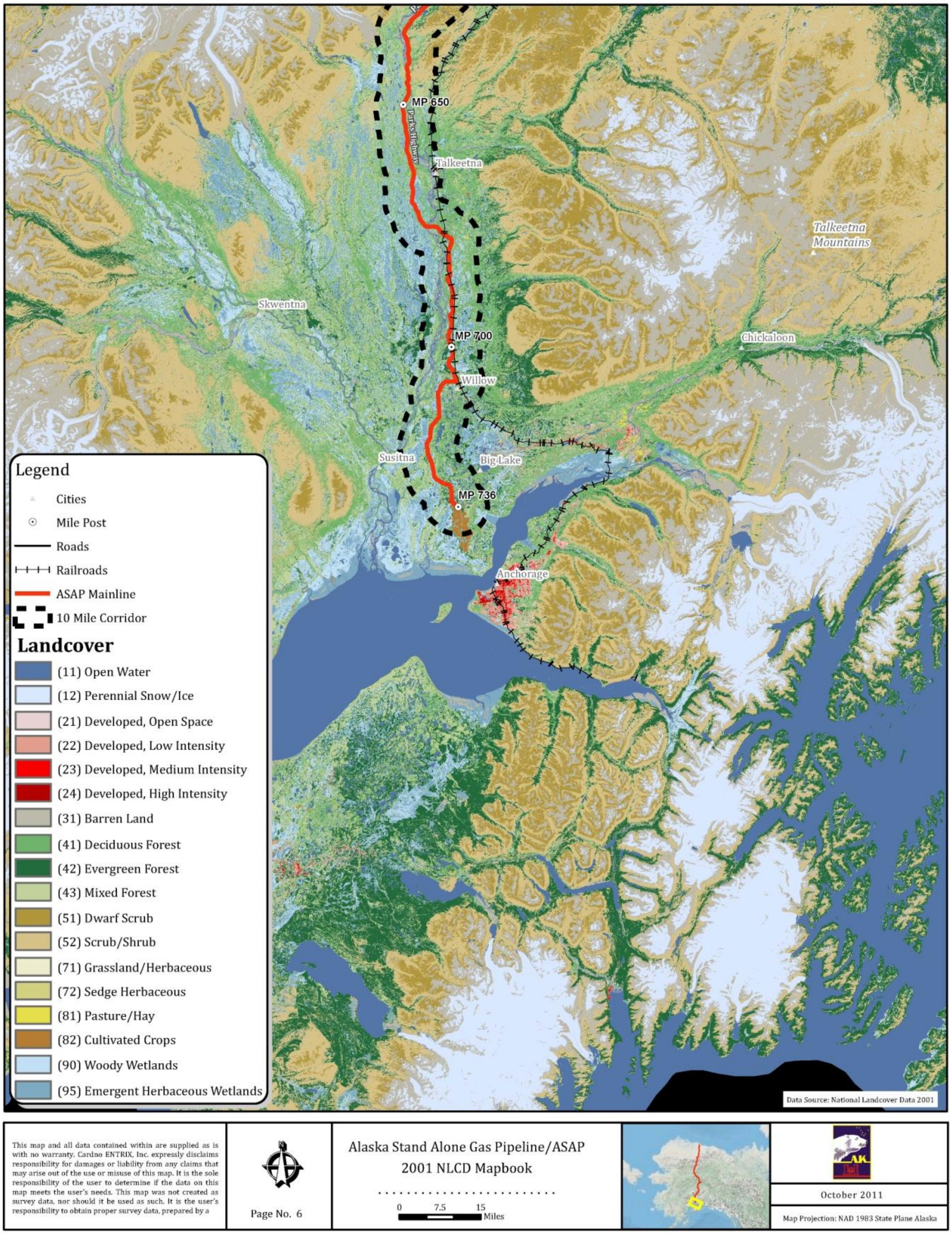

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 6)

5.3.1.3 Non-native and Invasive Plants

Alaska has remained relatively free of the wide-spread invasion of non-native plants seen in the continental United States; however, controlling and prohibiting their introduction and proliferation are important management issues. The Alaska Natural Heritage Program (ANHP), in cooperation with both state and federal agencies, currently tracks the distribution of 326 species of non-native plants in Alaska. The State of Alaska regulates the spread of invasive and non-native weed species (11 AAC 34.020). Nine species are listed as restricted and 14 species are prohibited. The distinguishing factor between the two types is that restricted non-native weeds can be controlled by ordinary agricultural means, while prohibited non-native weeds cannot. Executive Order 13112 was issued to prevent the introduction of invasive species to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

A comprehensive survey of non-native plants has not been conducted along the entire proposed Project area; however, non-native plants are well documented along many road and utility corridors in Alaska (i.e., Lapina and Carlson 2004), especially the Dalton Highway (Cortes et al. 2008) and George Parks Highway corridors (ANHP 2011). Along these corridors, non-native plant populations are frequently found in disturbed sites, including road construction and revegetation areas, parking lots, campgrounds, and Alaska Department of Transportation and Public Facilities (DOT&PF) stations (Cortes et al. 2008). Given the proposed Project and Denali National Park Route Variation's proximity to existing road and utility corridors along much of its alignment, it is likely that non-native plants exist within the corridor.

5.3.1.4 Rare and Sensitive Plants

A summary of the federally-protected and candidate species with the potential to occur in the proposed Project area is included in Section 5.8.3. However, there are no ESA listed or candidate plants within the Project area to date; the Aleutian Shield Fern (*Polystichum aleuticum*), is currently the only listed plant in Alaska. A comprehensive survey of rare and sensitive plant species has not been conducted along the entire proposed Project route. The following section is intended to describe the potential for the occurrence of rare and sensitive plant species, not federally listed under the ESA, along the proposed Project route.

A list of rare and sensitive plants was obtained from two sources, the Alaska Rare Plant List maintained by the ANHP (2008) and the BLM-Alaska Sensitive Animal and Plant List (2010). These two lists were cross-referenced to produce a single list, presented in Table 5.3-2. The probability of occurrence along the proposed Project route was estimated from species range maps and rare plant inventories relevant to the Project. Range maps from Hulten (1968) and the Alaska Rare Plant Guide (2008) were compared to the ecoregions traversed by the proposed Project. Results from Table 5.3-2 indicate that 23 rare and sensitive plants have the potential to occur along the Project corridor. In addition, area-specific plant inventories were also consulted to determine the potential occurrence of rare or sensitive plants. Specifically, the *Toolik Lake Research Natural Area/ACEC Rare Plant Inventory* (Carroll et al. 2002), *Rare Vascular Plant Species of the North Slope* (Carlson et al. 2006), and *The Vascular Plant*

Floristics of Denali National Park and Preserve, A Summary, including the Results of Plant Inventory Fieldwork 1998-2001 (Roland 2004) were referenced.

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Antennaria densifolia	Denseleaf pussytoes		✓			
Arnica lonchophylla	Northern arnica	H	✓			
Artemesia aleutica	Aleutian wormwood		♦	G1/S1	CAFF	FWS
Artemisia globularia ssp. lutea	Purple wormwood species		☒	G4T1/S1	CAFF	BLM, FWS, NPS, S?
Artemisia laciniata	Siberian wormwood	H	✓			
Artemisia senjavinensis	Arctic sage / Bering Sea wormwood		✓	G3/S2S3	CAFF	BLM, NPS, N, S?
Aster pygmaeus (Eurybia pygmaea)	Pygmy aster	M, TL	✓			
Beckwithia glacialis spp. Alaskensis [a]	Alaskan glacier buttercup	TL	♦	G4T2/S2	CAFF	S?
Botrychium ascendens	Upswept moonwort		☒	G3?/S1	S	FS, NPS
Carex adelostoma	Circumpolar sedge		✓			
Claytonia arctica	Arctic springbeauty	TL	✓			
Claytonia ogilviensis	Ogilvie mountains springbeauty		☒	G1/SP		
Cochlearia sessilifolia	Sessile-leaved scurvy grass		♦	G1G2Q/S1S2		FWS
Cryptantha shackletteana	Shacklettes' catseye		☒	G1Q/S1		NPS, N, S?
Douglasia alaskana	Alaska rock-jasmine		✓			
Douglasia arctica	Mackenzie River Douglasia		✓			
Douglasia beringensis	Bering Sea douglasia / Arctic Dwarf Primrose		☒	G1/S1	CAFF	BLM, NPS, N, S?
Draba aleutica	Aleutian Whitlow-Grass		♦	G2G3/S2	CAFF	FWS, N
Draba kananaskis	Kananaskis Whitlow-Grass		♦	G1Q/S1	S	FS
Draba micropetala	Alpine Whitlow-grass	T	✓			
Draba murrayi	Murray's Whitlow-grass		☒	G2/S2		BLM, NPS, N, S?
Draba ogilviensis	Ogilvie Mountains Whitlow-grass		☒	G2G3/S1		NPS

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Draba pauciflora	Adam's Whitlow-grass	C	✓			
Erigeron muirii	Muir's Fleabane	C, H, M, TL	☒	G2/S2	CAFF	BLM, FWS, NPS, N
Erigeron yukonensis	Yukon flea-bane		✓			
Eriogonum flavum var. aquilinum	Yukon Wild-Buckwheat		☒	G4T2Q/S2		BLM, FWS, NPS, N, S?
Erysimum asperum var. angustatum	Narrow-leaved Prairie Rocket		☒	G5T2/S1S2		FWS, NPS, N, S?
Gentianopsis detonsa ssp. detonsa	Sheared Gentian		✓			
Koeleria asiatica	Oriental Junegrass	H	✓			
Lesquerella calderi	Calder's Bladderpod		☒	G3/S1S2		FWS, FS
Ligusticum caldera	Clader's Lovage		♦	G3/S1	S	FWS, FS
Mertensia drummondii	Drummond's Bluebell		☒	G2Q/S2	CAFF	BLM, N, SB
Montia bostockii	Bostock's Miner's-lettuce	M, TL	✓			
Oxytropis arctica var. barnebyana	Barneby's Locoweed	TL	☒	G4T2/S2	CAFF	BLM, DOD, N
Oxytropis huddelsonii	Huddelson's locoweed	H	✓			
Oxytropis kobukensis	Kobuk Locoweed		☒	G2/S2		NPS, N
Papaver alboroseum	Pale Poppy	M	✓			
Papaver gorodkovii	Arctic poppy		✓			
Papaver walpolei	Walpole Poppy		✓			
Parrya nauruaq	None		✓			
Pedicularis hirsuta	Hairy horsewort	C, M, TL	✓			
Phacelia mollis	Macbride Phacelia		✓			
Pleuropogon sabinei	Sabine-grass	C, M	✓			
Poa hartzii ssp. alaskana	Alaskan bluegrass		☒	G3G4T1/S1	CAFF	BLM, FWS, N, SB
Poa porsildii	Porsild's Bluegrass		✓			
Podistera yukonensis	Yukon Podistera		♦	G2/S1		BLM, NPS, N, S?
Polystichum aleuticum	Aleutian Shield-fern		♦	G1/S1	E, CAFF	DOD, FWS
Potentilla stipularis	Circumpolar	H, TL	✓			

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
	Cinquefoil					
Primula tschuktschorum	Chukchi Primrose	H	✓			
Puccinellia wrightii	Wright's alkaligrass		✓			
Ranunculus camissonis	None	H	✓			
Ranunculus glacialis var.[a]	Glacier crowfoot	TL	✓			
Ranunculus turneri	Turner's Buttercup		✓			
Rumex graminifolius	Grassleaf sorrel	H	✓			
Rumex krausei	Cape Krause Sorrel		☒	G2/S2	CAFF	BLM, S?
Salix retucuata ssp. glabellicarpa	Smooth-fruited Netleaf Willow		♦	G5T2/S1	S	FS
Saxifraga aleutica	Aleutian Saxifrage		♦	G2G3/S2S3	CAFF	DOD, FWS, N
Senecio moresbiensis	Queen Charlotte Butterweed		♦	G3/S2	S	FS
Smelowskia johnsonii	Johnson's false candytuft	M	✓			
Smelowskia pyriformis	Pear-fruited Smelowskia	H	☒	G2/S2		BLM, FWS, SP, SB
Trisetum sibiricum ssp. litorale	Siberian False-oats	H	✓			

Key:
♦– On the Alaska Rare Plant List.
☒– On both the BLM Sensitive Plant List and the Alaska Rare Plant List
✓ – On the BLM Sensitive Plant List.
1 – Critically imperiled (5 or fewer occurrences)
2 – Imperiled (6 to 20 occurrences)
3 – Rare or uncommon (21 to 100 occurrences)
4 – Secure, but cause for concern.
5 – Secure.
a – same species
b – *Erysimum angustatum* in Hulten.
BLM – U.S. Bureau of Land Management
C – Carlson et al., 2006
CAFF – Designated as Rare by the Conservation of Arctic Flora and Fauna Program
DOD – U.S. Department of Defense
E – Listed as Endangered by FWS
FS – Forest Service
FWS – U.S. Fish and Wildlife Service
G# – Heritage rank globally.
H – Hulten, 1968
M – Murray, 1987
N – Native (regional or village corporation)
NPS – National Park Service
Q – Taxonomically questionable
S – Designated as Sensitive in Alaska by FSW
S# – Heritage rank in Alaska.
S? – Unknown
SB – State or Borough land
SP – State Park
T# – Heritage rank of subspecies/variety.
TL – Toolik Lake, Carroll et al., 2003

5.3.2 Environmental Consequences

5.3.2.1 No Action Alternative

Under the No Action Alternative, the Project would not be developed and there would therefore be no affects to vegetation communities.

5.3.2.2 Proposed Action

This section describes the potential impacts to vegetation communities from Project construction and operation activities. It includes the ROW, aboveground facilities, and extra work areas outside the ROW except for temporary extra workspaces (TEWS). The alternatives and options considered and the types of activities that would be expected to occur during each phase of the Project are also discussed. Some land cover types summarized are not vegetation specific (e.g., open water or barren), but are still reported to provide a complete description of the ROW composition, and to facilitate absolute percent composition calculations rather than relative percent composition (Table 5.3-3).

Pipeline Facilities

The proposed Project would cross 17 vegetation communities (excluding wetlands) within the 100 foot-wide construction ROW. For the permanent ROW, the proposed Project would retain a variable corridor of 30, 51 and 52 foot-widths along the 737 mile pipeline corridor. The width of the permanent ROW would be maintained dependant on land ownership of that segment of the ROW. Approximately 4,063 acres of land would be permanent easement or grant ROW. The vegetation within the permanent easement or grant would be maintained to a non-forested vegetation cover (Section 2.1.3). The aboveground facilities and extra work areas outside the ROW include acreage of vegetation impacted from operations. Wetland resources and impacts are discussed in the Section 5.4 Wetland Resources.

The following sections discuss activities that are proposed to occur during the construction of the 100 foot-wide ROW and during operations and maintenance of the permanent variable width ROW, with associated potential impacts.

Clearing, Grubbing and Grading

Clearing, grubbing and grading of vegetation in the proposed ROW would occur during preconstruction activities. Grading may include separating the topsoil (including the vegetative layer and roots) from the subsoil mineral layer to create a flat working surface for construction. Top soils would be segregated and stored for rehabilitation use. Pre-construction activities would begin in the summer prior to the first season of pipeline construction. It is expected that construction would occur for up to 4 months in duration from surveying to rehabilitation (Section 2.2.2). Subsoil exposed to physical environmental properties before construction could cause erosion, and sedimentation impacts and the extent of impacts would depend on the length of time the soil is exposed. An agency approved Storm Water Pollution Prevention Plan (SWPPP) and Erosion Sediment Control Plan (ESCP) would minimize or mitigate such impacts.

Grading and topsoil stripping would likely destroy the plant root stock, which would delay vegetation recovery substantially. Areas that are constructed in the winter on ice pads would have considerably less impact since grading would occur only over the centerline. Natural establishment of native vegetation would occur over time from slow encroachment and seed dispersal of surrounding vegetation. However, sensitive or intolerant plant species may not recover from this type of disturbance.

Herbaceous and scrub-shrub vegetative communities would be expected to recover within 5 to 20 years (ADFG 2001). Forested vegetation would take much longer to recover due to the length of time it takes for trees to reach maturity. Where forested vegetation is allowed to grow back (in areas outside of the permanent ROW), it would take several decades to several hundred years to reach pre-disturbance conditions (ADFG 2001). The potential for disturbance to forested vegetation types is reduced by associating the proposed Project alongside existing infrastructure where the amount of forested vegetation is generally less.

TABLE 5.3-3 Vegetation Communities across all Segments of the Construction and Permanent ROW including the Fairbanks Lateral and Denali National Park Route Variation

	MP 0 – MP 540		Fairbanks Lateral		MP 540 – MP 555		Denali National Park Route Variation		MP 555 – End	
Description[a]	**Construction ROW[b] (Acres)**	**Permanent ROW[c] (Acres)**	**Construction ROW[b] (Acres)**	**Permanent ROW[c] (Acres)**	**Construction ROW[b] (Acres)**	**Permanent ROW[c] (Acres)**	**Construction ROW[b] (Acres)**	**Permanent ROW[c] (Acres)**	**Construction ROW[b] (Acres)**	**Permanent ROW[c] (Acres)**
Open Water[d]	25.6	8.1	0.9	0.2	1.3	0.4	0.8	0.3	9.9	2.2
Developed, Open Space	10.2	3.1	5.6	1.8	0	0	0.4	0.1	85.4	17.4
Developed, Low Intensity	1,565.70	499.1	7.4	2.2	0.3	0	88.2	29.1	376.3	94.5
Developed, Medium Intensity	10.6	2.8	0	0	0	0	0	0	8.7	2.3
Developed, High Intensity	0.5	0.2	0	0	0	0	0	0	0	0
Barren Land	477	129.1	0.9	0.1	0.7	0.2	12.2	4.1	11.1	3.4
Deciduous Forest	770.1	254	271.4	82.8	17.4	4.2	2.4	0.8	639.8	205.9
Evergreen Forest	1,643.90	646.7	115.6	33.4	136.8	35.6	64.8	21.1	220.5	64.3
Mixed Forest	210.3	62.3	7.7	2.4	11.6	2.4	3	1	527.7	163.6
Dwarf Scrub	980.8	291.4	0	0	0	0	1.7	0.4	3.5	0.9
Scrub/Shrub	1,169.60	443.3	7.7	2.2	52.5	13.9	11.6	3.7	255	73.8
Grassland/Herbaceous	13.9	4.2	0	0	0	0	0	0	0	0
Sedge/Herbaceous	775.9	250.2	0	0	0	0	0	0	114.5	31.2
Pasture/Hay	0	0	0	0	0	0	0	0	1	0.4
Cultivated Crops	2.2	0.6	0	0	0	0	0	0	8.4	2.8
Total[e]	**7,656.30**	**2,595.10**	**220.6**	**56.7**	**185.1**	**60.6**	**2,261.80**	**662.7**	**417.2**	**125.1**

[a] Acreages derived from NLCD GIS data. Due to the methods used to determine land cover/vegetation for large-scale data sets (such as the NLCD), actual field conditions may differ from those reported. Areas within maintained ROWs specified as containing mixed forest vegetation may contain open vegetation that is not represented in the values reported in the NLCD data and this table.

[b] Acreage calculations are based on an offset 100-foot-wide ROW (40 foot on the western side and 60 foot on the eastern side of the centerline). The construction ROW was expanded to 230-feet in width along the approximately 77-mile-long segment that would require cut and fill.

[c] Mainline pipeline operational footprint calculations are based on a 52-foot-wide ROW on federal lands and an approximately 30-foot-wide ROW on private lands. Fairbanks Lateral operational footprint calculations are based on a 51-foot-wide ROW on federal lands and an approximately 30-foot-wide ROW on private lands.

[d] Estimate is based on NLCD data and does not capture all open water areas, as are discussed in the delineated wetland data in Section 5.4 (Wetlands).

[e] The total may not equal the sum of each individual due to rounding.

Non-native and Invasive Plants

Project construction would likely propagate invasive and non-native plants through several pathways:

- Transport and use of construction equipment and personnel from the continental United States where invasive and non-native plants are common;
- Spread of invasive and non-native plants already associated with existing ROWs (ARRC, TAPS, and Highways) from construction equipment and personnel;
- Some types of “Native” seed mixtures used to revegetate exposed soils could incidentally contain invasive and non-native seeds.

Invasive plants thrive and establish quickly on recently disturbed soils (Section 5.3.1.3). They are aggressive in growth and reproduction, are generalists, and are tolerant to many environmental conditions. Thus, they outcompete and displace native plants once exposure allows establishment. This causes a reduction in biological diversity and community composition. Changes in the composition of vegetation can in turn affect wildlife that inhabits these areas (Section 5.5 Wildlife).

Invasive and non-native plants are documented along much of the Dalton Highway and the George Parks Highway (ANHP 2011). In areas along the proposed ROW that are associated with existing ROWs (ARRC, TAPS, Highways), this would create further invasion of non-native plants. The majority of the proposed Project would parallel these transportation corridors, and the spread of invasive and non-native plants could occur throughout the Project’s construction workspace. A robust Non-native Invasive Plant (NIP) Prevention Plan would be required to prevent further spread of invasive and non-native plants.

Trenching

Trenching involves creating a narrow ditch to place the pipeline after the area has been graded and stripped of the topsoil. Trenching would include excavating subsoil and placing it on the non working side of the trench. Preserving the topsoil and subsoil strata during excavation would be essential for rehabilitation success. This would include filling the trench with subsoil (likely clays and gravels) first and replacing the organic layer (topsoil) on top. Vegetation would reestablish on topsoil faster than in clays or gravels that may be found deeper in the ground. Blasting may occur in areas with overlying bedrock, which would result in temporary and localized disturbance of vegetation in these areas. In areas such as the Beaufort Coastal Plain, recovery of vegetation would be expected to be slower than in other areas due to the short growing season.

Fragmentation

Fragmentation is the disruption of continuity (Lord and Norton 1990), and habitat fragmentation is the splitting of larger habitat blocks into smaller less continuous habitat, primarily by human disturbances such as land clearing and conversion of one vegetation type to another (Franklin et al. 2002). Linear construction projects, such as the proposed Project, can divide continuous vegetation communities and increase edge habitat (Watson 2005). Increases in edge habitat can facilitate invasive plant establishment and proliferation, which can substantially alter environmental conditions such as soil temperature and light availability (e.g., Brothers and Spingarn 1992). Habitat fragmentation and its affects to wildlife are discussed in detail in Section 5.5 (Wildlife).

The pipeline would be buried at the appropriate depth for USDOT standards for the majority of its length, and the landscape would be contoured to a preconstruction form. Effects from fragmentation would take decades to recover outside the permanent ROW as noted above and is dependent on the ability and length of time for preexisting vegetation to reestablish. If NIP species establish in the ROW, fragmentation may be permanent. Rehabilitation of forested vegetation in the construction ROW and temporary workspaces outside of the permanent ROW would be very slow (hundreds of years) to recover to reach a mature forested state. Forest vegetation loss may be permanent, or the species composition may change. Most of the proposed Project would be adjacent to TAPS, and existing ROWs, thus reducing the potential for additional vegetation fragmentation.

Backfilling

Backfilling includes cleaning the trench of debris before pipeline placement, and then adding fill with excavated material after pipeline installation. Fine grained material may be used as fill to surround the pipe; however, the placement of original excavated material near the surface would be necessary for success of vegetation establishment. Heavy vehicle activities can cause compaction of soils which can inhibit seed germination and root establishment, and reduce water infiltration which could result in bare soil exposure. Installation of erosion control barriers and timber mats would be required when vehicles are accessing the ROW to mitigate such impacts. Maintaining the natural soil strata would be an important aspect when backfilling the trench. Subsoil would be placed in the trench first and later covered with topsoil to expedite and improve rehabilitation success of the vegetation community.

Dust Deposition

Dust deposition would contribute temporary impacts to the construction ROW, primarily from hauling backfill and lining material to the construction area, and from crew vehicles accessing the construction site daily. Heavy vehicle use on existing gravel roads would produce more dust into the air than regular passenger vehicles. Additionally, numerous trips would be made between the material site and the construction area. Dust deposition would be greater during the summer months due to the dryer conditions and exposure of gravel on the road versus snow and ice. Dust would be produced at material sites from the mining of gravel and sand, which would potentially land on surrounding vegetation. However, these impacts would be localized and temporary because of the construction sequence of the Project. The ROW would be constructed and rehabilitated in sequence along the pipeline in segments. Impacts from the construction of the ROW would be expected to be temporary and localized for the construction activity for that segment of the Project.

Dust deposition could extend beyond the construction ROW and could interfere with plant photosynthesis and respiration. The magnitude and duration of dust deposition dictates the intensity of potential impacts (Auerbach et al. 1997), and in extreme cases, leads to the loss of more sensitive species altering the composition of the plant community.

Rehabilitation

Rehabilitation of the area includes clean up of remnant debris and finish grading to preconstruction contours as much as possible. Soil compaction and erosion control would be maintained by the use of low-ground pressure vehicles and permanent erosion control measures would be installed as required. Rehabilitation would occur during the rain free period to ensure rutting from vehicles does not occur since rutting would cause pooling of water, prevention of seed germination, and later additional erosion. The methods used to revegetate the ROW would be determined by site-specific conditions since not all revegetation or rehabilitation techniques would be successful for all vegetation communities and ecoregions. The speed of vegetation recovery during post-rehabilitation would be influenced primarily by the ecoregion, surrounding vegetation community, construction season, and the efficacy of restoration efforts.

An Erosion and Sediment Control Plan, Storm Water Pollution Prevention Plan (SWPPP), and a Stabilization, Rehabilitation, and Restoration Plan would be developed and approved prior to Project implementation. These plans would identify appropriate restoration and re-vegetation measures, including de-compaction and seeding rates. Revegetation measures would be implemented to promote the establishment of vegetation within the Project area throughout the life of the Project. The Stabilization, Rehabilitation and Restoration Plan would include regular long term monitoring of the ROW during the post-rehabilitation phase. The monitoring plan would identify problem areas where revegetation has not occurred and provide for additional mitigation as necessary.

Non-native and Invasive Plants

Non-native plant seeds may be introduced and spread into the ROW area throughout the construction process by the pathways noted above. Rehabilitation of the area would include contouring the area to near original state as possible. Post-rehabilitation of the TAPS ROW has resulted in non-native plant species establishment in the revegetated area along most of the ROW with some invasion of native species at varying degrees (McKendrick 2002). The proposed Project would likely cause additional spread of non-native and invasive plants along the ROW due to the collocation with TAPS. Thoroughly cleaned native seed would be required for reestablishment of the vegetation growth in disturbed areas. Implementation of an agency approved Project-specific NIP Plan would be required to mitigate for the potential pathways of non-native and invasive plant establishment (see Section 5.3.3).

Mowing

Mowing or clearing the vegetation overstory of the ROW would occur as needed on a regular basis to allow for visual inspections of the pipeline from aerial patrols. Approximately 1,340 acres of forested and 1,066 acres of scrub/shrub land exists within the permanent ROW and would be affected by vegetation clearing (Section 5.9.1.3). Vegetation communities impacted by segment of the construction and permanent ROW are included below in Table 5.3-3.

Regular maintenance of the permanent ROW would include mowing surface vegetation to a non-forested vegetative cover type. Forested land within the permanent ROW (1,340 acres) would be permanently removed and would be maintained potentially as a scrub/shrub vegetative type. Forest vegetation outside of the permanent ROW but inside the construction area would be allowed to grow back and would reestablish to mature forest vegetation through succession over the long term.

Impacts from mowing non-forested vegetation would not constitute a substantial additional negative impact to that vegetation type since vegetation would potentially grow denser as it is trimmed to maintain a low ground cover. Maintenance of the ROW would occur during dryer months when rutting and erosion from equipment would be less likely to occur. Mowing in the pre-nesting season would prevent additional impacts to wildlife such as nesting migratory birds (Section 5.5 Wildlife). The spread of non-native and invasive plant species could occur from transporting and traversing mowing equipment from one location to another along the ROW. The NIP Prevention Plan would address this aspect of the maintenance program to reduce potential spread of non-native and invasive plants from mowing equipment.

<u>Project Segments</u>

Vegetation communities found by segment within the construction and permanent ROW are identified in Table 5.3-3. The following information includes a short discussion on the vegetation composition in each segment of the ROW including the Denali National Park Route Variation and Fairbanks Lateral.

MP 0 to MP 540

The proposed Project would closely follow the TAPS ROW along the Dalton Highway from Prudhoe Bay to the community of Livengood (Figure 5.3-1, Maps 1-3). Much of this area was heavily disturbed during TAPS construction and now differs markedly from adjacent natural vegetation (McKendrick 2002). The surrounding areas are predominantly wetland communities of sedges, low shrubs, or shallow water marshes (*Arctophila fulva*), while within the TAPS ROW, vegetation is primarily comprised of species planted for revegetation purposes, such as red fescue (*Festuca rubra*), or species that frequently colonize gravels of nearby river channels, such as dwarf fireweed (*Epilobium latifolium*).

The key land use types in the construction ROW includes approximately 21 percent developed, 34 percent forested, 15 percent scrub/shrub, 13 percent dwarf scrub and 10 percent sedge/herbaceous land (Table 5.3-3). The remaining 7 percent land use types include barren land, open water, grassland/herbaceous, pasture, and cultivated crops (Table 5.3-3). The predominant forest type is evergreen, which would reestablish over a long period of time (decades to more than a century) outside the permanent ROW. As noted earlier, of all vegetation types, forest vegetation would experience the highest impacts due to the length of time it takes for succession of the vegetation to reach maturity. In addition, forest vegetation removal would create the highest visual impact and would also impact specific bird species (e.g., raptors) to a higher extent (Section 5.5 Wildlife).

South of Livengood, the proposed Project would pass through Minto Flats State Game Refuge, a large complex of undisturbed wetlands and boreal forest heavily influenced by numerous river meanders and frequent fire succession (Figure 5.3-1, Map 4). Near Dunbar, the proposed Project would begin to follow the George Parks Highway corridor where vegetation composition along much of this area consists of disturbed vegetation communities.

Much of this segment is associated with existing pipeline or highway ROWs and developed land (low intensity) comprises approximately 20 percent of the total land cover within the ROW. Forest vegetation (evergreen, deciduous and mixed), scrub/shrub, and sedge/herbaceous comprise approximately 37 percent, 17 percent and 9 percent of the land cover respectively (Table 5.3-3). The remaining 17 percent includes the open water, barren land, dwarf scrub, grassland herbaceous, pasture and cultivated crops (Table 5.3-3).

MP 540 to MP 555

This segment of the proposed Project would extend east of the George Parks Highway corridor, avoiding Denali National Park. The proposed mainline route (MP 540 to MP 555) would pass through undeveloped land, impacting approximately 75 percent forest and 24 percent scrub/shrub vegetation types for the construction ROW. For the permanent ROW, forested vegetation composes approximately 74 percent of the vegetation community, with scrub/shrub composing 25 percent (Table 5.3-3). The majority of the forest vegetation is evergreen along this route. No developed land currently exists in the proposed permanent ROW. An alternative to the proposed route is discussed below.

MP 555 to END

This segment extends south from the Denali NPP at MP 555 to the pipeline terminus near the Knik Arm in the Cook Inlet (Figure 5.3-1, Map 6). The majority of the route follows the George Parks Highway, but the section that continues south of Willow does not, and instead traverses to the west through undeveloped areas leading to the proposed NGLEP location. The construction ROW for this segment is composed of approximately 21 percent developed land (80 percent of which is low intensity), 61 percent forest (mainly deciduous) and 11 percent scrub/shrub vegetation (Table 5.3-3). Five percent is scrub herbaceous, and for all other land use types, they include less than 1 percent each in composition for the construction and permanent ROW (Table 5.3-3). For the permanent ROW, approximately 17 percent of the area is considered developed land, and 65 percent and 11 percent is composed of forest and scrub/shrub vegetation respectively (Table 5.3-3).

Fairbanks Lateral

The Fairbanks Lateral extends approximately 34 miles from near Dunbar headed northeast to Fairbanks. This route largely follows the existing railroad corridor (Figure 5.3-3, Map 4). For the construction ROW, the Fairbanks Lateral line is composed of approximately 95 percent forest vegetation, with 2 percent scrub/shrub (Table 5.3-3) and the remaining 3 percent as developed land (low intensity). For the permanent ROW, 94 percent of this segment is composed of forested lands (65 percent deciduous, 27 percent evergreen and 2 percent mixed forest). Three percent is developed, 2 percent scrub/shrub and 1 percent for open water, and barren land (Table 5.3-3). This area also contains wetlands (Section 5.4 Wetland).

Yukon River Crossing Options

As described in Section 2.2.3.2, the Project proposes to cross the Yukon River in one of three ways, via a suspension bridge to be constructed (Option 1), via the existing highway bridge (Option 2), or via HDD (Option 3). The construction of the ROW for Option 1 would include: impacts to approximately 48 percent forested vegetation, and no loss to scrub/shrub vegetation. Approximately 8 percent of the area is developed land (low intensity), and the remaining percentages include open water and wetlands. Wetlands are described in detail in Section 5.4 (Wetland Resources). For Option 2, construction impacts would be 23 percent for forested vegetation, 3 percent scrub/shrub, and 54 percent is currently developed. The remaining land use types for Option 2 is included as open water (5 percent) and wetlands (16 percent).

For Option 2, forested vegetation impacts for the permanent ROW would be approximately 24 percent versus 44 percent for Option 1. For the permanent ROW, 50 percent of the land cover for Option 2 is developed land (low intensity), versus 6 percent for Option 1. Eighteen percent is open water for Option 1 versus 2 percent for Option 2. Thirty-two percent is wetlands for Option 1 versus 20 percent for Options 2. Scrub/shrub land cover types would not be impacted in Option 1; however, would be impacted by 4 percent in Option 2.

Option 3 would result in construction of one acre of land within the ROW on each side of the Yukon River resulting in the same amount and types of vegetation impacted described for Option 1 above.

Overall, more forested vegetation would be impacted from building a suspension bridge (Option 1) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Bridge (Option 2).

Denali National Park Route Variation

The Denali National Park Route Variation would traverse 7 miles of Denali National Park lands. The proximity of this proposed route to the road corridor for most of the 15 miles is reflected in the vegetation composition of the construction ROW which is approximately 48 percent developed land.

This route variation is composed of approximately 38 percent forest and 6 percent scrub/shrub vegetation respectively throughout both the construction and permanent ROWs (Table 5.3-3). Forty-eight percent is developed, 7 percent barren land, and less than 1 percent composition for open water and dwarf scrub for the construction and permanent ROW (Table 5.3-3). Considerable impacts exist when comparing the acreage and type of vegetation to be impacted from ROW development between the mainline route and the alternative.

In comparison with the mainline route, the Denali National Park Route Variation would result in fewer impacts to vegetation, primarily by development of approximately 37 percent less forested vegetation, and 18 percent less scrub/shrub and by utilizing 48 percent of existing developed land.

Aboveground Facilities

Aboveground facilities would require approximately 80 acres of land during construction and operations (Section 2.1.2). Development of aboveground facilities would result in permanent loss of vegetation from gravel fill placement to develop pads. Table 5.3-4 includes the acreage of vegetation types impacted by aboveground facility development. This table is discussed in detail in Section 5.3.2.1.

Five types of aboveground facilities would be built for operations of the proposed Project. These are: gas conditioning facility (GCF), mainline valves (MLVs), compressor station (CS), straddle off-take facility and the natural gas liquid extraction plant (NGLEP) facility (Section 2.1.2). The vegetation communities that would be impacted for construction and operation of these major aboveground facilities for the Project are described in Table 5.3-4.

The GCF would impact the most vegetation and would impact approximately 68.5 acres of sedge/herbaceous vegetation. The MLVs would require an area of approximately 0.5 acres or less, which would not cause substantial impacts to any particular vegetation type. The CS at MP 225 would potentially impact approximately 1.4 acres of scrub/shrub vegetation. The CS at MP 286.6 would impact 1.3 acres of forested vegetation, and the CS at MP 458.1 would impact 3.3 acres of forested vegetation, the majority of which is located in a deciduous forest type. The NGLEP facility would be constructed in 4.7 acres of forested vegetation (Table 5.3-4). Overall, substantial vegetation impacts from permanent loss of forest vegetation would occur from the development of aboveground facilities for the proposed Project.

TABLE 5.3-4 Vegetation Communities (excluding developed lands) Impacted by Construction and Operation of Aboveground Facilities

Description	GCF (MP 0.0)	MLVs (Construction/ Operation) (various locations)[a, b]	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Compressor Station (MP 458.1)	Straddle and Off-Take Facility (MP 458.1)	NGLEP Facility (MP 736.4)
Open Water[c]	0.3	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0
Developed, Low Intensity	0.0	0.1/0.5	0.0	0.0	0.0	0.0	0.3
Barren Land	0.0	0.0/0.1	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	0.0	0.1/0.3	0.0	0.0	<0.1	2.6	0.0
Evergreen Forest	0.0	0.2/0.5	0.0	1.3	1.4	0.8	3.0
Mixed Forest	0.0	0.1/0.2	0.0	0.0	0.0	0.0	1.7
Dwarf Scrub	0.0	0.0/0.1	0.0	0.0	0.0	0.0	0.0
Scrub/Shrub	0.0	0.2/0.4	1.4	0.2	0.0	0.0	0.0
Sedge/Herbaceous	68.5	0.1/0.3	0.0	0.0	0.0	0.0	0.1
TOTAL[d]	**68.7**	**0.8/2.4**	**1.4**	**1.4**	**1.4**	**3.3**	**5.2**

[a] MLV acreages account for those portions of the valves that extend outside of the permanent or construction ROWs.

[b] Note that the AGDC indicated that two MLVs would be required along the Fairbanks Lateral, but has not identified their locations. It is assumed that these facilities would encumber approximately 0.1 acre of land. Because the location of these facilities is not known, their overlap with the proposed construction and operational ROWs could not be determined. Therefore, acreages associated with the two MLVs are not included in the above table.

[c] Estimate is based on NLCD data and does not capture all open water areas, as are discussed in the delineated wetland data in Section 5.4 (Wetlands).

[d] The sum of the individual entries may not match the overall total due to rounding.

Extra Work Areas Outside of ROW

Access roads are extra work areas that would impact vegetation resources. Access roads would be used by facility personnel to operate and maintain the pipeline and associated facilities.

Access Roads

The proposed mainline route would require the use of 90 permanent gravel roads, 60 of which would be new roads developed for the Project. Roads would be used to transport material, equipment and personnel, and to access water sources, material sites and camps. Section 5.9 (Land Use) contains further details on access roads. Approximately 524 acres of access roads would be used by the proposed Project for the permanent ROW. The majority of these roads (73 percent) would be located between MP 0 to 540 (Section 5.9.1.4). Five additional roads would be used for the Fairbanks Lateral.

There are four main impacts expected for increased road use and development. Permanent vegetation loss, dust deposition, non-native and invasive plant dispersal, and fragmentation. Vegetation would be permanently lost from road development, but the vegetation surrounding the constructed road would also receive impacts. These impacts are dust deposition; non-native and invasive plant dispersal and fragmentation. Forested vegetation would receive most impacts of the vegetation communities from access road development (Section 5.3.1.4). Forested vegetation would be permanently removed for road development and clearing of the ROW for maintenance purposes.

Permanent impacts to road development along the Fairbanks Lateral are 73 percent forest, 4 percent scrub/shrub vegetation and 23 percent developed. Approximately 23 percent of the Fairbanks Lateral is developed. Acreage for vegetation communities found along proposed and existing access roads is included in Table 5.3-5. Impacts from access roads developed for the mainline route would be 63 percent forest and 25 percent scrub/shrub vegetation. Approximately 9 percent of the mainline access road route is classified as developed. The remaining composition of vegetation communities includes 1 percent dwarf sedge, 1 percent sedge herbaceous and 1 percent for barren land, grassland/herbaceous, crops and open water combined. The acreage for vegetation communities is included in Table 5.3-5.

Dust Deposition

Dust would be generated from development of 60 permanent gravel roads, and the use of 30 existing gravel roads. Gravel would be placed as fill to construct access roads and the transportation of gravel with heavy trucks from material sites to road construction areas would create dust deposition onto the surrounding area. Heavy machinery including dump trucks would produce more dust than regular passenger vehicles.

Dust deposition in the construction ROW would result in temporary and local impacts to vegetation communities. Impacts would occur by pipeline segment and season as the Project is constructed. Impacts would depend on dust particle size, wind processes, wetting of the ground, duration and frequency of traffic, and speed of travel. Dust deposition could extend beyond the construction ROW and could interfere with plant photosynthesis and respiration. The magnitude and duration of dust deposition dictates the intensity of potential impacts (Auerbach at al. 1997), and in extreme cases, leads to the loss of more sensitive species altering the composition of the plant community. The AGDC would implement BMPs during construction to reduce fugitive dust (Section 5.15).

Regular vehicle use during construction and operation of the Project would also create dust along roadsides and pads. An enforceable road maintenance plan and on-site driving rules would aid in reducing dust deposition surrounding roads and facilities. During operations, long term dust deposition can potentially cause thermokarst effects in permafrost areas along access roads. Melting snow along roadsides is accelerated as dust is deposited over time. These areas cause a depression in the vegetation from melting permafrost which can alter vegetation growth and species composition. Early snow melt along roadsides exposes vegetation earlier than surrounding non-dusted vegetation, which can attract wildlife near the road, potentially causing increased mortality from vehicle collisions (Section 5.5 Wildlife). Additional information regarding dust generation and applicable minimization measures are discussed further in (Section 5.15 Air Quality).

Non-native and Invasive Plants

Access road development can act as a dispersal mechanism, where untouched land becomes exposed to non-native and invasive plant species. Spread can occur from vehicles, equipment, hand tools, boots and clothing. Non-native and invasive plants establish quickly on exposed soils, and impacts could be long term from continued exposure of NIP species along roadways. An agency approved NIP Plan that includes regular monitoring and assessment would be required to prevent invasion of non-native plant species along access roads. This plan would require updates over the long term throughout Project operations to maintain the integrity of the native flora.

Rare and Sensitive Plants

Twenty three rare and sensitive plants have been identified to potentially occur within the proposed Project area (Table 5.3-2). Two notable areas where the probability of occurrence of rare plants could be greater would be in the Minto Flats State Game Refuge and the mainline route (MP 540 to MP 555) that bypasses Denali NPP lands. Both of these areas are not associated with existing ROW systems and are therefore comparatively undisturbed. Much of Denali NPP has been inventoried for vegetation, with more than 1,500 species of vascular plants, mosses, and lichen identified. Fifty-three vascular plant taxa considered rare in Alaska by the ANHP (ranked S3 or lower) are known to occur in Denali NPP, but none were documented along the George Parks Highway within Denali NPP (Roland 2004). The relatively undeveloped mainline route (MP 540 to MP 555) east of Denali NPP, has the potential to possess similar flora as the Denali NPP.

If rare or sensitive plant species are present along the undeveloped proposed mainline route, the plants would be subject to the same impacts as other vegetation. Often, globally rare species are also locally rare (i.e., have small population sizes) and are much more susceptible to localized extinction events. However, a comprehensive rare and sensitive plant inventory has not yet been conducted in the Project area. The majority of the proposed ROW would be associated with existing pipeline, roadway, or utility corridors and as such, the vegetation in these existing ROWs is currently maintained. Therefore, there would be a low probability that rare or sensitive plants occur within the proposed Project ROW.

As described further in Section 5.8, the AGDC and USACE have consulted with the USFWS and NMFS under Section 7 of the ESA to minimize Project-related impacts to federally-listed threatened and endangered species; none are known to be present within the Project area.

TABLE 5.3-5 Vegetation Communities Found Along Proposed and Existing Access Roads[a]

Description	Fairbanks Access Roads (Acres)		Mainline Access Roads (Acres)	
	Construction[b]	Operational[c]	Construction[b]	Operational[c]
Open Water	0.2	0.2	0.2	0.2
Developed, Open Space	0.3	0.3	0.4	0.3
Developed, Low Intensity	27.2	27.2	35.7	35.0
Developed, Medium Intensity	0.0	0.0	1.5	1.5
Barren Land	0.0	0.0	1.9	2.0
Deciduous Forest	27.9	28.0	78.2	85.6
Evergreen Forest	47.0	47.0	124.0	145.5
Mixed Forest	13.7	13.7	38.2	33.9
Dwarf Scrub	0.0	0.0	7.9	5.6
Scrub/Shrub	4.4	4.4	109.8	104.9
Grassland/Herbaceous	0.0	0.0	1.4	1.4
Sedge/Herbaceous	0.0	0.0	3.1	4.4
Cultivated Crops	0.0	0.0	0.7	1.2
Total	**120.7**	**120.8**	**403.0**	**421.5**

[a] Access Roads acreage is for only the portion of the 50 foot-wide ROW that falls outside the permanent and construction ROW. Those lands along access roads within the permanent or construction ROWs are accounted for in the vegetation numbers for those facilities. For this reason, the total access road for the construction access roads may be smaller than those associated with the permanent access roads.

[b] Construction acreage includes permanent and temporary new and existing access roads.

[c] Permanent operational acreage includes permanent access roads.

Fragmentation

Construction of 60 new gravel roads would create permanent fragmentation impacts to vegetation and the wildlife that depend on it (see Section 5.5 Wildlife). Access road development would impact approximately 3,887 acres of forest vegetation (Section 5.9.1.6). Habitat fragmentation would impact sensitive species or species less tolerant to habitat discontinuity, especially in forested areas of the Project. Habitat fragmentation applies to wildlife and the habitat that they require to survive and is discussed in detail in Section 5.5 (Wildlife).

Material Sites

Existing material sites used for the TAPS Project would provide sufficient gravel and sand for the Project (Section 2.1.3.3). Impacts to surrounding vegetation from material site use include dust deposition during excavation of material, and transport. Dust deposition would have local and temporary impacts to vegetation surrounding material sites when heavy equipment is mining gravel and sand to be transported to road and pad development points.

Temporary Extra Workspaces

TEWS would be located adjacent to construction areas and would include additional areas of land required for temporary uses. These areas may include areas for spoil storage, staging of equipment, pull string assembly, HDD activities and railway crossing points (Section 2.1.3.3). The size and location of these areas are dependent on site specific conditions, and have not been determined by the AGDC to date. Therefore, calculations of Project impacts from TEWS have not been included.

5.3.3 Mitigation

As described throughout this section, the AGDC would implement the following mitigation measures to minimize Project-related impacts to vegetation resources:

- Develop and implement a Stabilization, Rehabilitation, and Restoration (SRR) Plan following ADNR's *Plant Materials Center Revegetation Manual for Alaska* (Wright 2009) in consultation with the BLM;
- Implement BMPs during construction to reduce fugitive dust, which would minimize dust deposition on vegetation adjacent to construction work areas;
- Develop a SWPPP that outlines erosion control measures, including the temporary stabilization and reseeding of construction work areas during and after construction; and
- Develop a NIP Prevention Plan to limit the establishment and spread of invasive and non-native species.

In addition to the minimization measures described throughout this section and summarized above, the following minimization and mitigation measures should be implemented to further reduce Project-related impacts to sensitive and rare vegetative resources:

- Consult with appropriate federal and state land management and resource agencies regarding rare plant species that may be located within the Project work areas and conduct appropriate survey, reporting, and mitigation developed through this consultation.

5.3.3.1 Construction

Additional mitigation measures that could be implemented into plans noted above include:

- Power wash all equipment and quarantine personnel clothing and boots used on previous work sites (continental US) to prevent the spread of non-native invasive plants;
- Address rehabilitation and restoration of all ground-disturbed areas associated with the pipeline construction in the Stabilization, Rehabilitation and Restoration (SRR) Plan, including the construction ROW, material sites, camp sites, temporary access roads, ice roads and pads, and temporary use areas;
- Minimize the construction area (grading and topsoil stripping) as much as possible; especially in forested areas due to the extended length of time required for forest vegetation to reach maturity; and
- Maintain the natural strata of subsoils as they are excavated to provide optimal substrate for native plant establishment on exposed rehabilitation areas.

5.3.3.2 Permanent Operations

Additional mitigation measures that could be implemented into plans noted above include:

- Power wash mowing equipment used to cut vegetation along the ROW when transported from one site to another to prevent the spread of non-native and invasive plants;
- Conduct regular assessments of roadside impacts over the life of the Project to document potential thermokarst development, changes to vegetation composition, and wildlife use;
- Mow the ROW during pre or post-nesting season for the area to prevent impacts to wildlife;
- Reevaluate the NIP Prevention Plan periodically to address and update existing conditions throughout the Project;
- Implement and enforce driving rules and road maintenance during the life of the Project to reduce dust deposition from regular traffic use on roads and pads during operations; and
- Monitor the rate of forest succession periodically over 10-year increments, and mitigate as needed. This may include tree planting outside the permanent ROW, or tilling soil for seeds to establish.

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5.4 WETLANDS

This section describes the classification and composition of wetlands within the Project Area, and the potential impacts proposed from Project construction, operations and the alternatives. The analysis methodology, affected environment, environmental consequences and mitigation are discussed in detail below.

Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3(b)). Jurisdictional wetlands regulated by the U.S. Army Corps of Engineers (USACE) under Section 404 must exhibit a positive wetland indicator from all three characteristics – vegetation, soils and hydrology – to make a wetland jurisdictional determination, except in limited instances identified in the manual;*1987 Corps of Engineers Wetlands Delineation Manual* (USACE 1987).

Under the National Environmental Policy Act (NEPA), Protection of Wetlands is defined as: to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative (EPA, Exec Order No. 11990).

5.4.1 Analysis Methodology

A multiyear preliminary jurisdictional determination (PJD) was conducted along the proposed 737-mile Project within the 2,000-foot planning corridor in support of USACE permitting (AES 2011). Four main components were included in developing the PJD: review of existing data, aerial photo interpretation, field data collection, and post field mapping and analysis. This study mapped wetlands by interpreting data at two scales: (1) the 2,000-foot (1,000 feet on each side of the centerline) planning corridor; and (2) within the 300-foot wide wetlands and uplands analysis corridor. The 2,000-foot planning corridor provides a broad spatial context for the proposed Project area, while the construction ROW provides a conservative estimate of the specific wetland habitat that would be directly impacted.

A wetlands and uplands analysis was conducted within the proposed 300-foot construction corridor (150 feet on either side of the centerline). This analysis included field verifying the desktop analysis to confirm wetlands and uplands at field target locations throughout the length of the pipeline. The remaining 1,700 feet of the planning corridor was interpreted primarily from aerial photographs and the select field target locations chosen for ground truthing (AES 2011). Areas with field-verified characteristics that met the three wetland criteria as outlined in USACE 1987 and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region* (USACE 2007) – vegetation, soil, and hydrology – were classified as wetlands.

Two classification systems were used to characterize the wetlands within the proposed Project area: The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) by Cowardin et al. (1979) Classification of Wetlands and Deepwater Habitats, and the Brinson (1993) hydrogeomorphic (HGM) classification. The NWI classification is based largely on biotic characteristics (e.g., vegetation), whereas the HGM classification describes the wetland's position in the landscape and its function using geomorphic and hydrologic characteristics. Both classification systems were used to provide information needed for a robust basis for wetland comparisons. For example, forested wetland vegetation is very slow to recover from disturbances. In contrast, emergent wetlands can recover much more quickly.   However, regardless of the type of wetland impacted, sloped wetlands are more susceptible to hydrologic changes resulting from soil and vegetation changes. Using both systems provides effective characterization of wetlands when considering potential impacts.

A third classification system, the National Land Cover Database (NLCD) (Homer et al. 2004) was used primarily to classify vegetation composition and impacts in Section 5.3 (Vegetation). In some cases where the two wetland classification systems (NWI and HGM) were not used, the NLCD classification was used to supplement the analysis, primarily for analysis of land use acreage for access roads and pads.

5.4.2 Affected Environment

The proposed Project corridor crosses a wide variety of wetland classes as it proceeds from the Beaufort Sea Coastal Plain southbound to the Cook Inlet Basin (Section 5.1.1.1 and Figure 5.1-1). Wetlands are important to the ecosystem for many reasons. They support numerous species of plants and provide necessary habitat for fish, wildlife, and insects throughout various stages of their life cycles. Wetlands provide feeding, breeding, rearing, and cover habitat for numerous animals. Wetlands also act as filters while providing flood control, sedimentation, erosion control, and the stabilization of shorelines.

Wetland classes transected by the proposed Project corridor can be grouped into four major classifications using the NWI classification system, which is used as the National Wetlands Classification Standard:

- *Forested wetlands (PFO)* – Forested wetlands include broadleaf, needleleaf, and mixed forest wetland communities. These wetlands are typically dominated by an over story of black spruce (*Picea mariana*), with an understory of alder (*Alnus* spp.), Labrador tea (*Ledum* spp.), and horsetail (*Equisetum* spp.), among others. Forested wetlands function to increase nutrient export, modify stream flow, and improve water quality;
- *Scrub/shrub wetlands (PSS)* – Scrub/shrub wetlands include broadleaf, needle-leaf, and mixed shrub communities. These wetlands are commonly dominated by swamp birch (*Betula nana*), sweetgale (*Myrica gale*), bluejoint reedgrass (*Calamagrostis canadensis*), horsetail (Equisetum spp.), marsh cinquefoil (*Comarum palustre*), and sedges (*Carex* spp.). These wetlands often function similar to forested wetlands in that they increase nutrient export and improve water quality. They also support extensive bird nesting and animal browsing;

- *Emergent wetlands (PEM)* – Emergent wetlands are dominated by graminoid species – sedges and grasses, with scattered shrubs. These can function to buffer floodwaters, moderate stream flow, facilitate nutrient export, and provide critical habitat for juvenile fish, waterfowl, and other wildlife; and
- *Other water and riverine wetlands (P, R, L)* – Other water and riverine wetlands include ponds, lakes (less than 20 acres), and small streams. These open water systems can support aquatic bed vegetation like lilypads, and pondweed (*Zannichellia* spp.). Open water systems transport sediment and nutrients, provide important wildlife and fisheries habitat as well as improve water quality, and buffer flood waters.

Wetlands crossed by the proposed Project corridor were also classified into seven HGM classification functional classes:

- *Mineral Soil Flats* – These wetlands do not receive groundwater discharge; they receive water from precipitation and overland flow. Flat wetlands lose water by evapotranspiration and saturation overland flow. Flat wetlands are very common in permafrost soils, but can also form from an accumulation of organic material and primarily function to store surface water and provide wildlife habitat, most notably waterfowl;
- *Depressional* – Wetlands occur in topographic depressions. These wetlands receive water sources from precipitation, ground water discharge, and both interflow and overland flow from adjacent wetlands. These wetlands store surface water and provide groundwater recharge, and wildlife habitat;
- *Slope* – Wetlands occur where there is groundwater discharge to the surface. They are normally found along elevation gradients. They do not store surface water, or recharge groundwater. Instead, they mediate surface flow to other wetlands and waterbodies;
- *Riverine* – Wetlands occur in floodplains and riparian corridors. Their water source is primarily overbank flow, supplemented by overland flow and precipitation. These wetlands can moderate stream flow, store floodwaters, and facilitate nutrient export;
- *Lacustrine Fringe* – Wetlands occur adjacent to ponds and lakes and are largely maintained by an elevated water table. They function to store floodwater and detritus (organic material) and provide habitat for wading birds and juvenile fish;
- *Extensive Peatlands* – These wetlands are created by the vertical accretion of organic matter. The water source for extensive peatlands is typically precipitation with water loss due to saturation and seepage to groundwater. Bogs or muskegs are common examples; and

- *Estuarine Fringe* – Wetlands occur along coasts and estuaries that are influenced by sea level. They intergrade with riverine wetlands where tidal current declines and river flow is the dominant source. These wetlands frequently flood from tidal exchange. Organic matter accumulates in higher elevated marsh areas. Salt marshes are an example of an Estuarine Fringe wetland. There are no wetlands of this class within the proposed Project. Therefore, they are not included or discussed further.

5.4.2.1 2,000-Foot Wide Planning Corridor

A 2,000-foot wide planning corridor (1,000 feet on either side of the centerline) was selected to provide ample coverage area for pipeline placement optimization (AES 2011) and thus represents the Project area for wetland resources. The planning corridor provides a quantifiable landscape context for understanding the wetland composition by region. Without the landscape context, it would be difficult to evaluate the relative magnitude of wetlands potentially impacted within the regional landscape. The Wetland compositions relative to the aboveground facilities locations are presented in Figures 5.4-1 through 5.4-5.

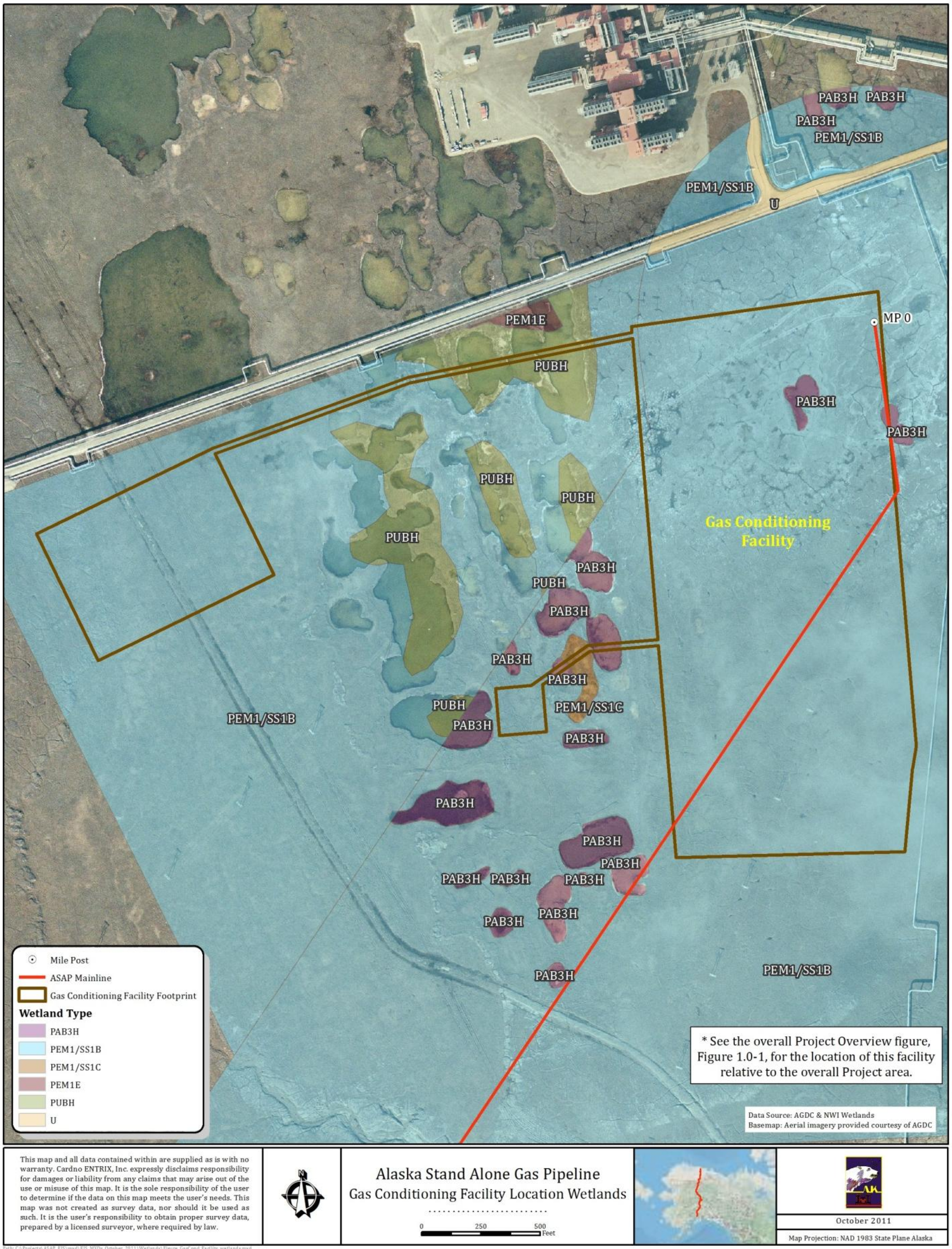

FIGURE 5.4-1 Gas Conditioning Facility Location Map with Wetlands

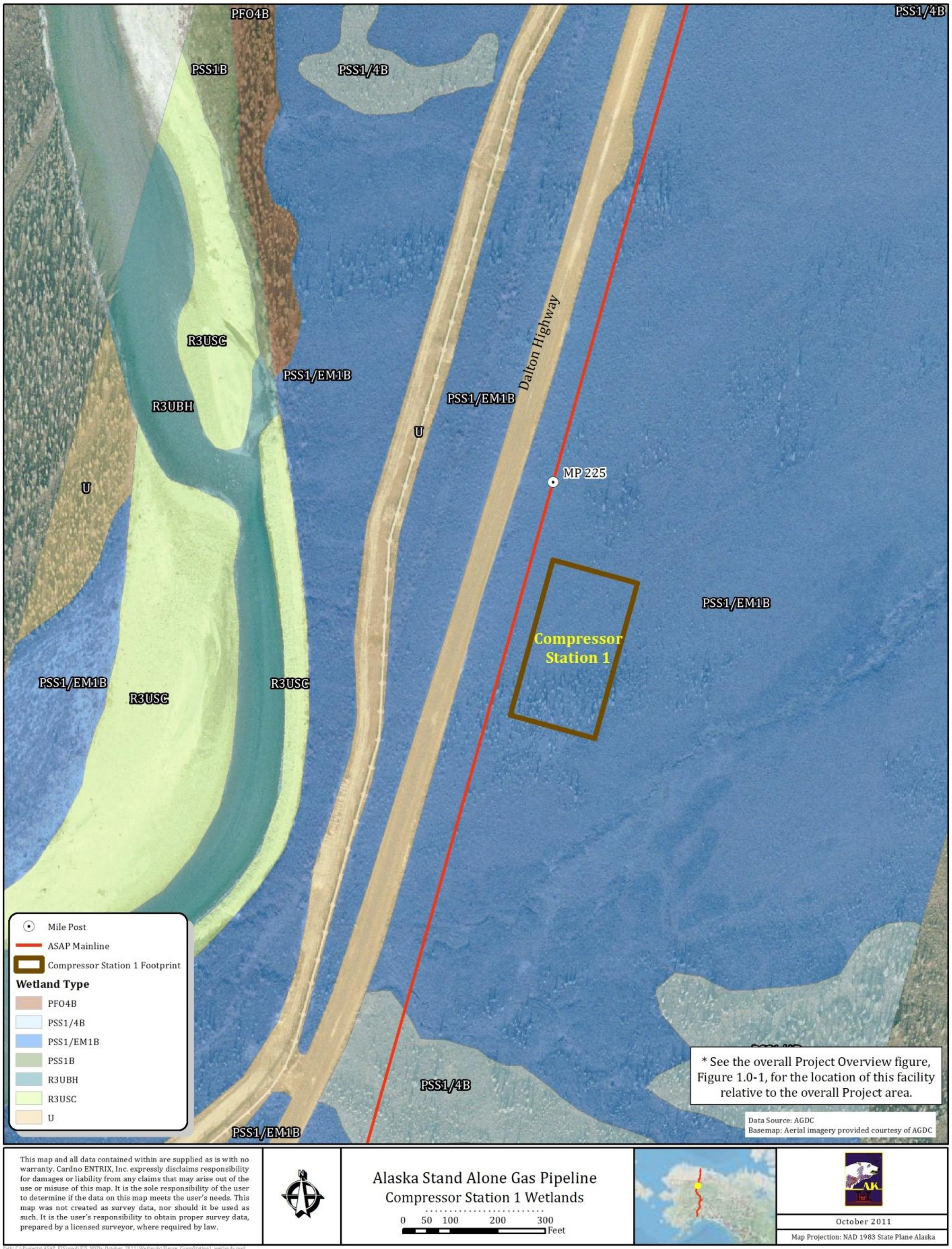

FIGURE 5.4-2 Compressor Station 1 Location Map with Wetlands

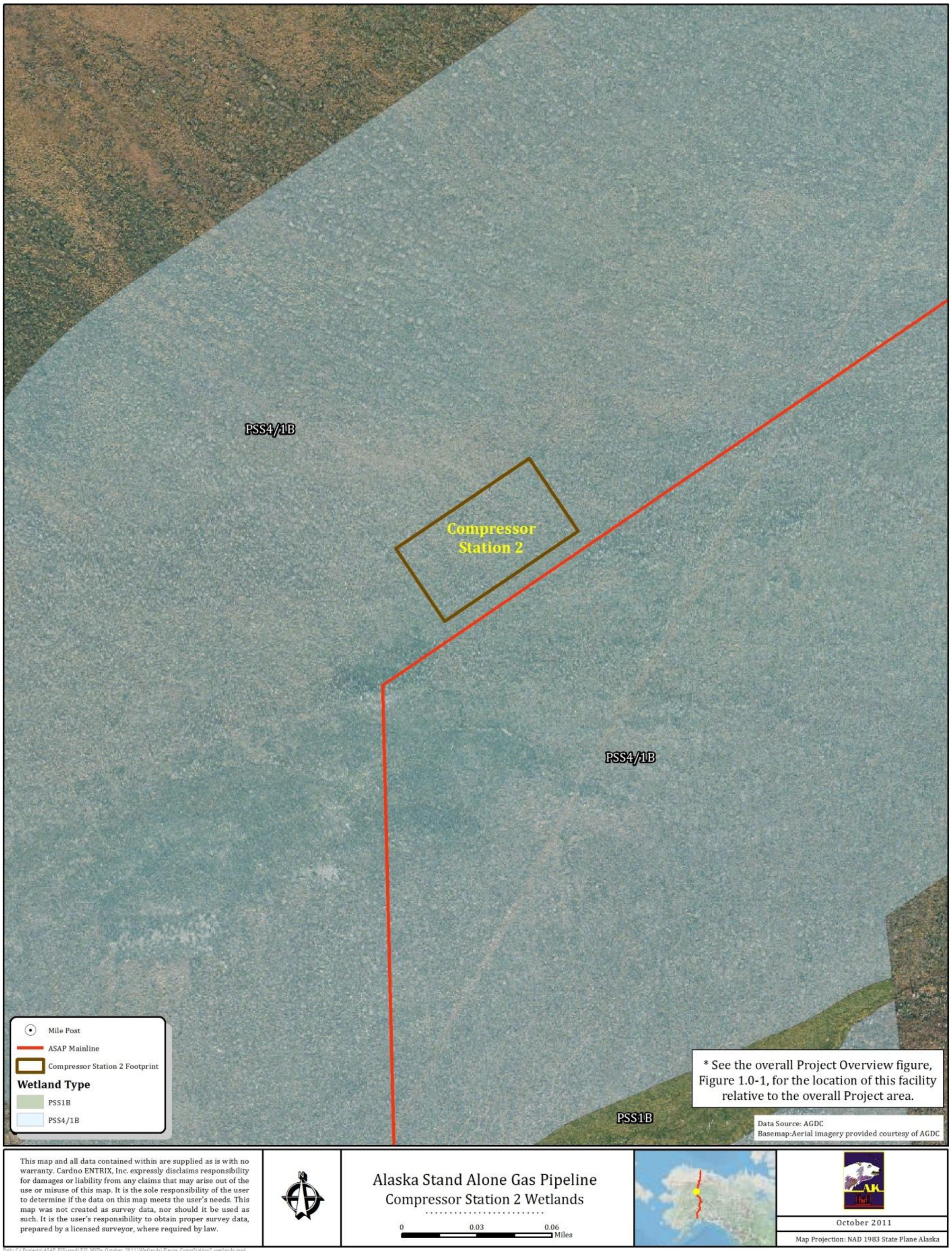

FIGURE 5.4-3 Compressor Station 2 Location Map with Wetlands

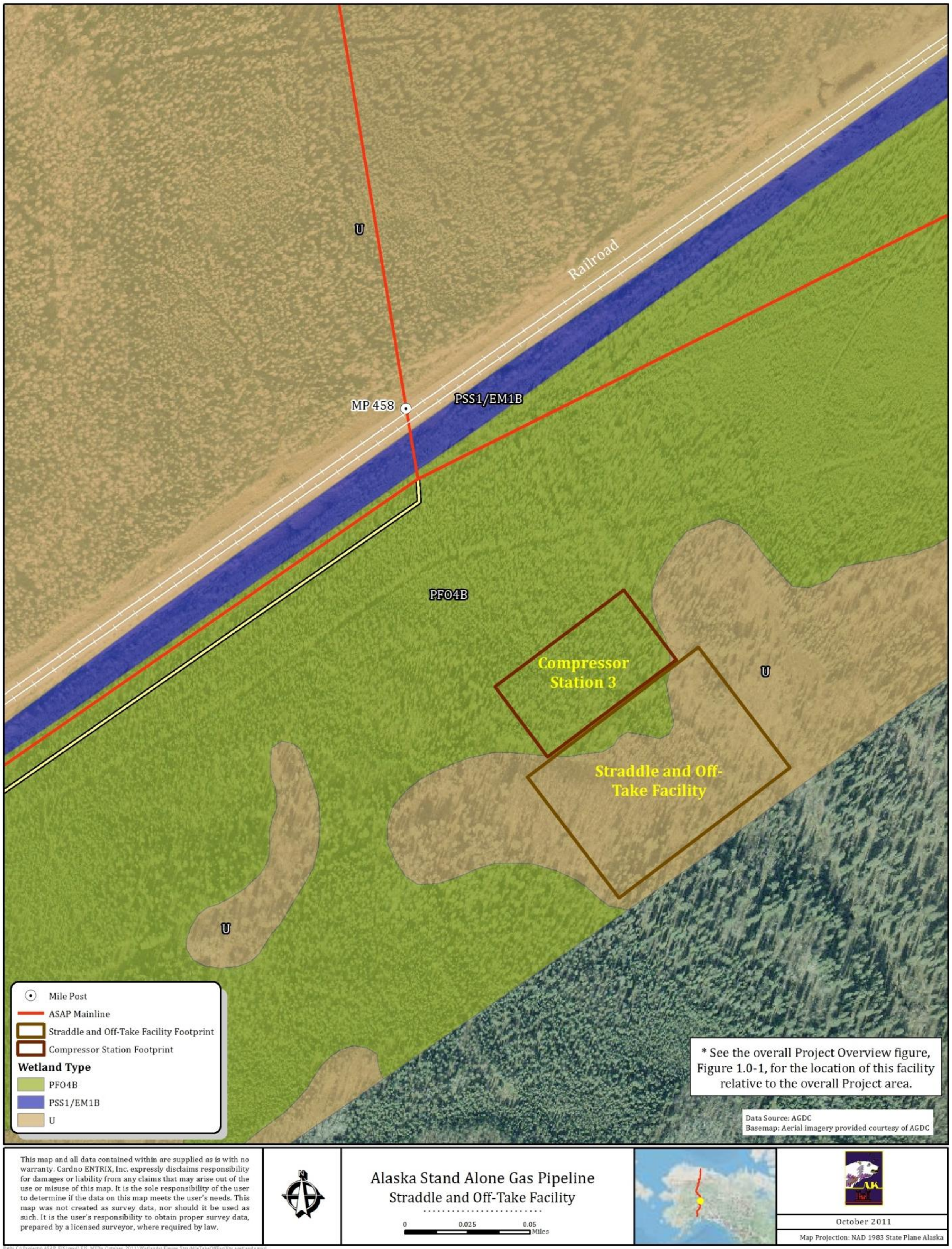

FIGURE 5.4-4 Straddle and Off-Take Facility Location Map with Wetlands

FIGURE 5.4-5 Natural Gas Liquids Extraction Plant Facility Location Map with Wetlands

The 2,000-foot planning corridor is composed of 55 percent wetlands, totaling approximately 105,357 acres. The planning area includes the area from MP 0 to MP 737, the Denali National Park Route Variation and the Fairbanks Lateral. To describe these wetlands using the NWI classification, the wetlands are summarized into four classes composed primarily of palustrine scrub/shrub (58 percent), palustrine emergent wetlands (28 percent), with smaller percentages of palustrine forested and other wetlands (8 percent and 6 percent, respectively) (Figure 5.4-6). A complete list of wetland subgroups that are summarized into the four primary classes as noted above is presented in Table 5.4-1. Using the HGM classification, of these wetlands evaluated, 71 percent are mineral soil flats, 12 percent are sloped, 10 percent are depressional, 6 percent are riverine, and 1 percent make up the lacustrine fringe and extensive peatlands (Figure 5.4-7).

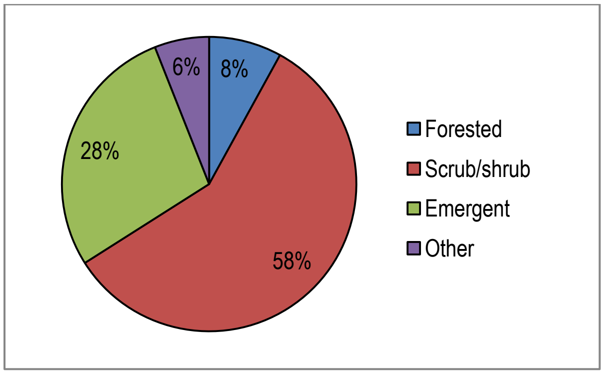

FIGURE 5.4-6
NWI Class of Wetlands within the 2,000-Foot Wide Planning Corridor

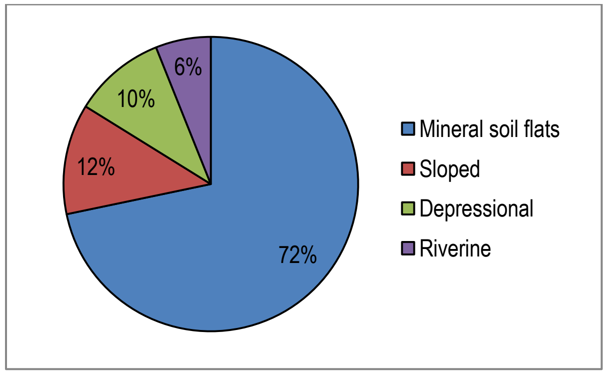

FIGURE 5.4-7
HGM Functional Class of Wetlands within the 2,000-Foot Wide Planning Corridor

TABLE 5.4-1 Wetland Subgroups

Broadleaf Forest (PF01)	Needleleaf Forest (PF04)	Mixed Forest (PFO)	Broadleaf Scrub/Shrub (PSS1)	Needleleaf Scrub/Shrub (PSS4)	Mixed and Other Scrub/Shrub (PSS)	Emergent Wetlands (PEM)	Palustrine Waters (POW)	Riverine Waters (R)	Lacustrine Waters (L)
PFO1/4B	PFO4/1B	PFO5C	PSS1/4B	PSS4/1B	PSS2B	PEM1/AB3H	PUB/AB3Hb	R2UBH	L1UBH
PFO1/4C	PFO4/2B	PFO5F	PSS1/4C	PSS4/1C	PSS5F	PEM1/FO1B	PUB/AB4Hb	R2USC	L2EM1H
PFO1/EM1B	PFO4/EM1B		PSS1/EM1B	PSS4/2B		PEM1/FO1C	PUB/EM1F	R3UBH	
PFO1/EM1C	PFO4/SS1B		PSS1/EM1Bx	PSS4/EM1B		PEM1/SS1B	PUB/EM1H	R3US/SS1C	
PFO1/SS1B	PFO4/SS4B		PSS1/EM1C	PSS4/EM1C		PEM1/SS1C	PUBF	R3USC	
PFO1/SS1Bb	PFO4B		PSS1/EM1F	PSS4/FO1B		PEM1/SS1Cb	PUBFb	R4SBC	
PFO1/SS1C	PFO4C		PSS1/EM2C	PSS4/FO2B		PEM1/SS1Ch	PUBFx	R5UBH	
PFO1/SS4B			PSS1/FO1C	PSS4/FO4B		PEM1/SS1Cx	PUBH	R5USC	
PFO1B			PSS1/FO4B	PSS4/SS1B		PEM1/SS1F	PUBHb		
PFO1C			PSS1/FO4C	PSS4/USB		PEM1/SS1Fb	PUBHx		
			PSS1/SS4B	PSS4B		PEM1/SS4B	PUS/EM1Cx		
			PSS1/USB	PSS4C		PEM1/SS4C	PUS/SS1C		
			PSS1/USC			PEM1/UBF	PUSC		
			PSS1B			PEM1/UBH	PAB3/EM1F		
			PSS1Bb			PEM1/USC	PAB3/EM1H		
			PSS1Bx			PEM1B	PAB3/EM1Hb		
			PSS1C			PEM1Bx	PAB3/UBHb		
			PSS1Cx			PEM1C	PAB3F		
			PSS1F			PEM1Cb	PAB3H		
						PEM1Cx	PAB3Hh		
						PEM1F	PAB3Hx		
						PEM1Fb	PAB4H		
						PEM1Fx	PML1/SS1B		
						PEM1H			
						PEM1Hx			
						PEM2/1C			
						PEM2F			

5.4.2.2 100-Foot Wide Construction ROW

Field work areas for wetland determinations were limited to specific field target locations within the 300-foot wide corridor (150 feet on either side of the center line) for analysis of the uplands and wetlands (AES 2011). The 300-foot wide corridor enables a buffer for adjustment of the proposed 100-foot wide mainline construction ROW alignment to avoid wetlands when possible. The total amount of wetlands resulting from the analysis within the 300-foot wide corridor was 13,669 acres, or 48 percent of the total area (AES 2011).

Actual widths used to determine wetland composition in the construction ROW (Figures 5.4-8 and 5.4-9) were primarily 100 feet wide; however, up to 77 miles of ROW was estimated at 230 feet wide in areas that require additional space (AES 2011). Areas that would require additional space would implement specialized cut and fill (two-tone) grading techniques. These areas include: Atigun Pass, Dietrich River/Chandalar Shelf, Cathedral Mountain, Minto Flat Area, Denali National Park and Preserve (NPP), Panorama Peak and Reindeer Hills-Cantwell (AES 2011). The percent composition below is indicative of all segments of the pipeline including the Fairbanks Lateral and Denali National Park Route Variation. Results indicate that the construction ROW has 63 percent scrub/shrub wetlands, 27 percent emergent, 8 percent were forested, and 2 percent were other wetlands classes using the NWI classification system (Figure 5.4-8). Seventy-eight percent of the wetlands have a HGM function of mineral soil flats, with sloped and depressional resulting in 13 percent and 6 percent respectively as the next most abundant functional classes (Figure 5.4-9).

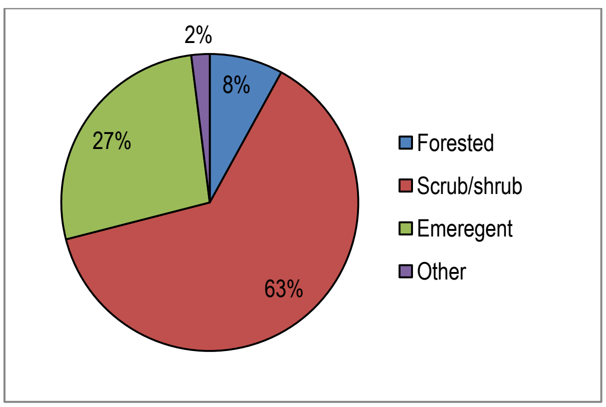

FIGURE 5.4-8
NWI Class of Wetlands within the Construction ROW

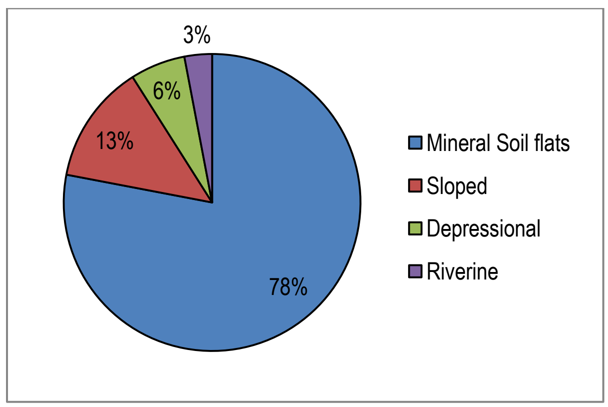

FIGURE 5.4-9
HGM Functional Class of Wetlands within the Construction ROW

5.4.2.3 Permanent ROW (Variable Width)

The permanent ROW width varies between 30, 51 and 52 feet depending on the land ownership of the pipeline segment (Section 2.1.3.1). Pipeline segments that cross federal lands would maintain a 51- or 52-foot ROW; however, non federal land segments would require a 30-foot ROW (Section 2.1.3.1). The percent composition below is indicative of all segments of the pipeline including the Fairbanks Lateral and Denali National Park Route Variation. Approximately 65 percent of the wetlands in the permanent ROW are scrub/shrub, 26 percent are emergent, 8 percent are forested, and 1 percent are other (Figure 5.4-10). Seventy-four percent of the wetlands have a functional class of mineral soil flats, 18 percent are sloped, 6 percent are depressional and 2 percent are riverine (Figure 5.4-11).

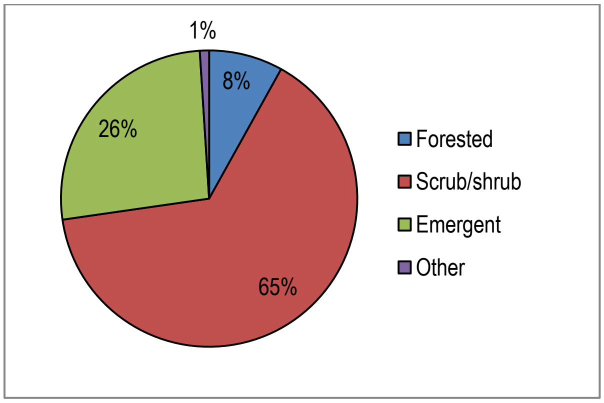

FIGURE 5.4-10
NWI Class of Wetlands within the Permanent ROW

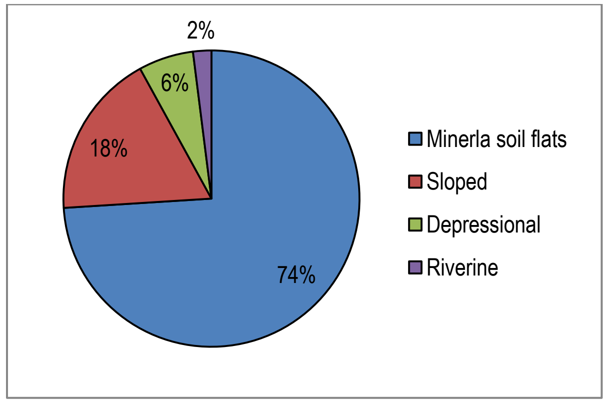

FIGURE 5.4-11
HGM Functional Class of Wetlands within the Permanent ROW

5.4.3 Environmental Consequences

5.4.3.1 No Action Alternative

Under the No Action Alternative, the Project would not be developed; therefore, there would be no impacts to wetland resources.

5.4.3.2 Proposed Action

This section describes the potential impacts to wetlands during Project construction activities (ROW and aboveground facilities), permanent operations and maintenance. It includes the alternatives and options considered and the types of activities that would be expected to occur during each phase of the Project. Approximately 11,468 acres of land would be required temporarily for construction of the Project. This includes the construction ROW, aboveground facilities, access roads and extra work areas outside of the ROW, with the exception of temporary extra workspaces (TEWS) (Section 2.1.3.3). The AGDC has not identified the site-specific locations of the TEWS; therefore, these areas have not been included in the Project impact calculations and assessment. TEWS would be typically located to reduce impacts to wetlands, and calculations of potential impacts to wetlands would be included prior to the permit application. Land retained for permanent easement would be approximately 4,063 acres.

Pipeline Facilities

Construction ROW

The proposed Project would affect approximately 5,387 acres of wetlands (Table 5.4-2) throughout its length. Construction of the 100-foot wide ROW (up to 230 feet in sloped areas) in these areas would depend primarily on the stability of the soils at the time of construction. The AGDC plans to target construction efforts in wetland areas during the winter months when possible (Section 2.2.3.2). Working in wetlands when the ground surface is frozen would minimize impacts to the soils, water quality, vegetation and wildlife use. The construction footprint would be minimized by grading directly over the centerline, and temporary workspace would occur on ice pads reducing heavy equipment impacts on surrounding wetlands. Dust deposition and non-native and invasive plant establishment would be reduced during the winter in contrast to summer construction.

Three main methods would be employed when constructing in wetlands: open-cut with matting, open-cut without matting and open-cut push/pull. The horizontal directional drilling method would not be used when working in wetland areas. HDD is not a practicable method when constructing through large wetland areas; it is applicable primarily for short distances (5,000-6,000 feet). The HDD process requires additional temporary workspace which would impact additional wetland areas; winter construction would reduce wetland impacts considerably. The potential impacts discussed below are considered common to all pipeline segments, alternatives, options, aboveground facilities and extra work areas outside the ROW. Wetland NWI class and HGM functional classifications are identified by pipeline segment in acreage and percent composition in Tables 5.4-2 and 5.4-3 for the construction ROW.

TABLE 5.4-2 NWI Wetland Classes within the Construction ROW

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation		MP 555-End	
Wetland Class[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
FORESTED WETLANDS										
Broadleaf Forest (PF01)	30.2	10.30%	6.1	7.30%	0.3	4.10%	0	0	8.8	16.30%
Needleleaf Forest (PF04)	261.5	89.20%	77.9	92.70%	6.6	96.50%	0	0	45	83.70%
Mixed Forest (PFO)	1.6	0.50%	0	0%	0	0.00%	0	0 %	0	0.00%
Subtotal Forested Wetlands (PFO)	**293.3**	**6.30%**	**84**	**24%**	**6.8**	**7.30%**	**0**	**0%**	**53.8**	**21%**
SCRUB SHRUB WETLANDS										
Broadleaf Scrub/Shrub (PSS1)	2,385.10	81.20%	113.4	49.90%	55.3	69.30%	1.3	96.90%	107.2	80.80%
Needleleaf Scrub/Shrub (PSS4)	536	18.30%	113.8	50.10%	24.5	30.70%	0.03	2.30%	25.4	19.20%
Mixed and Other Scrub/Shrub (PSS)	14.5	0.50%	0	0%	0	0.00%	0	0%	0	0.00%
Subtotal Scrub/Shrub Wetlands (PSS)	**2,935.60**	**62.60%**	**227.2**	**64.90%**	**79.9**	**85.30%**	**1.3**	**37.10%**	**132.6**	**51.90%**
EMERGENT WETLANDS										
Subtotal Emergent Wetlands (PEM)	**1,360.60**	**29%**	**35.8**	**10.20%**	**6.1**	**6.50%**	**0.2**	**5.70%**	**47.4**	**18.50%**
OTHER WETLANDS AND WATERS										
Palustrine Waters (POW)	26.5	27.20%	2.2	70%	0.2	20%	0	1.50%	10.6	48.80%
Riverine Waters (R)	69	70.80%	0.9	28.70%	0.8	80%	2	98.60%	11.1	50.90%
Lacustrine Waters (L)	1.9	2.00%	0	0%	0	0.00%	0	0%	0.1	0.30%
Subtotal Other Wetlands and Waters	**97.5**	**2.10%**	**3.2**	**0.90%**	**0.9**	**0.90%**	**2**	**57.10%**	**21.8**	**8.60%**
TOTAL										
All Wetlands and Waters	**4,686.90**		**350.2**		**93.7**		**3.5**		**255.6**	

[a] Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979).

Key: PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; P = Palustrine, R = Riverine; L = Lacustrine; OW = Open Water.

Totals might not equal sums of values due to rounding.

Source: AES 2011.

TABLE 5.4-3 HGM Functional Class of Wetlands within the Construction ROW

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation		MP 555-End	
Type[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
Mineral Soil Flats	3,640.8	47.60%	336.0	80.50%	79.1	35.80%	1.0	0.50%	138.3	6.10%
Sloped	723.6	9.50%	0.0	0.00%	0.0	0.00%	0.0	0.00%	2.3	0.10%
Depressional	203.6	2.70%	9.7	2.30%	12.1	5.50%	0.4	0.20%	89.5	4.00%
Riverine	116.9	1.50%	4.1	1.00%	2.7	1.20%	2.2	1.20%	24.2	1.10%
Lacustrine Fringe	2.1	<0.10%	0.0	0.00%	0.0	0.00%	0.0	0.00%	1.3	<0.10%
Extended Peatlands	0.0	0.00%	0.4	<0.10%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Estuarine Fringe	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Sub-Total Wetlands[b]	**4,686.9**	**61.30%**	**350.1**	**83.90%**	**93.9**	**42.50%**	**3.5**	**1.90%**	**255.6**	**11.30%**
Uplands[c]	2,969.3	38.70%	67.1	16.10%	126.8	57.50%	181.6	98.10%	2,006.0	88.70%
Totals	**7,656.2**		**417.2**		**220.7**		**185.1**		**2,261.6**	

[a] Hydrogeomorphic classification (Brinson1993).

[b] Total acres and percent of segment that is wetlands. For specific wetland type, percent is also of the total segment.

[c] Total acres and percent of segment that is uplands.

Note: Total acres may not match those in Appendix tables due to rounding.

Source: AES 2011.

Unsaturated Wetlands

Unsaturated wetlands are wetlands that do not possess standing water and may include forested and scrub/shrub wetland classes. These wetlands would be constructed via an open-cut method similar to upland vegetation (Section 2.2.2.2). This method may or may not use matting or geo-fabric and fill, depending on the level of soil stability. Geo-fabric matting would be used on unstable soils to limit impacts to unsaturated wetlands. Matting would disperse the weight of the heavy equipment use in wetland areas to prevent rutting and therefore erosion and sedimentation.

Saturated Wetlands

Saturated wetlands have waterlogged soils and are inundated with water. These wetlands may include emergent and other water and riverine wetland classes (Table 5.4-1). Methods used to construct the ROW in saturated wetlands include the open-cut/push-pull method (Section 2.2.3.2). Equipment would be placed on platforms and the pipeline would be strung across the wetland with floats via pushing or pulling it into place. The floats would then be removed and the pipeline would sink into place. To the extent possible, thawed unstable soils would be excavated during the winter season as a best management practice to minimize impacts to wetlands during construction.

Grading and Trenching

Wetland construction would occur primarily during the winter months as noted above to minimize the extent of impacts to wetlands. Unlike construction within upland vegetation communities, clearing, grubbing and burning debris would not occur in wetland areas to limit impacts to wetlands as feasible. Grading would occur directly over the center line (trench line) of the pipeline to minimize disturbance to the wetland as much as possible. The vegetative mat would be separated from the subsoil for preservation of the root stock and vegetative cover before trenching. Temporary impacts could occur from top soil storage placement overlaid on neighboring wetlands to allow for equipment movement within the ROW. Once backfill has been placed over the pipeline, the vegetative mat would be the last layer placed over the trench. The wetland would be contoured to its preconstruction state as close as possible. Impacts from trenching and blasting would include temporary disturbance to subsurface soil, topsoil, vegetation, and surface hydrology from heavy equipment use and excavation.

Construction of the ROW in wetland areas during the winter reduces impacts versus the summer construction season. There would be less likelihood to introduce non-native and invasive plant species into wetlands from equipment and personnel during the winter months. Although non-native invasive seeds are relatively resistant and would survive the winter, they may not establish and persist as quickly as in the summer months. Disturbance to aquatic vegetation and surface hydrology would be reduced due to working in stable (frozen) soil conditions and thus creating narrower trenches from higher soil stability. Ice pad and road development along the ROW would substantially reduce impacts to wetlands during construction. Erosion and soil compaction impacts would be temporary and minimized during the winter construction season because of ice road use. Migratory birds are absent during the winter and thus would not be impacted by temporary habitat loss or disturbance (Section 5.5 Wildlife). Dust deposition would also be reduced in the winter construction period versus the summer since the dust particles would be bound up within the frozen soil and snow and ice would cover gravel on roads further prohibiting fugitive dust dispersal.

Some wetlands classes would be expected to recover more quickly than others due to the length of time it would take for succession to occur. Scrub/shrub wetland disturbance could transform into an emergent wetland class temporarily from impounding effects until the vegetation recovers. This could alter wetland function temporarily and the recovery of this vegetation would be slow (likely decades). Forested wetland removal would result in much longer recovery (one hundred years or more) due to the loss of mature canopy and may also result in permanent loss.

Non-native and Invasive Plants

Project construction would likely propagate invasive and non-native wetland plants through several pathways:

- Transport and use of construction equipment and personnel from the continental United States where invasive and non-native wetland plants are common;
- Spread of invasive and non-native wetland plants already associated with existing ROW's (ARR, TAPS, and Highways) from construction equipment and personnel; and
- Some types of "Native" seed mixtures used to revegetate wetlands could inadvertently contain invasive and non-native seeds.

Invasive wetland plants (such as Canadian waterweed, didymo, and white sweet clover) are known invaders of Alaska's wetlands. These species thrive and establish quickly in recently disturbed wetland areas. These wetland plants are aggressive in growth and reproduction, are generalists, and are tolerant to many environmental conditions. Thus, they outcompete and displace native wetland vegetation once exposure allows establishment which causes a reduction in biological diversity and community composition. Changes in the composition of wetland structure and function can in turn affect wildlife habitat (Section 5.5 Wildlife).

Equipment and tools transported from other areas (outside of Alaska) could possess seeds and plant material of invasive and non-native species. Decontamination of all equipment previously exposed to invasive species would be required as a mitigation option to prevent further spread. Invasive and non-native wetland plants may be associated with existing highways or ROWs, which would create further invasion of non-native wetland plants. The majority of the proposed Project would parallel these highway corridors, and the spread of invasive and non-native wetland species could occur throughout the Project's construction workspace. A robust NIP Prevention Plan would be required to prevent further spread of invasive and non-native wetland plants.

Backfilling

The trench would be lined with fine grained material before pipe placement, filled with original subsoil, and then the vegetative mat would be placed on top to maintain natural strata. Preserving the vegetative root stock and soil strata in the wetland would be essential for the success of wetland recovery.

Dust Deposition

Heavy equipment (dump trucks) used for transporting fill from material sites to construction areas would contribute additional dust along roadsides. Heavy vehicles would produce more dust on gravel roads than regular passenger vehicles. Dust may also be produced from the material content (sand, gravel) being hauled in the bed of the truck. Numerous trips would be made between material sites and the construction areas daily.

Dust deposition from construction would be temporary and localized due to the timing sequence of construction activities by pipeline segment. Dust deposition on wetlands would be reduced during the winter construction period versus the summer, since gravel roads are drier in the summer and wind processes transport dust particles further. Whereas in winter, ice roads, pads and snow covered gravel roads would reduce dust production substantially.

Rehabilitation

Rehabilitation of the area would include clean up of construction debris including timber mats, geo-fabric and fill, and the ROW would be contoured as close as possible to preconstruction conditions. During the post-construction phase, the construction ROW area would likely revert to a wetland type and function similar to what had existed prior to Project implementation. Wetlands impacted along the construction ROW would be expected to recover to an early successional stage quickly as native seed is planted over the backfilled grade. The AGDC would consult with BLM and follow ADNR's Plant Materials Center Revegetation Manual for Alaska, and the Stabilization, Rehabilitation and Restoration Plan would be used as a guide for seed application and fertilization.

Disturbed soils are optimal locations for non-native and invasive plants to become established. Non-native and invasive seeds could be transferred from equipment completing final grading of contours onto exposed wetland soils along the ROW. Native seed mixes may potentially possess seeds from invasive and non-native species from the collection and cleaning process. Non-native invasive plant seed can be incidentally harvested in the collection process or in the cleaning equipment. An agency approved NIP Prevention Plan would be enforced and maintained as a mitigation measure to prevent the invasion of non-native species.

Fragmentation

The linear nature of the proposed Project has the potential to divide wetland systems, disrupting or altering vegetation, subsoil and hydrology. Fragmentation in wetlands would be expected to occur temporarily during the construction phase of the Project and for a short time thereafter. During post-construction, it would be expected that once soils subside over the buried pipeline, surface hydrology would resume quickly and disturbed vegetation would recover. The pipeline would be buried to the appropriate depth, consistent with Alaska Department of Transportation (ADOT) standards, for its entire length, with the exception of the mainline valves (MLVs). MLVs would function as locations where flow of gas could be restricted or stopped for maintenance, safety or operational purposes. MLVs would be placed every 20 miles on reinforced concrete pads and possess associated work pads and access roads (AGDC 2011). Burial of the pipeline would allow wetland vegetation to reestablish and surface flow to function naturally over the construction ROW.

Sloped wetlands often occur along elevation gradients and have the greatest potential for being impacted by subsurface soil disturbances. Changes in the permeability of the surface or subsurface soil of a sloped wetland could result in increased drainage and altered functionality, temporarily or permanently. The use of the original excavated material as backfill would be essential to maintain the natural function and structure of the wetland. Foreign material used as fill in the trench line could cause additional fragmentation impacts from discontinuity of the subsurface material. This in turn could alter vegetative growth if the subsurface soils are discontinuous. As stated in Section 2.2.2.5, original material excavated from the trench would be used as backfill as much as practicable. Ice road and pad development is not expected to fragment wetlands if BMPs are adhered to throughout the winter construction season. Ice roads and pads would be established over existing vegetation and will melt during break up.

Soil Compaction and Erosion

Construction of the ROW may compact soils along the ROW from heavy equipment access which could inhibit seed germination, reduce water infiltration, inhibit root establishment, and result in bare soil exposure. Soil erosion and fill placement could lead to increased sedimentation and turbidity in nearby waterbodies, which could then reduce water storage capacity, smother vegetation, and decrease oxygen concentration. These effects would be particularly applicable in areas of steep terrain and could extend beyond the construction ROW. Soil erosion could also alter water flow rates into and out of wetlands, thereby impacting local hydrologic processes. However, soil compaction and erosion impacts would likely be localized and temporary because timber and geo-textile mats would be used during the summer construction season to minimize the impacts to wetlands. Timber mats and geo-fabric disperse the weight of the heavy equipment use across the ground.

Permanent ROW

Wetland vegetation would persist in the permanent ROW; however, functional characteristics would be altered by maintenance activities. The impacts discussed below are considered common to all segments of the pipeline as well as all options and alternatives. Wetland NWI class and HGM functional classifications are identified by pipeline segment in acreage and percentage composition in Tables 5.4-4 and 5.4-5 for the permanent ROW.

TABLE 5.4-4 NWI Wetland Classes within the Permanent ROW (variable width)

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation		MP 555-End	
Wetland Class[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
					FORESTED WETLANDS					
Broadleaf Forest (PF01)	9.7	0.6%	2.0	1.9%	0.1	0.4%	0.0	0.0%	2.72	3.5%
Needleleaf Forest (PF04)	106.7	6.2%	23.42	22.1%	1.9	7.8%	0.0	0.0%	14.21	18.5%
Mixed Forest (PFO)	0.5	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Forested Wetlands (PFO)	**116.8**	**6.8%**	**25.38**	**24.0%**	**2.0**	**8.2%**	**0.0**	**0.0%**	**16.93**	**22.1%**
					SCRUB SHRUB WETLANDS					
Broadleaf Scrub/Shrub (PSS1)	855.0	50.1%	33.33	31.5%	14.4	58.8%	0.1	14.3%	32.0	41.7%
Needleleaf Scrub/Shrub (PSS4)	236.7	13.9%	36.20	34.2%	6.0	24.5%	0.0	0.0%	8.2	10.7%
Mixed and Other Scrub/Shrub (PSS)	4.9	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Scrub/Shrub Wetlands (PSS)	**1096.6**	**64.2%**	**69.53**	**65.7%**	**20.3**	**82.9%**	**0.1**	**14.3%**	**40.2**	**52.4%**
					EMERGENT WETLANDS					
Subtotal Emergent Wetlands (PEM)	**1,360.60**	**29%**	**35.8**	**10.20%**	**6.1**	**6.50%**	**0.2**	**5.70%**	**47.4**	**18.50%**
					OTHER WETLANDS AND WATERS					
Palustrine Waters (P)	5.1	0.3%	0.43	0.4%	0.1	0.4%	0.0	0.0%	2.0	2.6%
Riverine Waters (R)	13.0	0.8%	0.23	0.2%	0.2	0.8%	0.6	85.7%	3.2	4.2%
Lacustrine Waters (L)	0.5	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	<0.1	0.0%
Subtotal Other Wetlands and Waters	**18.6**	**1.1%**	**0.66**	**0.6%**	**0.3**	**1.2%**	**0.6**	**85.7%**	**5.2**	**6.8%**
					TOTAL					
All Wetlands and Waters	**1,707.3**		**105.9**		**24.5**		**0.7**		**76.7**	

[a] Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979).

Key: PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; P = Palustrine, R = Riverine; L = Lacustrine

Note: Totals might not equal sums of values due to rounding.

Source: AES 2011.

TABLE 5.4-5 HGM Functional Classes of Wetlands within the Permanent ROW (variable width)

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation		MP 555-End	
Type[a]	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Mineral Soil Flats	1264.0	48.70%	101.8	81.30%	19.9	35.10%	0.0	0.00%	41.2	6.20%
Sloped	344.0	13.30%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.9	0.10%
Depressional	74.8	2.90%	2.8	2.30%	3.7	6.40%	0.0	0.00%	27.8	4.20%
Riverine	36.0	1.40%	1.2	1.00%	0.8	1.50%	0.7	1.10%	7.8	1.20%
Lacustrine Fringe	0.6	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.4	0.10%
Extended Peatlands	0.0	0.00%	0.1	0.10%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Estuarine Fringe	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Total Wetlands[b]	**1719.3**	**0.70%**	**106.0**	**0.90%**	**24.4**	**0.43%**	**0.7**	**<0.1%**	**78.1**	**0.10%**
Uplands[c]	875.9	33.80%	19.2	15.40%	32.3	57.00%	60.0	98.90%	584.5	88.20%
Grand Total	**2595.3**		**125.2**		**56.7**		**60.7**		**662.6**	

[a] Hydrogeomorphic classification (Brinson1993).

[b] Total acres and percent of segment that is wetlands. For specific wetland type, percent is also of the total segment.

[c] Total acres and percent of segment that is uplands.

Note: Total acres may not match those in Appendix tables due to rounding.

Source: AES 2011.

Mowing

Regular maintenance of the permanent ROW would include mowing surface wetland vegetation to a non-forested vegetative cover type. This would allow visual inspections of the pipeline during aerial patrols in order to identify areas of concern. Forested wetlands within the permanent ROW would be permanently removed and converted to a scrub/shrub, emergent or other wetland type. Approximately 136 acres (Table 5.4-4) of forested wetlands along the mainline ROW would be permanently lost; however, these areas would function as a different wetland class. Forested wetland vegetation areas outside of the permanent ROW but inside the construction area would reestablish through succession to forest vegetation over a long period of time (one hundred years or more).

Slope wetlands would be the HGM wetland class most susceptible to a change in function resulting from the clearance of forested vegetation since the lack of vegetation could drastically alter water holding capacity, a function that would be slow to recover. Thus, clearing of sloped wetlands would result in a long-term and in many instances permanent impact. The majority of slope wetlands exist in the MP 0 to MP 540 segment of the ROW (Table 5.4-5).

The spread of non-native and invasive plant species could occur from transporting and traversing the mowing equipment from one location to another along the ROW. A NIP Prevention Plan would include this aspect of the Project to reduce the potential spread of invasive plants.

Climate Change

Future wetland loss could occur from changes to the climate over the next 20 to 100 years. Twentieth century climate records show that the United States is generally experiencing a trend towards a wetter, warmer climate; some climate models suggest that this trend will continue and possibly intensify over the next 100 years (Burkett and Kusler 2000). Permafrost wetlands and peatlands are the most likely wetland types found within the Project area that would be affected by climate changes in association with atmospheric carbon enrichment. Climate change would include sea level rising, and storm surges; however, there are no estuarine wetlands within the Project footprint. Global climate change could alter hydrologic parameters upon which wetlands and the species that inhabit them depend (IPCC 1995). Potential impacts range from changes in wetland community structure to changes in ecological function, and from extirpation to enhancement (Burkett and Kusler 2000). Climate change impacts on inland aquatic ecosystems would be caused by the direct effects of rising temperatures and rising CO_2 concentrations to indirect effects caused by changes in the regional or global precipitation and the melting of glaciers and ice cover (IPCC 2007). Potential impacts to wetlands from global climate change determined by IPCC, 2007; and Bates, et al. 2008 is summarized below:

- Many wetlands have world conservation status and their loss could lead to significant extinctions, especially among amphibians and aquatic reptiles;
- Some of the most vulnerable wetlands regions include: Arctic and sub-Arctic ombrotrophic (‘cloud-fed’) bogs, and depressional wetlands with small catchments;

- Invertebrates, waterfowl and tropical invasive species are likely to shift poleward with some potential extinctions;
- Enhanced UV-B radiation and increased summer precipitation will significantly increase dissolved organic carbon concentrations, altering major biogeochemical cycles;
- Numerous arctic lakes will dry out with a 2-3°C temperature rise;
- The seasonal migration patterns and routes of many wetland species will need to change and some may be threatened with extinction;
- Small increases in the variability of precipitation regimes will significantly impact wetland plants and animals at different stages of their life cycles;
- Changes in climate and land use will place additional pressures on already-stressed ecosystems along many rivers in the world; and
- Expansion in range for many invasive aquatic weeds.

Additional impacts to wetlands from climate change noted by Jon Kusler (2006) include: Flora and fauna in wetlands are more sensitive to changes in water levels than those of lakes, rivers, and streams. Lowering long-term water levels even a few inches can be the difference between a wetland or dry ground. Wetlands have been cut off from other wetlands by dams, dikes, roads, and other alterations so wetland plants and animals cannot migrate to other wetlands in response to changes in temperature or water levels. Mankind has already stressed wetlands which has reduced the biodiversity. A reduced biodiversity makes wetlands more vulnerable to small changes in temperature and water levels.

Potential wetland impacts described above from climate change could be enhanced by proposed Project development due to additional road development which could fragment habitat and the potential for NIP establishment.

Route Variations and Options

Yukon River Crossing Options

Three pipeline options exist to cross the Yukon River. Construct a suspension bridge across the Yukon River (Option 1), use the existing E.L. Patton Yukon River Bridge (Option 2), or use HDD (Option 3). Potential impacts to wetlands for Option 1 and 3 are expected to be the same during the construction and operation phase of the Project because of the same area impacted.

Option 1 and 3 would result in approximately 12.7 acres of wetland impacts within the construction ROW whereas Option 2 would have 4.1 acres of impacts to wetlands. The overall additional impact of implementing Options 1 or 3 would result in 8.6 acres more impact to wetlands than Option 2. The acreage for each class includes: 2.5 acres emergent, 0.8-acre forested, 0.7-acre scrub/shrub, and 4.6 acres of other wetlands and waters (AES 2011). Option 2 impacts 3.9 acres scrub/shrub, 0.1 acres forest wetlands and 0.1 acres of other wetland and waters (AES 2011).

Option 1 and 3 would result in approximately 4.0 additional acres of wetlands impacted within the permanent ROW than Option 2 (AES 2011). Impacts include mowing the vegetation along the ROW for inspection purposes throughout the life of the Project. The acreage of each wetland class which would likely be impacted by maintenance of the permanent ROW would be: 1.2 acres emergent; 0.4-acre forested; 1.0 acre scrub/shrub; and 1.4 acres other wetlands and waters (AES 2011). Option 2 would impact 1.2 acres of scrub/shrub wetlands and 0.1 acres of forest wetlands (AES 2011).

Impacts to wetlands for Option 1 and 3 would be from clearing and grubbing in wetlands on either side of the Yukon River and could potentially result in increased bank instability from removal of vegetation. Impacts could include accelerated soil erosion and sloughing of the bank. Vegetation would also be maintained to a non-forested cover type along the permanent ROW on either side of the Yukon River crossing for inspection purposes. For a discussion on additional resource impacts to the Yukon River from construction, see Section 4.6, Fisheries and Section 4.2, Water Resources.

Denali National Park Route Variation

The Denali National Park Route Variation would be located adjacent to the George Parks Highway and pass through Denali NPP lands. This route variation would have substantially less impact to wetland acres than the proposed mainline route (MP 540 to MP 555). The Denali National Park Route Variation would temporarily impact 3.5 acres of wetlands during construction and permanently impact 0.7-acre of wetlands during operations (for the permanent ROW) versus 93.7 acres associated with the mainline route (Table 5.4-2) for construction and 24.5 acres of wetlands during operations (Table 5.4-4).

The majority of wetlands impacted (85 percent) would be scrub/shrub (AES 2011). Impacts noted above from construction activities of the mainline route would apply to the 15 miles of this Variation Route segment. Impacts from wetland loss would affect wildlife that depends on wetland habitat in this area (Section 5.5 Wildlife).

The Denali National Park Route Variation would have no impacts to forested wetlands; however, the mainline route (MP 540 to MP 555) would impact 6.8 acres of forested wetlands (Tables 5.4-2 and 5.4-4) during construction and 2.0 acres of forested wetlands during operations.

Construction of the pipeline ROW, construction camps and storage yards totaling approximately 7,405 acres would be returned to preconstruction uses (AGDC 2011). Additionally approximately 80 acres of land would be required for aboveground facilities during construction and operations (Section 2.1.2). Development of aboveground facilities (including the GCF, compressor stations, and straddle off-take facility) would result in permanent loss of wetland habitat.

Approximately 4,063 acres of permanent aboveground easement (pipeline ROW and aboveground facilities) would be required for Project operations (Section 2.1.3). Permanent aboveground facilities include one gas conditioning facility, one natural gas liquid extraction plant (NGLEP) facility, up to two compressor stations, three meter stations, 37 MLVs, and five pig launcher and/or receiver facilities totaling approximately 80 acres of land (Section 2.1-2). The following includes a summary of the wetland impacts from permanent aboveground facilities and temporary disturbance.

Gas Conditioning Facility (GCF)

The GCF at MP 0 would occupy 70 acres of land in the Beaufort Sea Coastal Plain ecoregion for pad and facility development. The proposed area for the GCF is composed almost entirely of flat emergent scrub/shrub wetlands, which would be permanently impacted by the proposed Project. Temporary disturbance to wetlands from GCF development includes fugitive dust deposition, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Compressor Stations

Two compressor station options are being considered, both of which would permanently impact local wetlands:

- Option 1 – Two compressor stations: one at MP 225 and one at MP 458
- Option 2 – One compressor station at MP 285

Each compressor station would be constructed on a gravel pad and expected to occupy a 1.4-acre footprint. Within that footprint, different types of wetlands would be affected depending on the option chosen. For Option 1, the compressor station at MP 225 would likely impact flat scrub/shrub wetlands while the station at MP 458 would likely impact slope scrub/shrub wetlands. The compressor station proposed in Option 2 at MP 285 would likely impact flat forested wetlands. The exact amount of wetland area impacted would depend on the final location of each compressor station, and these facilities would be located to avoid wetlands as much as possible. Temporary disturbance to wetlands from compressor station development are fugitive dust deposition, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Straddle and Off-Take Facility

A straddle and off-take facility would be located at the Fairbanks Lateral tie-in at approximately MP 458 near Dunbar. This facility would be collocated with a mainline compressor station, if this facility is built, and a gas metering station. These facilities would be built on a 4.7-acre gravel pad and would require a permanent gravel access road. The gravel pad and access road would permanently impact flat forested wetlands. The exact amount of wetland area impacted would depend on the final location of the facilities and the access road. The straddle and off-take facility would be located to avoid wetlands as much as possible. Temporary disturbance to wetlands include fugitive dust deposition from construction activities, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Cook Inlet NGLEP Facility

The Cook Inlet NGLEP Facility would be constructed near MP 736 at the terminus of the pipeline. This facility would be built on a permanent 5.2-acre gravel pad and accessed by a permanent gravel road. The size and location of these structures would be determined during facility design optimization. The location of this facility would not affect wetlands because it would be located in an upland vegetated area, but roads leading to the facility could cross or be adjacent to wetlands (Table 5.4-6). Temporary disturbance to wetlands include fugitive dust deposition from construction activities, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Aboveground Facilities by Segment

The acreage of wetlands impacted by permanent aboveground facilities is listed in Table 5.4-6 below. The GCF would have the most impact (70 acres) to wetlands of all aboveground facilities. Wetlands would be filled and aboveground facilities constructed. All wetland impacts (up to 81 acres) from aboveground facilities would be permanent.

TABLE 5.4-6 Aboveground Facilities Wetland Impacts (Acres)

Wetland Class	GCF	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Fairbanks Lateral Off Take Facility	Compressor Station (MP 458.1)	NGLEP Facility
Forested	0.0	0.0	0.0	0.4	1.4	0.0
Scrub/Shrub	0.0	1.4	1.4	0.0	0.0	0.0
Emergent	67.7	0.0	0.0	0.0	0.0	0.0
Other Wetlands and Waters	1.0	0.0	0.0	0.0	0.0	0.0
Uplands	0.0	0.0	0.0	3.0	0.0	5.2
TOTAL	**68.7**	**1.4**	**1.4**	**3.4**	**1.4**	**5.2**

Support Facilities

Support facilities would be located in major centers like Fairbanks and Anchorage (Section 2.1.3.3), and are not expected to contribute to further permanent impacts to wetlands. It is likely that existing buildings within these centers would be utilized for Project support. Additional work spaces discussed in the following section include access roads and material sites.

Access Roads

Approximately 524 acres of access roads would be required for construction of the Project (Section 4.9.1.4). The majority of these access roads (73 percent) would be located between MP 0 and MP 540. Access roads would be developed for transport of equipment, workers, and materials as well as accessing water sources and aboveground facilities.

The proposed mainline construction ROW would require the use of 40 gravel and ice roads, 12 of which are existing roads (Section 2.1.3.3). These roads would be approximately 20 to 24 feet wide within a 50-foot wide ROW. Approximately 21 acres of wetlands would be impacted by development of temporary and permanent access roads associated with construction of the mainline and Fairbanks Lateral ROW's (Section 4.9.1.4). Nearly all of the wetlands impacted by access roads (99 percent) are woody wetlands, and 1 percent is an emergent herbaceous wetland type under National Land Cover Database (NLCD) classification (NLCD 2001). As noted above in Section 5.4.1, acreage for access road use was classified under the NLCD system, not NWI or HGM systems. Access roads would be located to avoid wetlands when possible and final wetland acreage would be determined before permit application submittal. The Fairbanks Lateral would constitute 36 percent of the total wetlands impacted by access road development of the construction ROW.

During operations, 90 gravel roads would be required, 30 of which are already in existence. Sixty new roads would be built for operations of the Project (Section 2.1.3.3). Five existing roads are proposed for permanent access to the Fairbanks Lateral. Approximately 30 acres of wetlands would be impacted from permanent placement of access roads (Section 5.9.1.4). All of the wetlands impacted by permanent access road development are classified under the NLCD as woody (Homer et al. 2004), and 34 percent of all wetlands impacted by access roads are located within the Fairbanks Lateral (Section 5.9.1.4). Wetlands would be avoided when possible for placement of access roads. The final number and location of permanent access roads would be determined during Project optimization prior to permit submittal. Permanent access road placement through wetlands would have permanent direct impacts, consisting of a loss of wetland acreage, which would result in a loss of wildlife habitat (Section 5.5 Wildlife), wetland function etc. Indirect impacts would include fragmentation, dust deposition on surrounding wetlands from road use, and non-native invasive species encroachment discussed below.

Dust Deposition

Dust created during construction activities would be transported by wind processes and deposited into surrounding wetlands. Increased vehicle usage on existing gravel roads and the construction of new access roads and pads would create additional impacts. According to Walker and Everett (1987), the most severe impacts to vegetation occur within 10 meters of the road and include early snowmelt along roadsides, decrease in moss near the road, a decrease in soil lichens, and opening of ground cover. The level of impact to wetlands would be dependent on the placement of the roads in relation to wetlands present. Road dust landing on the snow adjacent to roadsides would cause accelerated snow melt. Snow melting earlier along roadsides versus snow that is not exposed to dust can result in exposing vegetation for wildlife feeding opportunities near the road and increased mortality could occur due to vehicle collisions with wildlife. The primary occurrence of dust deposition expected during operations of the Project would be from regular vehicle use at aboveground facilities (GCF, compressor stations, meter stations, and mainline valves).

Dust deposition can have a variety of direct and indirect effects on wetlands. Physical effects of dust on plants could cause breakage and blockage of stomata, shading, and abrasion of leaf cuticle leading to photosynthesis inhibition. Increased dust in wetlands can also lead to increased sedimentation and water turbidity, diminished water storage capacity, and reduced oxygen concentrations. The chemistry of the dust could impact water and soil chemistry which could result in plant chemistry changes, altering species competition which in turn results in changes in community structure. Dust dispersal would be dependent on frequency of vehicle use, speed of travel, wetting of the ground, wind, topography, configuration of the road, and surrounding vegetation. Dust deposition impacts to wetlands would be localized and temporary during the construction ROW for access road and pad development. Impacts would be long term from regular vehicle use for Project operations.

Physical and Chemical Processes

Development of access roads to connect aboveground facilities would cause surface hydrologic disturbance to the natural system. Disturbances could create surface impoundments if water flow is inhibited or could result in an increase in water outflow if natural impoundments degrade. Increased water impoundment would decrease water circulation resulting in increased water temperature, lower dissolved oxygen levels, changes in salinity and pH, altered nutrient outflow, and increased sedimentation (EPA 1993). Conversely, decreases in water impoundment could lower water tables, degrade peat layers, change vegetation, and ultimately result in a reduction or loss of wetland functions.

Thermokarst development could occur at impoundments in areas where permafrost is present. In thermokarst areas, soil temperatures rise with thaw depth, and primary productivity can shift the species composition from changes in soil characteristics. Culvert placement and frequency would be a very important variable to allow natural drainage of wetlands to occur, especially in highly saturated wetlands. This would apply to all areas including facility pads where dust could be deposited on wetlands from vehicle use.

Altered water levels can change soil exposure, and water-dependent plant species composition. Wetlands can become channelized from road development which can change the rate and character of surface flow (Darnell 1976). Erosion of soil in wetlands results in increased sedimentation and turbidity which affects photosynthesis of wetland plants.

Chemicals reaching wetlands from vehicle leaks and ice salting during winter months can change the water quality of adjacent wetlands. These chemicals can alter the soil's chemical composition, which can in turn alter species composition and richness.

Fragmentation

Construction of 60 new roads (30 acres) would create permanent fragmentation to wetlands that are bisected by the roads. Habitat fragmentation would impact the wildlife that is dependent on the type of wetland habitat being disconnected by road development. Habitat fragmentation is therefore gauged by the wildlife that uses wetlands as habitat. Fragmentation is not expected to occur in areas where ice roads are developed but would persist longer in areas with slow-growing or long-lived vegetation (i.e., forested), or in areas more susceptible to hydrologic modifications (i.e., sloped wetlands). Habitat fragmentation is discussed in detail in Section 5.5 Wildlife.

Non-native and Invasive Plants

Development of roads can act as dispersal corridors for non-native and invasive plant species to access areas previously inaccessible. Recently disturbed soils are the optimal environment for seeds to establish in wetland areas. Wetland species such as canary reed grass, cattail, and purple loosestrife are aggressive invaders of wetland areas that tend to dominate and out-compete native species. Species such as Canadian waterweed, didymo, and white sweet clover are other known invaders of Alaska's wetlands.

Impacts from non-native and invasive plants in pristine wetlands include altered diversity and abundance of native species since invasive plants out-compete native plants for breeding areas, nutrients, and soil. They can also disrupt food webs, degrade habitat and biodiversity. The extent and potential for invasion of non-native wetland species would be determined by implementation of a robust NIP Prevention Plan developed though agency consultations and approval.

Material Sites

Existing material sites used for the Trans Alaska Pipeline System (TAPS) Project would provide sufficient gravel and sand for the Project (Section 2.1.3.3). Impacts to wetlands from material site use include dust deposition during excavation of material, and transport. No additional impacts would be expected to occur to wetlands from material sites.

Dust deposition may have impacts to wetlands surrounding material sites when heavy equipment is mining gravel and sand to be transported to road and pad development points. These impacts would be minimal, temporary and dispersed considering 546 existing material sites would be utilized to support the Project. The majority of material sites are not expected to be more than 10 miles from the Project (Section 2.1.3.3).

Temporary Extra Workspaces

TEWS would be located adjacent to construction areas and would include additional areas of land required for temporary uses. These areas may include areas for spoil storage, staging of equipment, pull string assembly, HDD activities and railway crossing points (Section 2.1.3.3). In addition, they would include areas for road, streams, pipeline, and wetland crossings; access roads, block valve installation sites and pig receiver and launcher sites. The size and location of these areas are dependent on site specific conditions and have not been determined by AGDC to date. Therefore, calculations of Project impacts from TEWS have not been included. The location of these facilities would be situated in upland areas when feasible to reduce additional impacts to wetlands.

5.4.4 Mitigation

Maintaining the physical, chemical and biological integrity of the Nation's waters is the objective of the Clean Water Act (CWA). In order for the discharge of dredged or fill material to be authorized by the USACE, the adverse impacts to wetlands, streams and other aquatic resources must be avoided and minimized to the extent practicable. For unavoidable impacts, compensatory mitigation may be required to replace the loss of wetland and aquatic resource functions in the watershed. Compensatory mitigation refers to the restoration, establishment, enhancement, or in certain circumstances preservation of wetlands, streams or other aquatic resources for the purpose of offsetting unavoidable adverse impacts.

5.4.4.1 Best Management Practices Guide

Mitigation measures proposed by the AGDC are included in Appendix C. The AGDC would implement all reasonable Best Management Practices (BMPs) imposed by the USACE under Section 404 of the CWA to minimize Project-related impacts to waters of the U.S., including wetlands. Standard BMPs are specified in the USACE Alaska District's Nationwide Permits General BMP Guide (USACE 2007b) and could include the following:

- Containing sediment and turbidity at the work site by installing diversion or containment structures;
- Disposing of dredge spoils or unusable excavated material not used as backfill at upland disposal sites in a manner that minimizes impacts to wetlands;
- Revegetating wetlands as soon as possible, preferably in the same growing season, by systematically removing vegetation, storing it in a manner to retain viability, and replacing it after construction to restore the site;
- Using fill materials that are free from fine material;
- Stockpiling topsoil and organic surface material such as root mats separately from overburden and returning it to the surface of the restored site;
- Dispersing the load of heavy equipment such that the bearing strength of the soil (the maximum load the soil can sustain) would not be exceeded. Suitable methods could include, but are not limited to, working in frozen or dry ground conditions, employing mats when working in wetlands or mudflats, and using tracked rather than wheeled vehicles; and
- Using techniques such as brush layering, brush mattressing, live siltation (a revegetation technique used to trap sediment), jute matting, and coir logs to stabilize soil and reestablish native vegetation.

During the construction of the ROW, the AGDC would remove all Project-related construction debris (including construction materials, soil, or woody debris) from waterbodies, including wetlands, as soon as practicable during spring break up and summer seasons; alternatively this can be handled prior to break-up for debris on top of or within ice or snow crossings. The

AGDC would not mine gravel required for Project-related construction within the limits of ordinary high water of waterbodies unless otherwise authorized by the ADNR, Division of Mining, Land, and Water, and ADF&G. The AGDC also would consult with the USACE prior to conducting these activities. Mine site development and restoration within the limits of ordinary high water of waterbodies would be performed in accordance with the reasonable requirements of the ADNR, ADF&G, and the USACE. During Project-related construction, the AGDC would use temporary barricades, fencing, and/or flagging in sensitive habitats to contain Project-related impacts to the construction area. The AGDC would locate staging areas in previously disturbed sites to the extent practicable, rather than in sensitive habitat areas.

5.4.4.2 Construction Phase

The Proposed Action would require some unavoidable impacts to waters of the U.S. including wetlands. A list of mitigation measures that may not be included in Appendix H is provided below. The following measures would apply to all segments of the pipeline, the aboveground facilities, and extra work areas outside the ROW:

- Place wetland boundary markers throughout the construction area to prevent further impacts to wetlands, and to designate native plant seeding;
- Place and maintain erosion control barriers as appropriate above wetland crossings to prevent sedimentation into the wetland;
- Keep sediment barriers in place until restoration is complete;
- Locate staging areas (spoil storage, equipment movement) at an appropriate distance from wetlands areas;
- Replace backfill material with original excavated material instead of foreign material when possible for reestablishment of native plants and natural hydrology of the wetland;
- Avoid burning debris on the ice/snow or ground in the ROW corridor, especially in permafrost areas, to prevent burning the peat layer;
- Remove remnant soil and vegetation from heavy equipment prior to use in construction ROW when necessary to avoid transfer of non-native and invasive plant species from one location to another;
- Seed all disturbed areas with native plant mixes only;
- Disperse stockpile soils and vegetative mats to prevent impacting underlying vegetation;
- Place gravel fill at base of vertical support members (VSMs) from MP 0 to MP 6 to prevent impoundment;
- Avoid clearing of vegetation with machines, which would be prohibited in sensitive sloped areas due to the likelihood of causing erosion; and
- Properly construct and maintain ice roads with monitored use (no use during spring break up) to minimize impacts to soil and erosion processes.

Many mitigation measures would be dependent on the ecoregion, season, wetland class, duration and frequency of the activity to be mitigated. For example, wetlands with high saturation (i.e., standing water) would have different mitigation measures then wetlands with low saturation. Wetlands that would be impacted in the Beaufort Sea Coastal Plain ecoregion would have different mitigation implemented to reduce impacts when working in permafrost areas.

Traditional mitigation methods are included in Section 2 with associated construction methods and procedures. Additional mitigation proposed for each component of the Project would be included in the following: Erosion Control Plan, Storm Water Pollution Prevention Plan, Material Site Mining and Reclamation Plans, NIP Prevention Plan, and a Stabilization Rehabilitation and Restoration Plans. These plans would be developed as the proposed Project progresses.

5.4.4.3 Permanent Operations and Maintenance

A list of additional mitigation measures is included below for all segments of the pipeline, the aboveground facilities, and extra work areas outside the ROW. The mitigation measures used for the operations of permanent facilities are primarily impacts from maintenance activities, including:

- Regular inspection and maintenance of culverts installed in access roads to prevent dewatering or impounding of natural wetland hydrology;
- Regular annual surveys along roads and pads to assess dust deposition accumulation in wetlands. Respond appropriately by installing speed bumps and signs to slow traffic speed;
- Place gravel in impoundments as they develop to prevent further degradation to prohibit thermokarst development;
- Enforce speed limits on roads and pads to reduce dust deposition;
- Replace culverts when they become perched or impede surface flow;
- Enforce the use of contamination reservoirs under vehicles to prevent contamination of chemicals such as oil, antifreeze, and fuel from draining off pads into wetlands;
- Revegetate with native plant seed where necessary to prevent soil exposure and changes in plant communities, particularly non-native and invasive plants; and
- Clear wetland vegetation located along the Yukon River bank as minimally as possible to prevent erosion and sedimentation impacts.

Compensatory Mitigation

Compensatory mitigation is required to offset unavoidable adverse impacts to wetlands under the Clean Water Act Section 404. After all appropriate steps have been taken to avoid and minimize adversely impacting wetlands pursuant to 40 CFR Part 230; compensatory mitigation would be required to meet the “no net loss” of wetland acreage and function.

The “Compensatroy Mitigation for Losses of Aquatic Resources; Final Rule” list three types of compensatory mitigation:

- Mitigation Banks;
- In Lieu Fee Mitigation;
- Permittee-Responsible Mitigation:
    a. Restoration of a previously-existing wetland or other aquatic site;
    b. Enhancement of an existing aquatic site’s function;
    c. Establishment of a new aquatic site; and
    d. Preservation of an existing aquatic site

The AGDC would consult with the USACE and other agencies to determine the preferred method of compensatory mitigation to offset unavoidable loss of wetlands from Project development.

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5.5 WILDLIFE

5.5.1 Affected Environment

This section addresses all terrestrial mammals and birds potentially inhabiting the area associated with the proposed Project at some point in their life history. This includes common big game, small game, and unclassified game animals, waterfowl and game birds, and other common nongame animals. Habitats crossed by the proposed Project support various life stages and functions for wildlife categories noted above. These include areas for breeding, migration, feeding, nesting, calving, rearing, molting and staging habitat functions. Wildlife habitats along the proposed Project ROW include Arctic tundra, alpine tundra, boreal forests, and coastal forests. Much of the proposed Project ROW crosses through wetland and riparian habitats which are important for water quality, flood control and other functions as noted in the Wetland Section 5.4. Vegetation communities provide forage, cover, and breeding habitats for wildlife.

The proposed Project right-of-way (ROW) crosses seven Alaska Department of Fish and Game (ADF&G) Game Management Units (GMU) from the Arctic Coastal Plain to the Cook Inlet in Southcentral Alaska (Figure 5.5-1). Most of the proposed mainline Project falls within four GMUs: GMU 20 (31 percent), GMU 26 (24 percent), GMU 24 (19 percent), and GMU 13 (11 percent) (see Table 5.5-1 and Figure 5.5-1). The remaining 9, 4 and 2 percent is located within GMU's 14, 16 and 25 respectively (Table 5.5-1).

TABLE 5.5-1 ADF&G Game Management Units Crossed by the Project ROW

Game Management Unit	Subunit	Approximate Start Milepost	Approximate End Milepost	Approximate Length (mile)
		Parks Highway Route		
26	B	0	174.8	174.8
25	A	174.8	180.7	5.9
24	A	180.7	322.2	141.5
25	D	322.2	329.5	7.3
20	F	329.5	398.3	68.8
20	B	398.3	476.0	77.7
20	A	476.0	502.1	26.1
20	C	502.1	535.2	33.1
20	A	535.2	562.0[a]	26.8
13	E	562.0	645.6	83.6
16	A	645.6	674.8	29.2
14	B	674.8	707.0	32.2
14	A	707.0	737.0	30.0
Total				**737.0**
		Fairbanks Lateral[b]		
20	B	0	48.2	48.2
Total				**48.2**

[a] Multiple minor crossings into Game Management Unit 20C.

[b] Fairbanks Lateral begins at about Parks Highway Route Milepost 458.7.

Terrestrial wildlife resources found along the proposed ROW were reviewed to determine if species are listed under the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA). Wildlife protected under the ESA is discussed in Section 5.8 (Threatened and Endangered Species). Regulations for species protected under the MBTA and the BGEPA are discussed below:

- Migratory Birds – Under the MBTA (16 U.S.C. 703), it is illegal for anyone to “take” migratory birds, their eggs, feathers or nests. “Take” includes by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof. In Alaska, all native birds except grouse and ptarmigan (protected by the State of Alaska) are protected under the MBTA. The destruction of active bird nests, eggs, or nestlings can result from mechanized land clearing, grubbing, and other site preparation and construction activities and would violate the MBTA. The U.S. Fish and Wildlife Service (USFWS) generally recommend that applicants comply with the MBTA by avoiding certain activities during the nesting season that could result in the "take" of birds during the nesting season. USFWS has issued an information sheet that further describes these recommendations by location and habitat type (USFWS 2007). The timing guidelines are not regulations, but are intended as recommendations to help proposed projects comply with the MBTA. Some species and their nests have additional protections under other federal laws (such as the bald and golden eagle).

- <u>Bald and Golden Eagles</u> – Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) and their nests are protected by the BGEPA (16 USC 688–688d [a and b]). All parties working in the vicinity of eagles are responsible for avoiding the taking, "at any time in any manner (of) any bald eagle...or any golden eagle... or any part, nest or egg thereof" (16 U.S.C. 688a). "Taking" is defined as to, "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" (16 U.S.C. 688a). During the nesting period (March 1 through August 31), eagles may be sensitive to noise and obtrusive human activity in the vicinity of nest sites. Eagle nests occurring in the vicinity of any project component, including borrow sources, roads, staging areas, etc. must be identified. Prior to conducting project activities that may cause disturbance of an eagle nest, it is necessary to contact the USFWS to determine measures to avoid and minimize potential eagle take. If take is unavoidable, the USFWS has a permit process available that can authorize take where it is deemed necessary and appropriate. Additional information on eagles and the BGEPA can be found at http://www.fws.gov/migratorybirds/BaldEagle.htm.

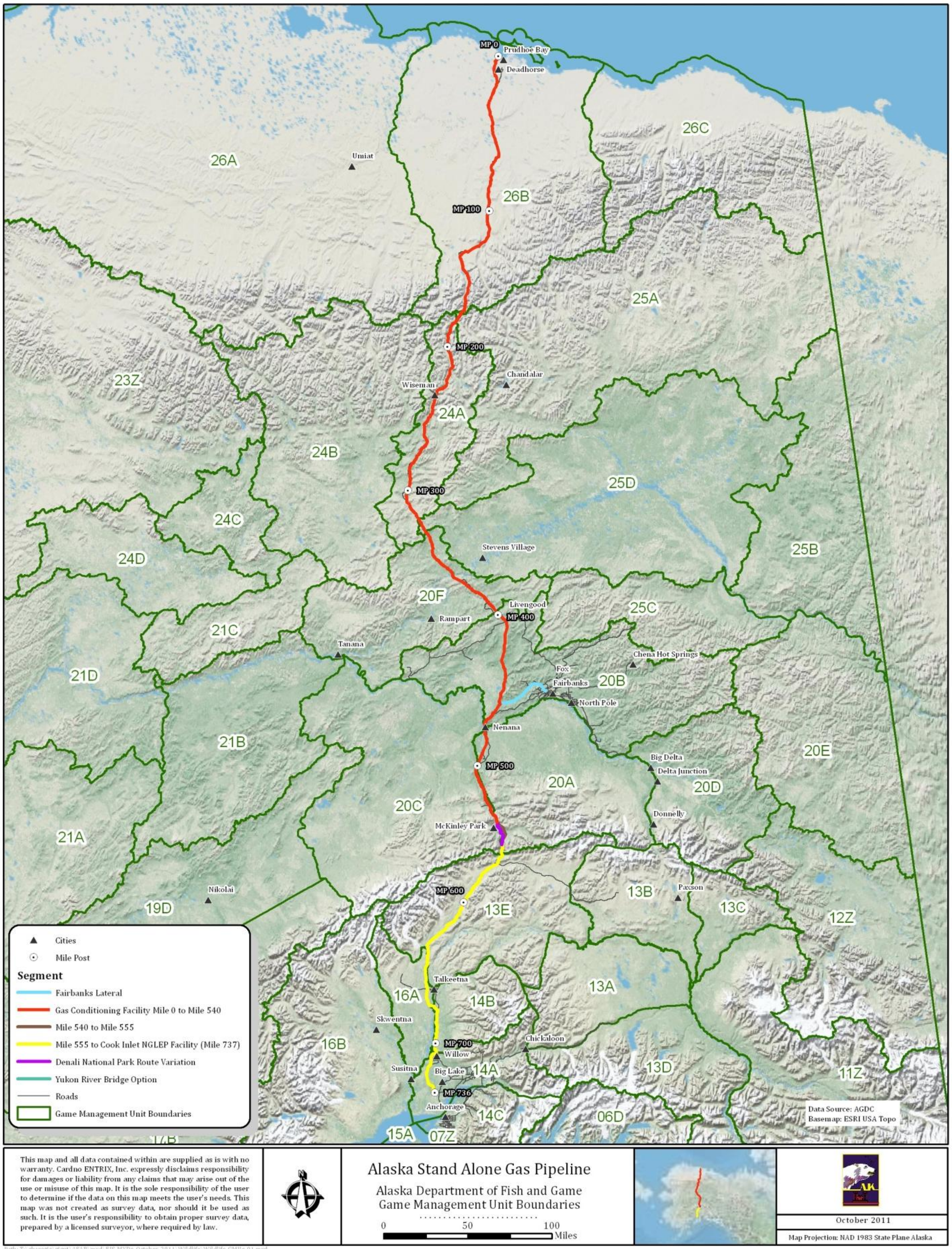

FIGURE 5.5-1 ADF&G Game Management Units Crossed by the Project ROW

5.5.1.1 Wildlife Resources

Terrestrial mammals commonly found along the proposed Project ROW that are categorized as big game animals include: moose, caribou, and bears. Muskoxen are also present within limited areas in the Arctic Coastal Plain. The wood bison may potentially be introduced into the Yukon Flats National Wildlife Refuge area in the future. Common terrestrial mammals, and their GMUs, habitat descriptions, and species abundance estimates are described in Table 5.5-2.

Waterfowl, game birds, shorebirds, and land birds that could occur within or near the Project area are discussed in detail below (Tables 5.5-3 and 5.5-4). Information used to analyze avian use of the Project area and surrounding was obtained from the USFWS waterfowl breeding pair survey areas (Larned et al. 2010; Mallek and Groves 2009) and Alaska biogeographic regions (Armstrong 1990; Boreal Partners in Flight Working Group 1999; Rich et al. 2004).

Many animals are valued as game for subsistence, sport hunting and trapping uses. Big and small game animals, furbearers, waterfowl, and upland game birds could occur year-round, with most sport hunting concentrated in the fall.

Big Game Animals

Moose and caribou are the primary big game animals that occur along the proposed Project ROW. Harvest record information is included by big game species to indicate resource use in the area. Average annual reported harvests between 2001 and 2006 were 3,726 moose and 3,184 caribou for the seven GMUs (ADF&G 2007a). Dall's sheep are the next most harvested ungulate with an average annual harvest of 556 sheep; followed by American bison with an average annual harvest of 98 bison. Few muskoxen are harvested; average annual harvest is six muskoxen. Annual harvest of bears averages 745 for black bears and 379 for brown bears; and annual harvest of wolves averages 625 wolves (ADF&G 2007a).

Moose

Moose occur throughout Alaska, although they are uncommon in coastal portions of the Arctic Coastal Plain north of the Brooks Range (Table 5.5-2). Sensitive periods include calving during mid-May to early June, rutting during late September and early October and winter foraging January through May. In GMU 26 (MP 0 – 174.8) moose are generally associated with narrow strips of shrub communities along drainages except during calving and summer when some dispersal occurs, and they may move extensively within and between North Slope drainages (Lenart 2008).

Moose are distributed throughout GMU 25 (MP 174.8 – 180.7; MP 322.2 – 329.5) in low densities with higher densities in riparian habitats in late winter and in early winter along the upper Sheenjek and Coleen Rivers reflecting some movement between higher elevation early winter range and lower elevation late winter and summer ranges (Caikoski 2008b). In GMU 24A (MP 180.7 – 322.2) moose use broad riparian habitats year-round with short seasonal migrations; in the northern portion moose are found at tree line in early winter moving to river bottoms during late winter and summer (Stout 2008). Moose densities in GMU 20C and 20F are generally low due to a combination of limited habitat, although there are some riparian areas, subalpine hills, and burn areas with habitat suitable for moose (Seaton 2008a). Moose are distributed throughout GMU 20B (MP 398.3 – 476.0) with both nonmigratory and migratory subpopulations. Migratory populations move from the Chena and Salcha river drainages from February to April to summer range on the Tanana Flats in GMU 20A (MP 476.0 – 502.1; MP 535.2 – 562.0) where most remain during the summer returning to the foothills from August through October (Young 2008b). Moose distribution in GMU 20A (MP 476.0 – 502.1; MP 535.2 – 562.0) varies widely, with both nonmigratory and migratory populations. Migratory populations travel from the surrounding foothills in the Alaska Range's Chena and Salcha river drainages to summer range on the Tanana Flats where they remain through June, returning to the foothills from July through October (Young 2008b). In GMU 13E (MP 562.0 – 645.6) moose concentrate in subalpine habitats during rutting and postrutting; with winter distributions dependent on snow depth and wolf distribution; with moose movements occurring earlier with lower densities in riparian habitats (Tobey and Schwanke 2008). In GMU 16A (MP 645.6 – 674.8) moose abundance fluctuates with winter severity and has likely declined due to predation with additional mortality from malnutrition and highway accidents (Kavalok 2008). In GMU 14B (MP 674.8 – 707.0) moose make annual movements that cross management unit boundaries into GMU 16A (MP 645.6 – 674.8) and 14A (MP 707.0 – 737.0); movements make moose in these units vulnerable to collision mortality from trains and vehicles (Peltier 2008a).

Caribou

Caribou from seven herds, defined by calving areas, range through the Project area (Table 5.5-2). Sensitive periods include: calving in May to June, summer insect season in late-June through mid-August, rut in September to October, and winter foraging from November through March. Herd ranges often overlap during summer and winter.

The Central Arctic caribou herd calves between the Colville and Canning rivers in GMU 26B; summer range extends from just west of the Colville River delta east and inland within 30 miles to the Katakturuk River; winter range includes northern and southern foothills and mountains of the Brooks Range (Lenart 2009a).

The Porcupine caribou herd migrates between Alaska and Yukon and Northwest Territories in Canada; calving distributions vary with snow cover. In 2007, calving was concentrated near the Malcolm and Firth rivers, Yukon; summer range in Alaska was concentrated between the Jago and Aichilik rivers south into the Brooks Range; fall distribution in Alaska includes the Richardson Mountains into the upper Sheenjek and Chandalar river drainages; winter distributions in Alaska were concentrated around Arctic

Village between the Sheenjek and East Fork Chandalar rivers in 2007-2008 (Caikoski 2009a).

The Ray Mountains caribou herd calves on the southern slopes of the Ray Mountains; summers in alpine areas of the Spooky Valley area around Mount Henry Eakins and south of the upper Tozitna River; and winters on the northern slopes of the Ray Mountains (Hollis 2009).

The Nelchina caribou herd calves in the eastern Talkeetna Mountains from the Little Nelchina River north to Fog Lakes where they remain after calving into early summer. The fall range extends from the Denali Highway across the Alphabet Hills and the Lake Louise flats as far east as the Gulkana River, and winter range extends from Cantwell east across GMU 13A and 13B and northeast into GMU 11, 12, and 20E (Tobey and Schwanke 2009a).

Dall's Sheep

Dall's sheep occur throughout the Project ROW area in alpine and subalpine habitats. Sensitive periods include: lambing in mid-may to June, winter habitat from November through February, and mineral lick sites in the spring. Dall's sheep in the Brooks Range may be limited in movement across major drainages with subpopulations north and south of the Junjik River and east and west of the East Fork Chandalar and Hulahula rivers (Caikoski 2008a). Dall's sheep in the White Mountain area are found in small, widely scattered groups throughout alpine habitat centered in two core areas Lime Peak to Mount Prindle and Victoria Mountain to Mount Schwatka. Dall's sheep move from wintering to lambing areas in late May to mid June then to rutting areas in late September to late October. Dall's sheep move to winter areas in late November through December (Seaton 2008b). Dall's sheep also occur in the Alaska Range, Talkeetna Mountains and the Chulitna-Watana Hills.

Muskoxen

Muskoxen occur on the Arctic Coastal Plain and Brooks Range foothills in GMU 26B. They are found primarily near Beechey Point, Deadhorse and along the Sagavanirktok and Ivishak Rivers, with a few animals reported on the south side of the Brooks Range (Lenart 2009b). Muskoxen aggregate in larger groups 6 to 60 during the winter and remain in one location for long periods of time splitting into smaller groups of 2 to 20 animals during the summer and moving more frequently (Lenart 2009b). Sensitive periods for muskoxen include: calving in April to June, and the winter period from November to February.

Bears

Sensitive periods for brown and black bears are the denning period; which begins in late September and extends to October with emergence in April and May. Brown bear densities are generally highest in the foothills and mountains of the Brooks Range and lowest on the Arctic Coastal Plain where riparian habitats are used extensively (Lenart

2009c). Brown bear densities are higher in the mountainous portion of GMU 20A and 20C for the Central and Lower Tanana Valley and Middle Yukon river drainages (Young 2009). Brown bear populations in the upper Cook Inlet have been influenced by agricultural settlement, development, and urbanization and population estimates are confounded by forest cover (Peltier 2009).

Black bears live throughout Interior and Southcentral Alaska. Distributions shift seasonally with bears using moist lowlands with early growing vegetation in spring, and berries in open meadow or alpine areas in fall (Seaton 2008c). Seasonal availability of salmon affects distributions of both brown and black bears (Tobey 2008; Seaton 2008c).

Small Game and Furbearers

The small game animals and furbearers that are hunted or trapped in the Project area are listed in Table 5.5-2 (Blejwas 2007). Fur animal harvest for the GMUs crossed by the proposed Project was dominated by American marten, American beaver, red fox, Canadian lynx, common muskrat, and American mink (Table 5.5-2). Harvest rates for small game and furbearers may increase with increased hunter access to areas from Project development. Small game and furbearers use a wide variety of habitats, including forests, river and stream banks, ponds and marshes. Many furbearers, such as American beavers, American mink, North American river otter, and weasels, are associated with riparian and wetland areas. Most furbearers are associated with some type of den or cover for giving birth and for shelter during winter months.

The proposed Project crosses many different habitats that are home to a wide variety of animals, most of which are considered game. Small mammals such as Arctic ground squirrels, red squirrels, lemmings, voles, and shrews provide important prey for bears, wolves, wolverines, coyotes, foxes, American marten, ermine, raptors and owls.

Other Species

One species of amphibian inhabits the Project area, the wood frog, which occurs throughout mainland Alaska in a variety of habitats. A wide variety of invertebrates occur across the project area including bees, beetles, butterflies, grasshoppers, hornets, moths, spiders, and earthworms. They all provide an important food source for birds, wood frogs, and small mammals.

TABLE 5.5-2 Common Terrestrial Mammals that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0-174.8	25A,D MP174.8-180.7; MP322.2-329.5	24 MP180.7-322.2	20A,B,C,D,F MP398.3-562.0	13E	16A MP645.6-674.8	14A,B MP674.8-737.0	
Big Game Animals								
Moose (*Alces americanus*)	√ ~450	√ ~2,200	√ ~8,500	√ ~46,000	√ ~4,500	√ ~1,600	√ ~8,000	Abundant and associated with a wide variety of forest, shrub, particularly willow, and wetland habitats. Traditionally move between mountains and adjoining lowlands on a seasonal basis. Wildfire important in improving forage (MacDonald and Cook 2009).
Caribou (*Rangifer tarandus*)	√ CA 66,800	√ P 100,000	√ RM 1,000		√ N		√ N 36,600	Caribou herds: CA – Central Arctic, P – Porcupine, RM – Ray Mountain, D – Delta, N – Nelchina. Social and nomadic, spring calving area traditional center of distribution and define herds, calving above timber line or along coast in windswept rolling hills. Summer ranges may seek high mountains or coast for relief from biting insects. May travel long distances to find adequate lichens, sedges, browse in boreal forest and tundra. Herds may mix on winter ranges (MacDonald and Cook 2009).
Muskoxen (*Ovibose moschatus*)	√ ~200							Social and gregarious, in summer uses moist habitats and riparian vegetation, in winter shifts to windswept hill-tops, slopes (MacDonald and Cook 2009).
Dall's Sheep (*Ovix dalli*)	√ ~900	√ ~1,300	√	√ ~3,300	√	√	~1,300	Subalpine grass-low shrub habitats in dry, mountainous terrain; expand range during summer, restricted in late winter to snow-free areas; mineral licks essential during spring (MacDonald and Cook 2009).
Brown bear (*Ursus arctos*)	√ ~270	√ ~860	√ ~850	√ ~650	√ ~1,300	√ ~130	√ ~200	Most common in areas of open tundra and grasslands; mountain meadows, muskeg, sedge flats. Den sites are often on hillsides (MacDonald and Cook 2009).
American black bear (*Ursus americanus*)				√ ~3,700	√ A	√ ~400	√ ~750	Usually within forested habitats, prefer semi-open areas with fruit-bearing shrubs and herbs, lush grasses, and succulent forbs (MacDonald and Cook 2009). Black bears considered abundant (A) in GMU 13 (Tobey 2008)

TABLE 5.5-2 Common Terrestrial Mammals that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0-174.8	25A,D MP174.8 -180.7; MP322.2 -329.5	24 MP180.7 -322.2	20A,B,C, D,F MP398.3 -562.0	13E	16A MP645.6 -674.8	14A,B MP674.8 -737.0	
Furbearers								
American beaver (*Castor canadensis*)		√ *11* A ±	√ *9* A ±	√ *307* A ±	√ *63* C ±	√ *7* A ±	√ *91* A ±	Found in lakes, ponds, marshes, rivers and streams over most of mainland Alaska, north to near crest of Brooks Range. Common to abundant in suitable habitat (MacDonald and Cook 2009).
American marten (*Martes americana*)		√ *199* A ±	√ *143* A +	√ *1,188* C ±	√ *333* C ±	√ *102* A ±	√ *54* A ±	Found in most forested regions of Alaska, adapted to variety of forested habitats, optimum habitat mature old-growth spruce with well-established understory, and abundant rodents and other prey (MacDonald and Cook 2009).
American mink (*Neovison vision*)		√ *36* C +	√ *4* C ±	√ *187* C ±	√ *51* C ±	√ *0* C ±	√ *12* C ±	Found throughout much of Alaska south of the Brooks Range, associated with marine and freshwater systems; riparian habitats, lakeshores, marshes, stream banks, lower densities and larger population fluctuations in interior populations (MacDonald and Cook 2009).
Arctic fox (*Vulpes lagopus*)	√ *0* C ±							Occur along arctic coast, adapted to life in cold harsh environment, arctic tundra, rocky beaches, pack ice. Den in sandy soil along river banks, on hills, common and sometimes abundant; populations fluctuate with food availability (MacDonald and Cook 2009)
Arctic ground squirrel (*Spermophilus parryii*)	√	√	√	√	√	√	√	Widely distributed across Alaska, occur in tundra, meadow, riverbank and lakeshore habitats where well-drained permafrost-free sites provide vantage, vegetation, and soils for burrows. Colonial and locally abundant over much of range, burrows, hibernates. The arctic subspecies (*Spermophilus parryii kennicottii*) occurring north of the Brooks Range is considered a conservation concern (Alaska Department of Fish and Game 2006).
Canada Lynx (*Lynx canadensis*)		√ *93* C +	√ *2* C ±	√ *154* C ±	√ *73* C ±	√ S ±*3*	√ *0* S ±	Found primarily in interior forests of Alaska, uncommon to common and periodically abundant, prefer forests with dense understory, populations fluctuate with snowshoe hare (MacDonald and Cook 2009).

TABLE 5.5-2 Common Terrestrial Mammals that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0- 174.8	25A,D MP174.8 -180.7; MP322.2 -329.5	24 MP180.7 -322.2	20A,B,C, D,F MP398.3 -562.0	13E	16A MP645.6 -674.8	14A,B MP674.8 -737.0	
Common muskrat (*Ondatra zibethicus*)		√ *200* C +	√ *11* S ±	√ *18* S ±	√ *44* C ±	√ *0* C ±	√ *49* C ±	Found throughout much of Alaska south of the Brooks Range, inhabit fresh, brackish, saltwater marshes, ponds, lakes, rivers, streams, widespread and common, sometime abundant (MacDonald and Cook 2009).
Coyote (*Canis latrans*)		√ *0* S ±	√ *0*	√ *99* C ±	√ *46* C ±	√ *7* C ±	√ *35* C ±	Thrive in diverse habitats, prefer broken and open country in Alaska, not especially abundant, common in Tanana, Matanuska, and Susitna drainages (MacDonald and Cook 2009).
Ermine (*Mustela erminea*)	√ *0* C +	√ *6* C -	√ *19* C +	√ *135* C ±	√ *68* A ±	√ *9* A ±	√ *6* A ±	Found throughout Alaska, use wide variety of habitats, common and widespread, populations fluctuate with small mammal prey, prefer edge habitats, near meadows, stream banks, lakeshores, beaver ponds, cover of rock talus, shrub thickets, stumps, logs (MacDonald and Cook 2009).
Hoary marmot (*Marmota caligata*)			√	√	√	√	√	Found in mountainous regions south of Yukon river in Alaska, prefer rocky tundra habitats on sides of canyons and valleys in mountains, common in suitable habitat (MacDonald and Cook 2009)
Least weasel (*Mustela nivalis*)	√ C +	√ C -	√ C +	√ C ±	√ A ±	√ A ±	√ A ±	Found throughout Alaska, wide variety of forest and tundra habitats, prefer meadows, marshes, riparian habitat with abundant small mammal prey (MacDonald and Cook 2009).
North American river otter (*Lontra canadensis*)		√ *0* S ±	√ *2* C ±	√ *31* S ±	√ *13* C ±	√ *3* C ±	√ *6* C ±	Occur throughout most of Alaska south of the Brooks Range, semi aquatic, inhabits wide variety of coastal marine and freshwater habitats (MacDonald and Cook 2009).
Northern flying squirrel (*Glaucomys sabrinus*)			√	√	√	√	√	Probably occurs throughout much of forested Alaska, but distribution poorly documented. Occurs in wide variety of boreal forests and coastal rain forest; assumed association with mature and old-growth forests, uses tree cavities, snags for shelter.
Red fox (*Vulpes vulpes*)	√ *2* A +	√ *9* C ±	√ *11* C ±	√ *207* C ±	√ *152* C ±	√ *4* C ±	√ *26* C ±	Occur throughout most of mainland Alaska, live in wide variety of habitats, common south of arctic tundra (MacDonald and Cook 2009).

TABLE 5.5-2 Common Terrestrial Mammals that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0- 174.8	25A,D MP174.8 -180.7; MP322.2 -329.5	24 MP180.7 -322.2	20A,B,C, D,F MP398.3 -562.0	13E	16A MP645.6 -674.8	14A,B MP674.8 -737.0	
Red squirrel (*Tamiasciurus hudsonicus*)	√ *0*	√ *20* A ±	√ *25* A +	√ *172* A ±	√ *40* A ±	√ *0* A ±	√ *20* A ±	Throughout most of forested Alaska, from near crest of the Brooks Range, common within core range, characteristic of coniferous forest but also occur in mixed hardwood forests and occasionally beyond tree line in riparian shrub thickets (MacDonald and Cook 2009), uses cavities, middens for food storage and shelter.
Wolf (*Canis lupus*)	√ ~25 *3* A ±	√ ~470 *9* A ±	√ ~460 *3* A ±	√ ~800 *74* C -	√ ~350 *27* C -	√ ~30 *0* C ±	√ ~80 *4* C ±	Widely distributed in Alaska, populations generally stable, thrive in a wide variety of climates and terrains, found where suitable prey populations exist in Alaska (MacDonald and Cook 2009).
Wolverine (*Gulo gulo*)	√ *1*	√ *1* C ±	√ *1* C ±	√ *10* S ±	√ *27* C ±	√ *2* S ±	√ *0* S ±	Widely distributed throughout Alaska, range great distances and habitat types, reproductive dens usually long, complex snow tunnels with no associated trees or boulders, not abundant (MacDonald and Cook 2009). Annual harvest ~190 across GMUs (Alaska Department of Fish and Game 2007b)
Woodchuck (*Marmota monax*)			√	√	√	√	√	Restricted to between Tanana and Yukon rivers from Nenana to the Alaska-Yukon border, rare to uncommon within range prefer open, well-drained grassy areas and open deciduous forest with grasses, forbs and shrubs (MacDonald and Cook 2009)
Small Game Animals								
Snowshoe hare (*Lepus americanus*)	√	√	√	√	√	√	√	Found throughout taiga in Alaska; inhabit forests, shrubby woodlands and riparian shrub thickets, generally common and periodically very abundant (MacDonald and Cook 2009).
North American porcupine (*Erethizon dorsatum*)	√	√	√	√	√	√	√	Occur in wide variety of habitats from closed forest to open shrub tundra, common and widespread throughout most of Alaska (MacDonald and Cook 2009).

TABLE 5.5-2 Common Terrestrial Mammals that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0-174.8	25A,D MP174.8-180.7; MP322.2-329.5	24 MP180.7-322.2	20A,B,C,D,F MP398.3-562.0	13E	16A MP645.6-674.8	14A,B MP674.8-737.0	
Unclassified Mammals								
Brown lemming (*Lemmus trimucronatus*)	√	√	√	√	√	√	√	Occurs in variety of arctic, alpine tundra, and taiga habitats, usually associated with wet sedge-grass tundra, spruce bogs, wet meadows, densities vary year to year (MacDonald and Cook 2009).
Cinereus shrew (*Sorex cinereus*)		√	√	√	√	√	√	Common and widespread throughout Alaska; abundance can fluctuate year to year, wide variety of habitats, but may be especially abundant in riparian areas with dense ground cover (MacDonald and Cook 2009).
Collared pika (*Ochotona collaris*)				√	√	√	√	Occur in mountains of east-central and southern Alaska; may be locally common, form colonies in mountainous terrain. Rock slides, talus slopes, and large boulders near meadows and vegetated patches (MacDonald and Cook 2009)
Dusky shrew (*Sorex monticolus*)		√	√	√	√	√	√	Common, sometimes abundant, and widespread throughout Alaska south of the Brooks Range, uses a wide variety of habitats, dense moist or wet understory ground cover (MacDonald and Cook 2009).
Little brown myotis (*Myotis lucifugus*)				√	√	√	√	Most common and widespread bat in Alaska, in numerous habitats but especially forested regions at roosts and maternity colonies. Unknown if overwinter at northern latitudes or if they migrate to hibernacula (MacDonald and Cook 2009).
Northern red-backed vole (*Myodes rutilus*)	√	√	√	√	√	√	√	Common and widespread throughout mainland Alaska although densities may fluctuate between years. Most abundant in forested, woodland, and shrub habitats (MacDonald and Cook 2009).
Root vole (*Microtus oeconomus*)	√	√	√	√	√	√	√	Broadly distributed across Alaska, densities fluctuate between years, uses variety of open herbaceous habitats, most abundant in wet sedge and grass-forb meadows and bogs (MacDonald and Cook 2009).

√ = Indicates that the species occurs in the Game Management Unit or Subunit. Square brackets present alternative common names.

[a] Numbers are population estimates for Big Game Animals from management reports. Italic numbers are harvest estimates for Furbearers, followed by abundance (A = abundant, C = common, S = scarce) and population trend (+ = increase, - = decrease, ± = no change) for 2005-2006 as reported by trappers (Blejwas 2007).

[b] Protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 5.8. Aquatic animals are discussed in Section 5.6.

Sources: Big Game Animals: Caikoski 2008a, Caikoski 2008b, Caikoski 2009a, DuBois 2007a, DuBois 2008a, DuBois 2008b, DuBois 2008c, DuBois 2008d, DuBois 2007b, DuBois 2008e, Gross 2007, Hollis 2007, Kavalok 2008, Kavalok 2005, Kavalok 2007a, Kavalok 2007b, Lenart 2007, Lenart 2008, Lenart 2009a, Lenart 2009b, Peltier 2008a, Peltier 2008b, Peltier 2008c, Seaton 2008a, Seaton 2008b, Seaton 2008c, Stout 2008, Stout 2007, Tobey and Kelleyhouse 2007a, Tobey and Schwanke 2008, Tobey 2008, Tobey and Kelleyhouse 2007b, Young 2007a, Young 2008a, Young 2008b, Young 2008c, Young 2007b. Furbearers: Blejwas 2007, Caikoski 2009b, DuBois 2006, Kelleyhouse 2006, Parker McNeill 2006, Peltier 2006a, Peltier 2006b, Stephenson 2006, Young 2006.

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Waterfowl and Game Birds

The Project area is administered by the Pacific Flyway Council. All ducks, geese, swans, waterbirds, shorebirds and sandhill cranes are considered migratory. Waterfowl from the Pacific, Central, and Mississippi Flyways are known to breed or migrate within the Project area. Most bird species migrate through the Project area and use it for staging or stop over uses during the spring and fall migration periods. Some birds may winter in the Cook Inlet near the southern end of the proposed Project.

All migratory birds are protected by the Migratory Bird Treaty Act (MBTA) (16 USC 703–712; 40 Stat. 755 as amended) which prohibits the take of any migratory bird without authorization from USFWS. Hunting seasons are set and regulated by USFWS and the ADF&G. Waterfowl are harvested primarily in fall; however, subsistence hunting may occur year-round. Non-migratory birds such as upland game birds (grouse and ptarmigan) and non-native birds such as European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), and house sparrow (*Passer domesticus*) are not protected by the MBTA.

The proposed Project ROW would be located near three Important Bird Areas (IBAs) which provide important habitat for breeding, migrating, and staging waterbirds (Figure 5.5-2). These areas include:

- Kahiltna Flats–Petersville Road, Globally Important Bird Area: Kahiltna floodplain contains one of the largest concentrations of Trumpeter Swan nesting sites in upper Cook Inlet, wetlands at the base of Kahiltna Glacier used by molting post-breeders, and young-of-the-year Tule greater white-fronted geese;
- Susitna Flats, Globally Important Bird Area: Spring and fall migrant ducks, geese, and swans exceed 100,000 birds in spring with peak densities early May; lesser sandhill cranes and swan migration staging (Audubon Alaska 2010).
- Minto Flats State Game Refuge: One of the highest quality waterfowl habitats in Alaska and sustains one of the largest trumpeter swan breeding populations in North America. Minto Flats is also an important spring and fall waterfowl staging area, particularly for geese and swans.

Table 5.3-3 illustrates the common bird species, breeding abundance, harvest data, and habitat association within the proposed Project area.

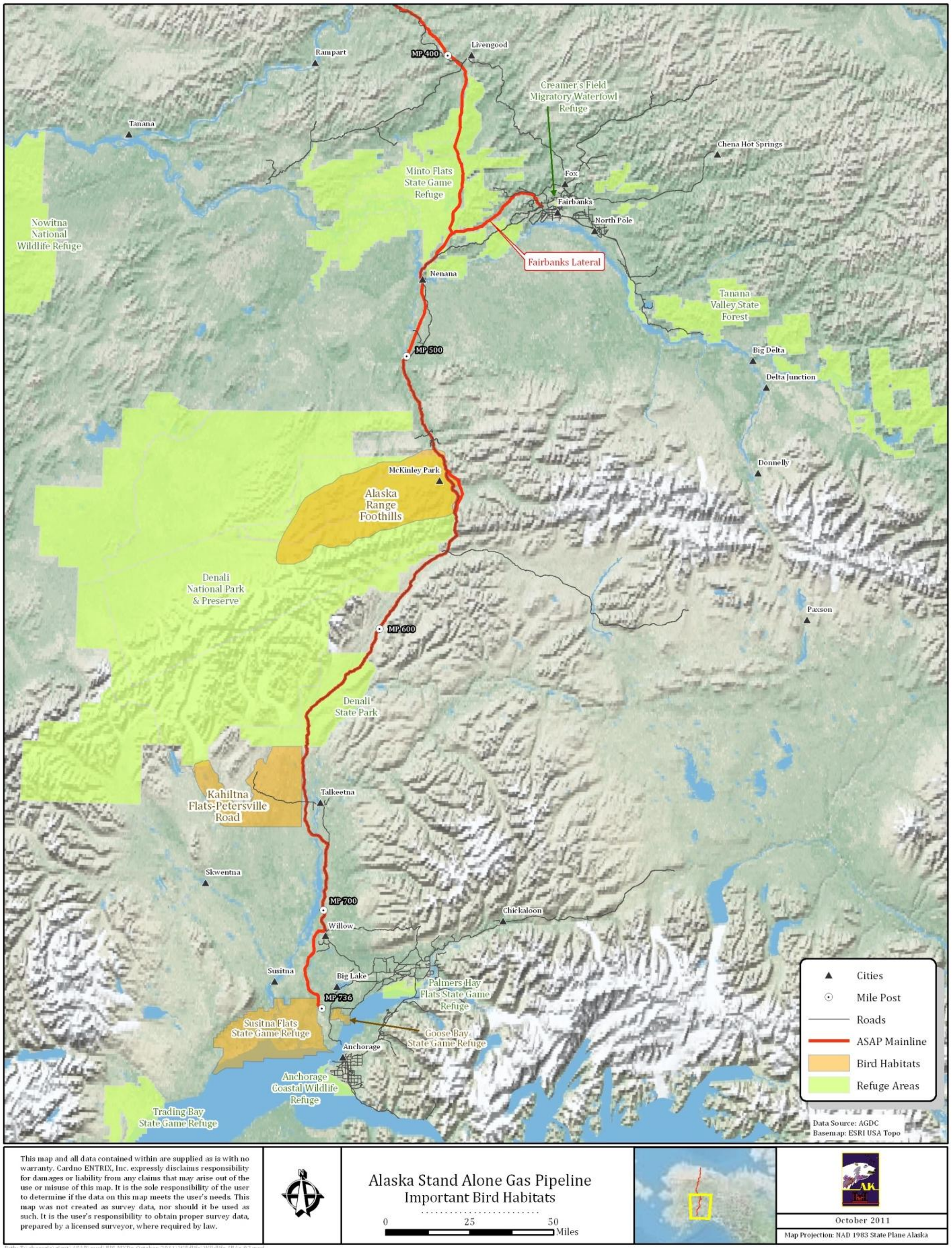

FIGURE 5.5-2 Important Bird Areas and Wildlife Refuges along the Project ROW (Audubon Alaska 2008)

TABLE 5.5-3 Common Waterbirds and Game Birds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Waterbirds						
Waterfowl - Dark Geese						
Brant (*Branta bernicla*)	√ 10,221				1,700	Nests in lowland, coastal tundra; during migration uses saltwater bays and estuaries.
Canada goose (*Branta canadensis*)	√ 21,289	√ 4,455	√ 564	√ 605	5,422	Various subspecies use wide variety of habitats from tundra to south coastal wetlands; usually associated with wetland, lakes, ponds. Nest throughout Alaska, large aggregations during migrations. Cackling goose (*Branta hutchinsii*), previously considered a subspecies of the Canada goose, nest on ACP.
Greater white-fronted goose (*Anser albifrons*)	√ 222,891	√ 0	√ 0	√ 0	339	Nests in arctic and Yukon Flats; migrates through Kenai-Susitna. Subspecies – tule white-fronted goose (*Anser albifrons elgasi*) nests in Kenai-Susitna.
Waterfowl - White Geese						
Snow goose (*Chen caerulescens*)	√ 27,926	√ 0	√ 0	√ 0	339	Nests in arctic, often in colonies; migrates through central Alaska. A few Ross's geese (*Chen rossii*), a similar small white goose, also nest in arctic Alaska.
Waterfowl - Swans						
Tundra swan (*Cygnus columbianus*)	√ 14,174	√	√	√		Nests on tundra, during migration use saltwater, wetlands, lakes and rivers. Tundra swans breed on Arctic Coastal Plain and western Alaska. Occur throughout Alaska during spring and fall migrations. No sport hunting of tundra swans allowed in GMUs crossed by the project; subsistence harvest in western Alaska.
Trumpeter swan (*Cygnus buccinator*)		√ 810	√ 9,455	√ 605		Forest wetlands, lakes, marshes, rivers with dense vegetation. Trumpeter swans breed in central and southcoastal Alaska. No sport hunting of trumpeter swans allowed in Alaska.

TABLE 5.5-3 Common Waterbirds and Game Birds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Waterfowl - Ducks						
Mallard (*Anas platyrhynchos*)	√ 325	√ 100,246	√ 79,481	√ 7,461	22,126	Marshes, sloughs, lakes, rivers throughout Alaska; less common in arctic and brackish waters.
American wigeon *(Anas americana)*	√ 630	√ 239,477	√ 105,178	√ 8,833	9,901	Breeds in freshwater marshes, sloughs, ponds, marshy edges of lakes; migration and winter in shallow coastal bays; less common in arctic
Green-winged teal *(Anas crecca)*	√ 246	√ 124,675	√ 80,081	√ 5,861	9,396	Breeds in freshwater ponds, marshes and shallows of lakes surrounded by woods; migration uses brackish intertidal areas near mouths of streams; less common in arctic.
Northern shoveler *(Anas clypeata)*	√ 848	√ 75,074	√ 42,012	√ 1,843	1,515	Breeds in shallow, often muddy, freshwater marshes, sloughs and lakes; for migration uses coastal saltwater mud flats and shallow freshwater areas.
Northern pintail *(Anas acuta)*	√ 56,073	√ 93,523	√ 41,734	√ 3,037	7,779	Most widely distributed and abundant dabbling duck in Alaska; breeds in marshy, low areas with shallow freshwater lakes, brackish estuaries and sluggish streams with marshy borders; for migration uses salt and brackish waters along coast
Canvasback *(Aythya valisineria)*		√ 24,276	√ 7,704		202	Breeds in marshes, sloughs, deep-water lakes with vegetated shorelines; migration uses saltwater bays, large lakes and rivers.
Lesser scaup (*Aythya affinis*) Greater scaup (*Aythya marila*)	√ 17,693	√ 166,339	√ 46,162	√ 6,507	303	Greater scaup breeds on tundra or low forest next to tundra, nests in dense vegetation next to freshwater lakes and ponds. Lesser scaup breeds on interior lakes and ponds, nests in dry grassy areas near lakeshores. Both winter in coastal saltwater.
Common goldeneye (*Bucephala clangula*) Barrow's goldeneye (*Buchephala islandica*)		√ 3,899	√ 11,191	√ 3,574	4,647	Nests in cavities, lakes and ponds surrounded by trees. Barrow's goldeneye may also use rocks or cliffs. Winters in inshore marine waters, lakes and rivers with open water.
Bufflehead (*Bucephala albeola*)		√ 20,088	√ 18,084	√ 1,637	1,010	Nests in cavities, lakes and ponds surrounded by trees. Winters in inshore marine waters, lakes and rivers with open water.
Waterfowl - Sea Ducks						

TABLE 5.5-3 Common Waterbirds and Game Birds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Common merganser (*Mergus merganser*) Red-breasted merganser (*Mergus serrator*)	√ 1,487	√ 1,372	√ 2,684	√ 2,375	2,159	Breeds in forested areas where associated with rivers and clear freshwater lakes. Common merganser nests in hollow trees, cliffs and on ground under cover. Red-breasted merganser nests on ground under cover or in driftwood – often near coast. Winter inshore marine or freshwaters.
Common eider (*Somateria mollissima*)	√ ~2,000			√		Nests coastal arctic, uses barrier islands, migration and winter uses inshore marine waters.
King eider (*Somateria spectabilis*)	√ 22,375			√		Nests on ponds and lakes on coastal arctic tundra, migration and winter uses inshore marine waters.
Harlequin duck (*Histrionicus histrionicus*)		√	√	√		Nests along cold, rapidly flowing streams, often surrounded by forest, on ground close to water protected by dense vegetation; not visible during standard breeding pair surveys; in winter uses inshore marine waters, rocky shorelines.
Long-tailed duck (*Clanula hyemalis*)	√ 48,812		√ 2,524	√ 219		Breeds on tundra near lakes or ponds on ground often under low shrubs; winters inshore marine waters.
Black scoter (*Melanitta nigra*) Surf scoter (*Melanitta perspicillata*) White-winged scoter (*Melanitta fusca*)	√ 2,872	√ 11,372	√ 36,904	√ 2,554	6,477	Black scoter – nests on lakes, ponds or rivers in tundra and woodlands on ground. Surf scoter – not well known, probably near freshwater in shrubby cover or woodland. White-winged scoter – interior lakes and streams on ground under shrubs and trees. All winter on inshore marine waters.
Other Waterbirds						
Pacific loon (*Gavia pacifica*)	√ 39,188	√ 4,300	√ 1,100	√ 100		Breeds on lakes in tundra or coniferous forest habitats; nests on shoreline points or small islands; migration and winter uses inshore and offshore marine waters.
Common loon (*Gavia immer*)	√	√ 1,100	√ 1,600	√ 700		Breeds on lakes in coniferous forests; nest mound of vegetation near water often on small islands; winter uses inshore marine waters.
Red-throated loon (*Gavia stellata*)	√ 3,080	√ 0	√ 300	√ 0		Breeds on ponds and small lakes, nest on shoreline or islands; migration and winter uses inshore marine waters.

TABLE 5.5-3 Common Waterbirds and Game Birds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Wilson's Snipe *(Gallinago delicata)*	√	√	√	√	1,100	Breeds on muskeg, freshwater marshes, on ground usually in grass; migration and winter uses grass meadows on tidal flats and freshwater marshes.
Sandhill crane *(Grus canadensis)*	√ 14,174	√ 1,215	√ 916	√ 110	1,700	Breeds lowland tundra marshes, nest on ground; migration, tidal flats, muskegs – during migration roosts at night on exposed and shallow submerged river bars in large rivers.
Upland Game Birds						
Spruce grouse (*Falcipennis canadensis*)		√	√	√		Inhabits white spruce and paper birch woodlands, black spruce bogs. Males display in May; nests on the ground, at base of spruce tree or beneath log, hatch mid-June. In winter, loaf and feed on spruce trees and needles.
Ruffed grouse (*Bonasa umbellus*)		√				Most abundant in dense stands of aspen or birch, established after fire or timber harvest. Males establish breeding territories previous fall, display during spring. Nest beside a stump, under a fallen tree, beneath overhanging shrubs along forest edges or openings.
Sharp-tailed grouse (*Tympanuchus phasianellus*)		√				Inhabits forested habitats, recent burn areas, open grass-shrub muskegs. Males display in leks late April through early May, nest on ground.
Willow ptarmigan (*Lagopus lagopus*)	√	√	√	√		Inhabits willow-lined waterways, tall bushes important habitat feature; wetter places with luxuriant vegetation. Males establish breeding territories by late April or early May, nests on ground under shrub at edge of opening. Flocks form in September; move southward to wintering areas as much as 100 miles away during October and November, move northward in February with peak movement in April.
Rock ptarmigan (*Lagupus mutus*)	√	√	√	√		Inhabits slopes and high valleys with shin-high shrubs with low herbs and grasses. Nest under low shrubs or in open, nest sites not re-used, hatch in June. Flocks form in September and move to low-elevation wintering areas.
White-tailed ptarmigan (*Lagopus leucurus*)				√		Inhabits areas above timberline in mountains most of year; boulder fields, snowfields, rockslides; move lower during late fall winter on slope in alder, willow, birch. Males establish territories by late April, nest on narrow, mossy ledges or against boulders.

√ = Indicates that the species occurs in the survey area or Subunit.

[a] Numbers are population estimates from survey area reports.

[b] Protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 3.8. Aquatic animals are discussed in Section 3.7.

Sources: Armstrong 1990, Larned et al. 2010, Mallek and Groves 2009.

Landbirds

Landbird is an informal name that represents a large and diverse group of birds that share molecular characters. Landbirds include the passerines (primarily), owls, falcons, hawks, and woodpeckers. The Project area crosses through the Arctic and Northern Forest Avifaunal Biomes (Rich et al. 2004). Landbirds breeding in tundra and boreal forest habitats include short-distance migrants, long-distance migrants, and resident species.

The number of breeding landbirds increases from north to south with two to 31 species inhabiting the Arctic tundra, 32 to 61 landbird species in the Brooks Range, and 62 to 91 landbird species in northern forests (Rich et al. 2004). Most landbirds breeding in Arctic Alaska are short-distance migrants, and many winter in the north Pacific coastal states and across the northern U.S. (Rich et al. 2004). Short-distance and long-distance migrants breed in central Alaska, and may winter in the north Pacific coastal states, across the southern U.S., or into Central and South America (Rich et al. 2004). The two IBAs noted earlier support landbirds during breeding and migration staging (Figure 5.5-2):

- Alaska Range Foothills, State IBA: contains one of the highest reported densities of nesting golden eagles in North America, substantial numbers of nesting gyrfalcons and other subalpine nesting birds; and

- Kahiltna Flats – Petersville Road, Globally IBA: supports significant multi-species assemblages and concentrations including 10 landbirds of conservation concern (Audubon Alaska 2010). These landbirds include the: Gray-cheeked Thrush; Golden-crowned Sparrow; Varied Thrush; Bohemian Waxwing; Arctic Warbler; White-winged Crossbill, Blackpoll Warbler, and Olive-sided Flycatcher).

Common birds, survey areas, estimated breeding abundance and associated habitats are described in Table 5.5-4. Estimated breeding abundance was obtained from Breeding Bird Survey data (Sauer et al. 2008a). Although quantitative data on bird distribution and abundance along the proposed Project is limited, breeding-bird surveys represent the best available data for the entire Project area (Sauer, Hines, and Fallon 2008b).

TABLE 5.5-4 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Shorebirds				
American golden plover *(Pluvialis dominica)*	√	√	√	Breeds on drier tundra in moss; migration uses tidal flats.
Semipalmated plover *(Charadrius semipalmatus)*	√	√	√	Breeds on gravelly or sandy beaches of lakes, ponds, rivers, glacial moraines on ground in sand, gravel or moss; migration uses lakes, ponds, rivers, glacial moraines, tidal flats.
Greater yellowlegs *(Tringa melanoleuca)*		√	√ 1.0	Breeds in muskegs, freshwater marshes, nests on ground in moss; uses tidal flats, lakes ponds during migration.
Lesser yellowlegs *(Tringa flavipes)*	√ 1.2	√ 0.6	√ 4.0	Breeds in muskegs, freshwater marshes; uses tidal flats, lakes, ponds during migration.
Solitary sandpiper *(Tringa solitaria)*		√ 0.1	√ 0.4	Breeds in muskegs, freshwater marshes, lakes ponds; nests in deserted nests of other birds; migration uses muddy shorelines of ponds, streams in wooded areas.
Semipalmated sandpiper *(Clicris pusilla)*	√			Breeds in wet tundra, nests on ground; during migration uses tidal flats, beaches, lake shores.
Spotted sandpiper *(Actitis macularia)*	√ 0.1	√ 0.1	√ 0.5	Found on shores of rivers, streams, lakes and saltwater beaches; nests near water in gravel or grass.
Upland sandpiper *(Bartramia longicauda)*		√	√ 0.2	Breeds in open grassy fields, sparsely vegetated uplands, not usually associated with water, perches on small trees.
Red-necked phalarope *(Phalaropus lobatus)*	√	√	√	Breeds in wet tundra, freshwater marshes, ponds, lakes; nests on ground in wet grassy areas; migration uses inshore and offshore marine waters, tidal ponds, sloughs, ponds, lakes.
Seabirds				
Herring gull (*Larus argentatus*)		√	√ 1.7	Breeds in lakes, rivers, islands, tidal flats and beaches; nests on ground; migration and winter uses lakes, rivers, tidal flats, beaches, garbage dumps, inshore marine water – often more inland than other gulls.

TABLE 5.5-4 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route) Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	Habitat Association
Glaucous-winged gull (*Larus glaucescens*)		√	√ 3.2	Nests in colonies on flat, low islands, cliff ledges and rocky beaches; uses tidal flats, beaches, inshore marine waters; for migration and winter uses various habitats often associated with salmon streams.
Glaucous gull (*Larus hyperboreus*)	√			Nests in colonies on cliff ledges on ground on tundra or on barrier islands; for migration and winter uses tidal flats, beaches, inshore marine waters.
Arctic tern (*Sterna paradisaea*)	√	√	√	Nests in colonies or scattered pairs on sand, gravel, moss; uses tidal flats, beaches, glacial moraines, rivers, lakes, marshes; migration uses inshore and offshore marine waters, tidal flats, beaches, rivers, lakes.
Raptors				
Osprey (*Pandion haliaetus*)	√ 0.1	√	√ 0.1	Nests near water in trees or on cliffs; forages on fish.
Bald eagle (*Haliaeetus leucocephalus*)	√ 0.1	√	√ 0.2	Nests in trees or on cliffs old-growth timber along coast and larger mainland rivers; uses coniferous forests, deciduous woodlands, rivers, streams, beaches, tidal flats, rocky shores.
Northern harrier *(Circus cyaneus)*	√ 0.1	√ 0.1	√ 0.1	Uses open country, especially tidal marshes, freshwater marshes; open mountain ridges in Interior; nests on ground in wet marshy areas.
Sharp-shinned hawk *(Accipiter striatus)*		√ 0.1	√	Uses coastal and interior coniferous forests, shrubs, mixed woodlands, forest edges; nests in conifers.
Northern goshawk *(Accipiter gentilis)*	√ 0.1	√	√ 0.1	Uses coastal and boreal forests, forest edges; nests in heavy timber usually in conifers.
Red-tailed hawk *(Buteo jamaicensis)*		√ 0.1	√ 0.1	Uses coniferous forests and deciduous woodlands with open areas for hunting; nests in trees or on cliffs.
Rough-legged hawk *(Buteo lagopus)*	√			Uses upland tundra with cliffs and rocky outcrops; nests on cliffs or trees.
American kestral *(Falco sparverius)*	√ 0.2	√ 0.1	√ 0.1	Uses forest edges and openings; nests in tree cavities.

TABLE 5.5-4 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Great-horned owl (*Bubo virginianus*)	√ 0.1	√ 0.1	√ 0.1	Inhabits coniferous and deciduous forests, nests in abandoned hawk nests or cliff crevices.
Northern hawk owl (*Surnia ulula*)		√	√	Inhabits open coniferous and deciduous forests, nests in tree cavities on tops of tree stubs, or occasionally on cliffs or tree limb crevice.
Songbirds and Other Birds				
Northern flicker *(Colaptes spp.)*	√ 0.2	√ 0.1	√ 0.4	Nests in holes in trees or stumps; most common in mixed forests, shrub habitats, infrequently observed.
Alder flycatcher *(Empidonax alnorum)*	√ 1.6	√ 5.5	√ 57.9	Inhabits broadleaf forests and shrubs; alder and willow thickets; nests in shrubs.
Gray jay *(Perisoreus canadensis)*	√ 2.0	√ 5.2	√ 3.3	Widely distributed throughout central Alaska; associated with closed and open needleleaf and mixed forests.
Black-billed magpie *(Pica hudsonia)*		√	√ 4.1	Inhabits open broadleaf forest and shrub habitats; nests in tall bushes.
Common raven *(Corvus corax)*	√ 1.6	√ 1.1	√ 1.3	Inhabits marine shores to mountain ridges and glaciers; mixed forests and shrubs; nests in trees or on cliffs.
Black-capped chickadee *(Poecile atricapillus)*	√ 0.1	√ 2.1	√ 5.2	Inhabits broadleaf and mixed forests; nests in tree cavities.
Boreal chickadee (*Poecile hudsonicus*)	√ 1.2	√ 0.3	√ 1.0	Inhabits coniferous and mixed forests; nests in tree cavities.
Ruby-crowned kinglet (*Regulus calendula*)	√ 2.4	√ 6.7	√ 10.9	Coniferous forests and mixed woodlands; nests in conifers; widely distributed, uses more open woodland habitats.
Swainson's thrush (*Catharus ustulatus*)	√ 3.5	√ 37.1	√ 41.2	Mixed woodlands and shrub habitats; nests low in trees or bushes close to trunks.
American robin (*Turdus migratorius*)	√ 10.0	√ 14.7	√ 40.9	Wide variety of habitats primarily mixed forests, and shrubs; nests in crotches of trees
Varied thrush (*Ixoreus naevius*)	√ 2.9	√ 5.8	√ 11.2	Widespread in shady, damp forested habitats; usually nests in conifers.

TABLE 5.5-4 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Orange-crowned warbler (*Vermivora peregrina*)	√ 6.3	√ 17.8	√ 19.0	Deciduous forests, shrub thickets, coniferous forest edges; nests on ground or in low shrubs.
Yellow-rumped warbler (*Dendroica coronata*)	√ 9.5	√ 19.1	√ 42.1	Mixed forests and woodlands, shrub thickets; nests in conifers.
Savannah sparrow (*Passerculus sandwichensis*)	√ 48.6	√ 4.1	√ 14.9	Widespread in Alaska; open habitats – herbaceous, low shrubs; nests on ground usually in open grassy areas.
Fox sparrow (*Passerella iliaca*)	√ 2.7	√ 3.9	√ 14.7	Widespread in Alaska; tall shrubs, forest edges; nests on ground under shrubs or low in trees or shrubs.
White-crowned sparrow (*Zonotrichia leucophrys*)	√ 27.6	√ 35.0	√ 45.9	Shrubs, shrub tundra; forest edges; nests on ground in grass clumps or low shrubs.
Dark-eyed Junco (*Junco hyemalis*)	√ 11.6	√ 45.5	√ 37.5	Breeds coniferous forests and forest edges, clearings, muskeg; nests on ground.
Lapland longspur (*Calcarius lapponicus*)	√	√	√	Common and widespread on tundra; herbaceous and dwarf shrub habitats, nests on ground.
Pine grosbeak (*Pinicola enucleator*)	√ 0.3	√ 0.1	√ 0.1	Forested habitats; nests in conifers.
Redpolls (*Carduelis* spp.)	√	√	√	Tundra shrub thickets, mixed woodlands, open fields, grasslands; nests on ground or lower branches of shrubs.
White-winged crossbill (*Loxia leucoptera*)	√ 5.4	√ 2.2	√ 4.8	Coniferous forests, nests in conifers.

√ = Indicates that the species occurs in the level 2 ecoregion.
[a] Numbers represent the sum of birds per survey route divided by the number of survey routes.
[b] Protected animals including federal and state listed endangered, threatened or candidate species are discussed in Section 5.8. Aquatic animals are discussed in Section 5.6.
Sources: Armstrong 1990, Cotter and Andres 2000, Sauer et al. 2008a.

5.5.1.2 Bureau of Land Management Sensitive Species

BLM has responsibility for the designation and protection of sensitive species on BLM managed lands. Sensitive species require special management considerations to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Alaska evaluates potential project impacts on BLM-Alaska sensitive animals and plants. Alaska sensitive animals and plants are determined in coordination with recommendations by the Alaska Natural Heritage Program, Alaska Fish and Game Department, and U.S. Forest Service. BLM also evaluates both federal candidate species and federal delisted species within five years of delisting. BLM sensitive fish and aquatic invertebrates and BLM sensitive plants are discussed in the Fisheries Section 5.6 and Vegetation in Section 5.3, respectively. The proposed Project would cross about 230 miles of BLM managed lands between MP 123.3 and MP 361 along the Parks Highway route. The BLM sensitive animals (Bureau of Land Management 2010) that may occur within the Project area include two species of mammals, and eight species of birds (Table 5.5-5).

TABLE 5.5-5 Evaluation of BLM Sensitive Animals Potentially Occurring along the Project ROW

Common and Scientific Names	Group	Status	Occurrence and Habitat	Potential Impacts	Proposed Conservation Measures
Mammals					
Alaska tiny shrew *(Sorex yukonicus)*	Mammal – Shrew	BLM-SS	Occurs throughout Alaska, associated with wide range of forested and non-forested habitats; usually with riparian scrub habitats.	Construction mortality, habitat loss and alteration.	Construction Mitigation and Reclamation Plan – no additional measures.
Osgood's arctic ground squirrel *(Spermophilus parryii osgoodi)*	Mammal – Squirrel	BLM-SS	Central Alaska, in lowland areas of Yukon Flats.	Construction mortality, habitat loss and alteration.	Construction Mitigation and Reclamation Plan – no additional measures.
Birds					
Blackpoll warbler *(Dendroica striata)*	Bird – Passerine	BLM-SS	Breeds throughout central and southcentral Alaska; associated with wet coniferous and mixed forests; uses fens, bogs, muskegs, beaver ponds and other swampy forest openings along lakes and streams.	Nesting habitat loss, disturbance to nest sites.	Construction Mitigation and Reclamation Plan – avoid vegetation clearing during nesting season.
Golden eagle *(Aquila chrysaetos)*	Bird – Raptor	BLM-SS	Migrates through Alaska and nests in interior Alaska, nests March to August uses upland tundra, mountain ridges; nests on cliffs and in tops of trees, forages on hares, ground squirrels, carrion, ungulate fawns, waterfowl, grouse.	Disturbance to nest sites, reduced prey availability due to habitat loss and alteration.	Construction Mitigation and Reclamation Plan – avoid blasting near nests during nesting season.
Olive-sided flycatcher *(Contopus cooperi)*	Bird – Passerine	BLM-SS	Nests throughout central Alaska, associated with forest openings, muskeg, meadows, burns, and logged areas; and with streams, ponds, bogs, lakes; use dead or partially dead trees.	Fire suppression, disturbance to nest sites, direct or indirect (through food web) exposure to contaminants.	Construction Mitigation and Reclamation Plan – avoid vegetation clearing during nesting season.
Red knot *(Calidris canutus)*	Bird – Shorebird	BLM-SS	Arctic Alaska, generally west of Project along coast west of Harrison Bay.	Disturbance to nest sites; foraging or staging birds.	Construction Mitigation and Reclamation Plan – avoid vegetation clearing during nesting season.
Rusty blackbird *(Euphagus carolinus)*	Bird – Passerine	BLM-SS	Breeds throughout central and southcentral Alaska; most commonly associated with boreal black spruce forest in spruce-alder-willow thickets in riparian areas or tundra-taiga transition.	Nesting habitat loss, disturbance to nest sites.	Construction Mitigation and Reclamation Plan – avoid vegetation clearing during nesting season.

TABLE 5.5-5 Evaluation of BLM Sensitive Animals Potentially Occurring along the Project ROW

Common and Scientific Names	Group	Status	Occurrence and Habitat	Potential Impacts	Proposed Conservation Measures
Short-eared owl *(Assio flammeus)*	Bird – Raptor	BLM-SS	Widespread throughout Alaska in lowland habitats, common breeder in north, northeast and interior Alaska, nests on ground in grass –lined depression, usually associated with marshes or grasslands; open habitats; preys on rodents, birds, insects.	Disturbance to nest sites, altered predator abundance or distribution, reduced prey availability due to habitat loss and alteration.	Construction Mitigation and Reclamation Plan – avoid vegetation clearing during nesting season.
Trumpeter swan *(Cygnus buccinators)*	Bird – Waterfowl	BLM-SS	Interior and southcentral Alaska, nests on ponds, lakes and rivers with extensive submergent vegetation.	Disturbance to nest sites, staging habitats, reduced habitat suitability due to altered water quality.	Construction Mitigation and Reclamation Plan – avoid construction activities near active nests.
Yellow-billed loon *(Gavia adamsii)*	Bird – Loon	BLM-SS; ESA-C	Arctic Alaska, most abundant west of Colville River, nests on large lakes usually near the coast; uses coastal marine waters; estimated 3,569 on Arctic Coastal Plain in 2009.	Disturbance to nest sites; foraging or staging birds, reduced habitat suitability due to altered water quality.	Construction Mitigation and Reclamation Plan – avoid construction activities near active nests.

Key: BLM-SS = BLM Sensitive Species; ESA-C = ESA Candidate Species.

Sources: Avery 1995, Bureau of Land Management 2010, Harrington 2001, Hunt and Eliason 1999, Larned et al. 2010, MacDonald and Cook 2009, Mitchell and Eichholz 2010, North 1994, Wright 2008.

5.5.2 Environmental Consequences

The proposed Project would cross habitats used by a wide variety of wildlife described in Tables 5.5-2 through 5.5-5. Construction of the proposed Project would result in a loss or alteration of about 12,250 acres of land as presented in the Vegetation Section 5.3 (Table 5.3-2). The mainline ROW includes 1,033 acres of tundra habitat (Dwarf Scrub), 4,862 acres of boreal forested habitat (Deciduous, Evergreen, and Mixed Forest), and 3,729 acres of wetland habitat (Scrub/Shrub, Sedge Herbaceous, Woody Wetlands, Emergent Herbaceous Wetland) (Table 5.3-2). The Fairbanks Lateral would cross primarily boreal and riparian forests. Sensitive wildlife habitats present along the Project route are listed in Table 5.5-6. In addition, 40 temporary access roads (approximately 252 miles) and 60 permanent access roads (approximately 34 miles) would be used; the majority (over 90 percent) would be new road corridors. Areas altered by construction of temporary access roads would be rehabilitated and revegetated.

The proposed Project would affect wildlife resources through:

- Habitat loss, alteration, and fragmentation;
- Direct mortality during construction and operation;
- A potential increase in wildlife mortality from hunting due to an increase in access to previously inaccessible areas;
- Indirect mortality from stress caused by disturbance from feeding areas, due to construction and operations noise (low-level helicopter or airplane monitoring over flights);
- Reduced survival and reproduction due to a decrease in vegetative cover for optimal nesting, feeding and rearing sites; and
- Altered survival, mortality, or reproduction due to exposure to equipment fuel or lubricants spilled during construction or maintenance.

Fragmentation is the splitting of a large continuous blocks of habitat into numerous smaller areas that results in both a smaller total area of habitat, and in isolation of the habitat within a matrix of unlike habitat (Wilcove et al. 1986). Habitat fragmentation includes a reduction in total habitat area and reorganization of areas into isolated patches. Habitat loss generally has large negative effects on biodiversity, while fragmentation generally has a much weaker effect that may affect wildlife species either positively or negatively (Fahrig 2003). For instance, habitat fragmentation would not be expected to affect small mammals, coyote, moose, or snowshoe hares. Although wolves often avoid human development, they may be attracted to roads with little traffic if increased prey or carcasses occur there. Wolverines prefer large areas of undisturbed wilderness and would thus be negatively affected by habitat fragmentation. The effects of habitat fragmentation on nesting birds depend on original habitat structure, landscape context, predator communities, susceptibility to nest parasitism, and many other recognized or unrecognized variables (Tewksbury et al. 1998). Impacts to wildlife from habitat loss, alteration and fragmentation would be minimized by co-locating the proposed Project along existing

ROWs. The proposed Project would follow the route of the TAPS, the Parks Highway, other transportation corridors (including railroads), or other utility or transportation ROWs along the majority of its 737 mile route. Nevertheless, some new ROW corridors would be created along portions of the route and these would fragment surrounding habitats.

After construction, pipeline corridors may be used as travel corridors by wolves, coyotes, moose, and many other animals. Wildlife habitat fragmentation issues created by pipeline construction and operation include:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Barriers to movement;
- Intrusion of invasive plants, animals, and nest parasites;
- Facilitation of predator movements;
- Habitat disturbance; and
- Intrusion of humans (Hinkle et al. 2002).

Habitat fragmentation effects could be most pronounced in forested and shrubland habitats due to the habitat structure they provide compared to herbaceous cover and would generally be reduced for pipeline corridors compared to road corridors because their widths are usually narrower, vegetation cover is reestablished, and there is usually less human disturbance during operation (Hinkle et al. 2002). During construction, pipelines could be significant barriers to wildlife movements (Hinkle et al. 2002). The AGDC would minimize the duration of open-ditch construction activities and would develop systems or mechanisms to facilitate escape of wildlife from the pipeline trench to minimize the risk of animal entrapment (AGDC 2011). Details of these systems and mechanisms to prevent animal entrapment have not yet been determined.

Pipeline construction removes vegetation including tundra vegetation, native grasses, shrubs, and trees, creating an unvegetated strip over the pipeline trench and the adjacent construction areas. Subsequent revegetation may not provide habitat features comparable to pre-project habitats. Typically, seed mixes for reclamation include many non-native plants that quickly establish vegetative cover to prevent soil erosion, but these plants often outcompete and do not allow subsequent reestablishment of native flora and vegetation structure (McKendrick 1997; Trans Alaska Pipeline System Owners 2001). To minimize vegetation impacts, the AGDC would conduct seeding of the disturbed corridor in consultation with the BLM and State of Alaska and would adhere to ADNR's *Plant Materials Center Revegetation Manual for Alaska* (AGDC 2011). Seed mixes will be developed for different geographic areas and fertilizers applied at an optimum rate per acre. However, freshly seeded grasses can attract wildlife and are often preferentially grazed. The pipeline ROW would be maintained free of trees and shrubs resulting in long-term alteration of wildlife habitat structure and value (Hinkle et al. 2002).

Removal of vegetation also increases the potential for the establishment and spread of non-native weeds and other invasive plants that have little use or value for wildlife and that displace native plants resulting in degraded wildlife habitat values. The AGDC would develop a non-native invasive plant (NIP) Prevention Plan to prevent the introduction and spread of plants (AGDC 2011). The NIP Prevention Plan would provide details of the measures to control invasive species through appropriate site preparation, monitoring, revegetation of disturbed areas with native species, and performance standards.

During construction, the pipeline could present a significant temporary physical and behavioral barrier for wildlife movement. The open trench and welded pipeline sections stored along the construction ROW prior to burial can block movements of both large and small animals across the construction ROW. The length of time that the trench is made and pipeline is placed and buried is expected to be one to three days, which reduces the potential impacts to wildlife.

Operation of heavy equipment producing noise and presence of humans can create behavioral barriers to wildlife movements by displacing animals from the construction area through disturbance. The AGDC has proposed mitigation measures to reduce impacts of construction to wildlife including by: 1) avoid locating pipeline facilities in sensitive wildlife habitats whenever possible; 2) schedule construction activities to avoid effects during sensitive periods in the life cycle of wildlife to the maximum extent practicable; 3) developing a Blasting Control Plan with ADF&G blasting standards to protect wildlife (AGDC 2011).

During the post-construction period, the pipeline ROW, temporary access roads, new permanent access roads may potentially allow an increase in human activity within remote areas of the proposed Project. This could lead to increased wildlife disturbance and potentially to increased direct wildlife mortality from vehicle-animal collisions, and from legal and illegal harvest of wildlife. These new access corridors could increase indirect mortality through reduced reproduction due to displacement from habitat, increased stress, and increased predation. All-terrain vehicle users could travel on portions of the ROW, either legally or illegally. Additionally, the construction of new roads, upgrades to existing roads, and the subsequent use of those roads generally would result in negative impacts to a wide range of wildlife (Hinkle et al. 2002; Jalkotzy, Ross, and Masserden 1997; Trans Alaska Pipeline System Owners 2001). Increased impacts by humans to wildlife would be minimal because 87 percent of the proposed Project would occur along existing ROW corridors. In addition, the AGDC would adopt motor vehicle and aircraft procedures that minimize disturbances to wildlife and would avoid or minimize operational activities during sensitive periods in life cycles such as moose and caribou calving, bear denning, raptor nesting, and nesting migratory birds. Public accessing to the ROW would be limited for recreation or hunting by blocking entry areas with large boulders, berms, or fencing (AGDC 2011).

TABLE 5.5-6 Sensitive Wildlife Habitats along the Project ROW

Milepost	Name	Description	Proposed Construction Season
		Parks Highway Route	
0 to 32	Waterfowl	Concentrated nesting habitat	Winter
0 to 33	Caribou	Concentrated use during calving	Winter
0 to 175	Caribou	Concentrated use in winter	Winter MP 0 to 163; Summer MP 163 to 183
19 to 41	Franklin Bluffs Peregrine Falcon ZRA	Concentrated nesting habitat	Winter
47 to 51	Waterfowl	Concentrated nesting habitat	Winter
55 to 63	Waterfowl	Concentrated nesting habitat	Winter
62 to 66 and 64 to 74	Sagawon Bluffs Peregrine Falcon ZRA	Concentrated nesting habitat	Winter
68 to 118	Moose	Concentrated use in winter	Winter
75 to 84	Waterfowl	Concentrated use spring or fall	Winter
115 to 125	Caribou	Migration route – North/South, crosses pipeline route	Winter
118 to 121	Slope Mountain Peregrine Falcon ZRA	Concentrated nesting habitat	Winter
122	Dall's Sheep	Mineral lick area	Winter
124 to 126	Waterfowl	Migration route – North/South, crosses pipeline route	Winter
150 to 165	Waterfowl	Migration route – North/South, parallel to pipeline route	Winter MP 0 to 163; Summer MP 163 to 173
143 to 152	Galbraith Lake ACEC	Crucial lambing areas and mineral licks for Dall's sheep	Winter
146 to 170	Caribou	Migration route – North/South, parallel to pipeline route	Winter MP 0 to 163; Summer MP 163 to 173
155 to 175	Dall's Sheep	Concentrated use in winter	Winter MP 0 to 163; Summer MP 163 to 183
163 to 170	West Fork Atigun ACEC	Dall's sheep lambing habitat and mineral licks	Summer
175 to 190	Caribou	Migration route – North, parallel to pipeline route	Summer MP 173 to 183; Winter MP 183 to 248
175 to 314	Caribou	Concentrated use in winter	Summer MP 173 to 183 and 286 to 348; Winter MP 183 to 248
184	Dall's Sheep	Mineral lick area	Winter
190 to 226	Brown Bear	Concentrated spring use and berry area	Winter
197 to 207	Snowden Mountain ACEC	Dall's sheep habitat and mineral lick area	Winter
223 to 228	Nugget Creek ACEC	Dall's sheep lambing habitat and mineral licks	Winter
224 to 226	Poss Mountain ACEC	Dall's sheep habitat and mineral lick	Winter

TABLE 5.5-6 Sensitive Wildlife Habitats along the Project ROW

Milepost	Name	Description	Proposed Construction Season
		area	
230 to 257	Brown Bear	Concentrated spring use and berry area	Winter
265 to 288	Jim River ACEC	Raptor habitat	Winter MP 183 to 286; Summer MP 286 to 348
302 to 306	Moose	Concentrated use in winter	Summer
358 to 362	Yukon River Peregrine Falcon ZRA	Concentrated nesting habitat for falcons and other raptors	Winter MP 358 to 360; Summer: MP 360 to 405
360 to 390	Moose	Concentrated use in winter	Summer
396 to 409	Moose	Concentrated use in winter	Summer MP 360 to 405; Winter MP 405 to 468
400 to 405	Waterfowl	Migration route – East/West, crosses pipeline route	Summer MP 360 to 405; Winter MP 405 to 468
412 to 426	Moose	Concentrated use during calving	Winter
412 to 426	Moose	Concentrated use in winter	Winter
418 to 455	Minto Flats State Game Refuge	Waterfowl production and migration staging; abundant moose, black bear, and furbearers	Winter
417 to 425	Waterfowl	Concentrated nesting habitat	Winter
430 to 434	Waterfowl	Concentrated nesting habitat	Winter
430 to 442	Moose	Concentrated use during calving	Winter
430 to 471	Moose	Concentrated use in winter	Winter
438 to 441	Waterfowl	Concentrated nesting habitat	Winter
445 to 471	Moose	Concentrated use during calving	Winter
446 to 447	Waterfowl	Concentrated use spring or fall	Winter
475 to 496	Moose	Concentrated use during calving	Winter
475 to 500	Moose	Concentrated use in winter	Winter
493 to 530	Caribou	Concentrated use in winter	Winter MP 468 to 529; Summer MP 529 to 535
496 to 500	Moose	Concentrated use during rut	Winter
501 to 532	Waterfowl	Migration route – North/South, parallel to pipeline route	Winter MP 468 to 529; Summer MP 529 to 535
514 to 522	Moose	Concentrated use during rut	Winter
514 to 559	Moose	Concentrated use in winter	Winter MP 468 to 529; Summer MP 529 to 535; Fall/Winter MP 535 to 541; Summer MP 541 to 602
515	Caribou	Migration route – East/West, crosses pipeline route	Winter

TABLE 5.5-6 Sensitive Wildlife Habitats along the Project ROW

Milepost	Name	Description	Proposed Construction Season
522 to 559	Moose	Concentrated use during calving	Winter MP 468 to 529; Summer MP 529 to 535; Fall/Winter MP 535 to 541; Summer MP 541 to 602
531 to 554	Alaska Range Foothills IBA	Golden eagle and other raptor nesting area	Summer MP 529 to 535; Fall/Winter MP 535 to 541; Summer MP 541 to 602
535 to 540	Brown Bear	Concentrated spring use	Fall/Winter
590 to 597	Moose	Concentrated use in winter	Summer
602 to 635	Moose	Concentrated use in winter	Winter
602 to 635	Moose	Concentrated use during rut	Winter
650 to 659	Kahiltna Flats – Petersville Road IBA	Trumpeter Swan and Tule greater white-fronted geese	Winter
660 to 718	Moose	Concentrated use in winter	Winter
674 to 709	Moose	Concentrated use during calving	Winter
713 to 716	Moose	Concentrated use during calving	Winter
723 to 734	Waterfowl	Concentrated use in fall	Winter
718 to 724	Moose	Concentrated use during calving	Winter
724 to 736	Moose	Concentrated use in winter	Winter
732 to 734	Susitna Flats IBA	Spring and fall migrant ducks, geese, swans, and sandhill cranes	Winter
738 to 741	Waterfowl	Concentrated use in fall	Fall
Denali National Park Route Variation			
535 to 540	Brown Bear	Concentrated spring use	Fall/Winter
535 to 555	Caribou	Concentrated use for calving	Fall/Winter MP 535 to 541; Summer MP 541 to 602
535 to 555	Caribou	Concentrated use in winter	Fall/Winter MP 535 to 541; Summer MP 541 to 602
Fairbanks Lateral			
0 to 35	Moose	Concentrated use for calving	Summer
0 to 35	Moose	Concentrated use in winter	Summer

ADF&G Habitat Atlas (1:1,000,000 scale) Arctic, Interior, Southcentral (ADF&G 1985, 1986a, b, c).

ZRA = zone of restricted activity; ACEC = areas of critical ecological concern; IBA = Important Bird Area.

Source: Alyeska Pipeline Service Company 2002, EA_119, Second Edition, May 2002; Audubon Alaska 2008; Trans Alaska Pipeline System Owners 2001, Volume 1.

5.5.2.1 No Action Alternative

Under the No Action Alternative, the AGDC would not construct the proposed Project and there would be no direct or indirect impacts to wildlife or their habitats.

5.5.2.2 Proposed Action

The proposed Project would impact wildlife and their habitats as described above. Additional information on anticipated impacts to wildlife from specific Project components is described below.

Pipeline Facilities

<u>Mainline</u>

Construction

The primary impacts to wildlife from construction of the mainline ROW would be disturbance to habitat either permanently or temporarily, and disturbance from noise produced from construction activities as noted above. Other impacts could be increased mortality from vehicle and train collisions with wildlife from the additional activity related to project construction. Whenever possible, construction would be timed to occur outside of sensitive time periods for wildlife (i.e., calving, nesting, or migration seasons). Approximately 57 percent of the total pipeline construction would take place during the winter months and all construction on the North Slope would occur during the winter months to minimize impacts to wildlife and their habitats.

Vegetation clearing and grading necessary for pipeline construction would result in temporary or permanent loss of habitats and may result in permanent habitat alteration that leaves habitats unsuitable for some wildlife. Construction within the ROW would result in removal of about 8,532 acres of wildlife habitats including 4,951.6 acres of forested habitats, and 3515.5 acres of wetland habitats (Table 5.5-7). Vegetation cover would be reestablished within the ROW after construction and trees would be allowed to grow back in the temporary ROW, although they would take years to decades to reach maturity, resulting in long-term impacts. Trees would not be allowed to reestablish over the permanent ROW and so the loss of forested habitats would be considered a permanent habitat impact. Forest nesting and burrow habitats for red squirrels and birds would be lost. Clearing forest in some areas would allow for the establishment of shrubs and forbs that could provide forage for moose and bears. Construction of the segments that have no existing ROW's including the areas from Willow to the extraction plant and Minto Flats would result in fragmentation of forested habitats and would open a travel corridor that may facilitate hunter access in this area. The AGDC would block or remove access roads after construction to help prevent hunters from using this as a travel corridor. In addition, construction of access roads would require removal of about 360 acres of wildlife habitat, including 227.4 acres of forested habitats and 130.9 acres of wetland habitats.

Transportation of the pipeline, construction materials and supplies by rail line to Anchorage and Fairbanks would increase the frequency of trains along these routes which in turn would lead to an incremental increase in wildlife mortality due to collision with trains. Several sections of the rail line from Seward to Fairbanks have experienced significant rail collision mortality for moose during years with snow depths of more than 34 inches (Modafferi 1991). With the proposed increase in rail runs, the chance of increased mortality also rises. Increased truck traffic associated with transportation of the pipeline, construction materials and supplies would also likely increase wildlife mortality from vehicle collisions; small mammals and birds are especially susceptible. To minimize collisions with wildlife, the AGDC would adopt motor vehicle and aircraft procedures. These procedures will be developed as the Project progresses.

Sensitive Wildlife Habitats

Disturbance from construction activities could displace some wildlife, especially during sensitive nesting periods. Construction through most of the sensitive wildlife habitats that have been established for raptors and other birds would occur during the winter, thereby avoiding disturbance to nesting areas along the proposed Project (Table 5.5-6). Exceptions would be the proposed summer construction through portions of the Yukon River Peregrine Falcon ZRA (MP 360-362), the Jim River ACEC (MP 286-288), and the Alaska Range Foothills IBA (MP 531-535 and 542-554).

Construction through sensitive wildlife habitats includes Dall's sheep lambing areas in mountainous areas. Construction would occur during the winter primarily, outside lambing periods, thereby avoiding disturbance to lambs and ewes (Table 5.5-6). Summer construction would occur through the West Fork Atigun ACEC, which provides important Dall's sheep lambing areas and mineral licks; however, lambing takes place in late May to early June and mineral licks are also visited primarily in the spring. Potential impacts to Dall's sheep sensitive habitat would be unlikely.

Birds

Impacts to birds during construction would be minimized by timing the construction of the pipeline to occur during the winter months. Approximately 57 percent of the total pipeline construction would take place during the winter months and all construction on the North Slope would occur during the winter months when migratory birds are not present.

Construction of the pipeline corridor and permanent access roads would occur over two years, and disturbance could cause some alteration of habitat such that the area may not be suitable for some species of birds. Displacement could be temporary; however, habitat fragmentation and edge effects may result in long-term displacement and reduced nesting success for some birds. Nesting habitat loss during construction would displace nesting birds as described in Table 5.5-8. Unfortunately, quantitative data on bird distribution and abundance along the proposed Project is limited. Breeding-bird surveys represent the best available data for the entire Project area. Thus, although the impacts to birds presented in Table 5.5-8 are based on the best available data for the length of the proposed Project, estimates should be considered preliminary. To minimize habitat fragmentation, the proposed Project would follow existing ROWs along the majority of its 737 mile route.

Yukon River Crossing Options

Option 1: The first option would be to construct a suspension bridge across the Yukon River. Approximately 8.6 more acres of wetlands could be impacted with development of the suspension bridge compared to option 2. This option would impact 48 percent more forested vegetation, 7 percent of the area is currently developed and the remaining amount would be open water and wetlands (see Wetland Section 5.4 for details). The forested habitat lost for this option would be substantial compared to utilizing the existing bridge.

Option 2: The second option would be to utilize the existing E.L. Patton Yukon River Bridge. This option would result in 23 percent forested habitat impacted, 54 percent of the land is currently developed, 3 percent scrub/shrub and the remaining 20 percent is open water and wetlands (see Wetland Section 5.4).

Option 3: The third option would be to cross the Yukon River via HDD method at the same location as the proposed suspension bridge. One acre construction pads would be needed at each side of the river. These would be located within the construction ROW of the proposed new suspension bridge; thus, disturbance to wildlife habitats would be identical to Option 1.

TABLE 5.5-7 Estimated Direct Temporary Loss of Wildlife Habitat for the Proposed Action and Denali National Park Route Variation (acres).

Habitat Type	MP 0 to MP 540	Fairbanks Lateral	Fairbanks Lateral Access Roads	MP 540 to MP 555	Denali National Park Route Variation	MP 555 to End	Mainline Access Roads	Project Total[b]
Open Water	25.6	0.9	0.2	1.2	0.8	9.9	0.2	38.8
Agricultural	2.2	0.0	0.0	0.0	0.0	8.4	0.0	10.6
Grassland/ Herbaceous	13.9	0.0	0.0	0.0	0.0	0.0	1.4	15.3
Evergreen Forest	1643.9	115.6	47.0	136.8	64.8	220.5	124	2352.6
Deciduous Forest	450.1	35.1	20.5	5.5	0.0	521.7	65.2	1098.1
Mixed Forest	210.3	7.7	13.7	11.6	3.0	527.7	38.2	812.2
Forested Habitats	**2304.3**	**158.4**	**81.2**	**153.9**	**67.8**	**1269.9**	**227.4**	**4262.9**
Sedge Herbaceous	807.1	0.0	0.0	0.0	0.0	0.3	2.9	810.3
Dwarf Scrub	980.8	0.0	0.0	0.0	1.7	3.5	7.9	993.9
Scrub/Shrub	1169.6	7.7	4.4	52.5	11.6	255.0	109.8	1610.6
Woody Wetlands	320	263.3	7.4	11.9	2.4	118.1	13.0	736.1
Wetland Habitats	**3277.5**	**271**	**11.8**	**64.4**	**15.7**	**376.9**	**133.6**	**4150.9**
Total Habitat Area	**5623.5**	**430.3**	**93.2**	**219.5**	**84.3**	**1665.1**	**362.6**	**8478.5**

[a] Habitat impacts include the 100-foot ROW.

[b] Denali National Park Route Variation not included.

Source: National Land Cover Dataset (NLCD 2000).

TABLE 5.5-8 Estimated Nesting Habitat Loss Impacts to Birds for the Project ROW (Individuals Displaced) Within the Pipeline Corridor and Permanent Access Road Corridors[a]

Bird Type	Arctic Tundra MP 0 – MP 256	Intermontane Boreal Forest MP 256 – MP 519	Alaska Range Transition MP 519 – MP 736	Denali National Park Route Variation and MP 540 – MP 555	Project Total MP 0 – MP 736
Waterbirds	71	174	858	8	1,102
Geese & Swans	1,459	21	319	1	1,799
Ducks	*589*	*559*	*695*	*24*	*1,844*
Dabbling Ducks	305	550	467	24	1,322
Diving and Sea Ducks	284	9	228	0	522
Raptors and Owls	150	89	108	4	347
Upland Game Birds	0	11	0	0	11
Shorebirds	807	654	3,658	28	5,119
Seabirds (gulls)	0	0	1,078	0	1,078
Landbirds	*37,305*	*86,657*	*101,436*	*3,756*	*225,398*
Resident	2,627	3,833	4,822	166	11,283
Short-Distance Migrant	7,870	27,440	26,463	1,189	61,772
Long-Distance Migrant	26,808	55,384	70,151	2,400	152,343
Total Individuals[b]	**40,381**	**88,154**	**108,153**	**3,821**	**236,688**

[a] Estimate based on pipeline route length and permanent access road lengths multiplied by nesting season density for waterbirds, geese and swans, ducks, raptors and owls, shorebirds, seabirds, and landbirds based on breeding bird survey data (Sauer et al. 2008b).

[b] Total includes waterbirds, geese and swans, ducks, raptors and owls, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds.

Operations and Maintenance

Aerial and ground-based pipeline inspections have the potential to cause disturbance to some wildlife, especially if activities occur during sensitive periods such as calving or nesting periods. Monitoring activity may result in decreased habitat suitability for the pipeline corridor for those species that may be particularly sensitive to and that avoid human activity.

Maintenance of access roads would require removal of approximately 362 acres of wildlife habitat, which includes approximately 228 acres of forested habitat and 134 acres of wetland habitat (Table 5.5-7). Acreage for access roads acreage is for the portion of 50-foot-wide ROW of access roads that falls outside the permanent and construction ROW. Those lands along access roads within the permanent or construction ROW are accounted for in the vegetation numbers for those facilities. For this reason, the total area of construction access roads may be smaller than those associated with the permanent access roads.

Access road maintenance in the winter may cause wildlife mortality from collisions if wildlife is attracted to salts spread on the road to accelerate snow melting. Dust from road use, causes the snow to melt along roadsides, exposing vegetation faster than the areas that do not receive dust from the road. Wildlife collisions could be increased causing mortality from animals feeding on the exposed vegetation.

Fairbanks Lateral

Construction

The Fairbanks Lateral is routed through the riparian corridor of the Goldstream Creek which is occupied by a rail corridor. Additional construction through this riparian area would contribute to additional habitat fragmentation which may reduce the suitability of this area to support some nesting landbirds. Vegetation clearing prior to construction would affect 430 acres of primarily forested wildlife habitat for the ROW (Table 5.5-7). In addition, construction of access roads for the Fairbanks Lateral would require removal of approximately 93 acres of wildlife habitat, including approximately 81 acres of forested habitats and 12 acres of wetland habitats (Table 5.5-7).

Operations and Maintenance

The access roads developed in association with the Fairbanks Lateral and mainline in this area may facilitate hunter access to this region. All terrain vehicles can cause damage to surrounding wetlands and vegetation which can take a long time to recover. The AGDC would block or remove access roads after construction to help prevent hunters from using access roads as a travel corridor. Signs would be erected to keep recreational vehicles out.

Maintenance of access roads for the Fairbanks Lateral would require removal of the same habitat acreage as the construction ROW as noted above. Acreage calculated for access roads is for only the portion of the 50-foot-wide ROW of access roads that falls outside the permanent and construction ROW. Those lands along access roads within the permanent or construction ROWs are accounted for in the vegetation numbers for those facilities. For this reason, the total area of construction access roads may be smaller than those associated with the permanent access roads.

Aboveground Facilities

Gas Conditioning Facility

Construction

Equipment staging prior to construction and post-construction grading during summer would likely displace some caribou from this area and potentially delay movements through the area of the GCF. Most construction along the pipeline corridor would occur during winter however, when nearly all caribou would leave the oil field area. Construction of the GCF would result in 68.5 acres of emergent herbaceous wetland habitat and 0.3 acres of open water to be permanently lost to wildlife (Table 5.5-9). The first 6 miles of pipeline extending from the CGF would be aboveground and placed on VSMs approximately 7 feet above the ground to allow for wildlife movement.

TABLE 5.5-9 Habitats Affected by Aboveground Facilities

Mainline	GCF	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Compressor Station (MP 458.1)	Straddle and Off-Take Facility (MP 458.1)	NGLEP Facility (MP736.4)
Operational Footprint (acres)						
Vegetation						
Open Water	0.3	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	0.0	0.0	1.3	1.4	0.8	3.0
Deciduous Forest	0.0	0.0	0.0	<0.1	2.6	0.0
Mixed Forest	0.0	0.0	0.0	0.0	0.0	1.7
Total Forested Habitats	**0.0**	**0.0**	**1.3**	**1.4**	**3.4**	**4.7**
Emergent Herbaceous Wetlands	68.5	0.0	0.0	0.0	0.0	0.1
Shrub/Scrub Wetlands	0.0	1.4	0.2	0.0	0.0	0.0
Total Wetland Habitats	**68.5**	**1.4**	**0.2**	0.0	**0.0**	**0.1**
Total Wildlife Habitat Area[a]	**68.7**	**1.4**	**1.4**	**1.4**	**3.3**	**4.8**

[a] The sum of the individual entries may not match the overall total due to rounding.

Operations and Maintenance

Operation of the GCF would result in personnel traffic to and from pads and camps that could result in some delay of movement for caribou, and collision mortality to foxes and birds. Mortality to wildlife from vehicle collisions would be uncommon due to the slow and highly regulated driving speeds in the North Slope oilfields.

Common raven populations could increase with development of infrastructure for nesting, in particular in the Arctic Coastal Plain. Common ravens are considered subsidized predators and may affect prey abundance, distribution, and demography (Kristan and Boarman 2007). Common ravens in the Prudhoe Bay area feed on shorebird and waterfowl eggs, lemmings, fledglings, and garbage in dumpsters and landfills. Human-provided food resources are thought to be important drivers of raven population growth, and human developments add other features as well, such as nesting platforms (Kristan and Boarman 2007).

The development of infrastructure could result in an unnatural increase in Arctic fox and red fox populations. Materials and facilities needed for development of the Project can provide artificial shelters as denning habitat for mothers with pups. Human waste in garbage dumpsters or landfills can subsidize population growth of these species. There are also safety concerns with the potential for rabies outbreaks when fox populations reach unnaturally high levels and are associated with anthropogenic resources.

Compressor Stations

Construction

Disturbance from construction could displace some wildlife, especially construction activities that occur during sensitive nesting or calving, periods. Construction of compressor stations would result in the permanent loss of 2.7 acres of forested habitats and 1.6 acres of shrub/scrub wetland habitats for wildlife (Table 5.5-9). This impact could result in the loss of existing nesting sites for bird species like the bald eagle that use nest locations repeatedly. Some species are more susceptible to noise and human disturbance than others, which would likely displace these species from the area permanently.

Operations and Maintenance

Noise from compressor stations may displace a few nesting birds and cause avoidance of the area by ungulates during sensitive calving or lambing periods. Most wildlife would likely habituate to the noise and human activity around the facilities over time.

Cook Inlet Natural Gas Liquids Extraction Plant Facility

Construction

Construction of the Cook Inlet NGLEP Facility could disturb wildlife if activities occurred during the calving period for moose and would result in 4.7 acres of forested habitats and 0.1 acre of emergent herbaceous wetland habitat to be permanently lost for wildlife (Table 5.5-9). Nesting habitat for tree nesters could be impacted permanently from the loss of forest canopy. Cover and habitat for other nesting birds and small furbearers would be impacted by fragmentation or the loss of territories or home ranges needed for breeding.

Operations and Maintenance

Operation of the extraction plant would require permanent employees which would in turn increase vehicle traffic in the area potentially resulting in increased moose-vehicle collisions.

Straddle and Off-Take Facility

Construction

Construction of the Fairbanks Lateral straddle and off-take facility would result in 3.3 acres of forested habitats to be permanently lost for wildlife (Table 5.5-9). This could potentially result in a loss of nesting habitat for birds, and cover for large game animals.

Operations and Maintenance

The straddle and off-take facility would be installed at the proposed Fairbanks lateral tie-in to provide utility grade natural gas, primarily through the removal of natural gas liquids (NGL), prior to sending natural gas into the Fairbanks Lateral. Operation of the straddle and off-take facility would create disturbance to wildlife initially from noise and human activity; however, wildlife would be expected to habituate to the noise and human activity around the facility over time. Vehicle collisions with small game and large game could occur from increased activity and use of access roads. Salts spread on roads in the winter may attract large game as they lick the salt off the roads which may increase mortality from vehicle collisions.

Support Facilities

Construction Camps and Pipeline Yards

Operation of construction camps creates the potential for bear-human interactions and attraction of wildlife to the site by odors from foods. Bears that have been allowed to access human foods may be attracted to camps and can pose a threat to human safety. In some instances bears may be shot and killed to protect human life. Increased vehicle traffic on secondary roads would lead to increased wildlife-vehicle collision mortality.

5.5.2.3 Denali National Park Route Variation

Construction

The Denali National Park Route Variation would be located along the Parks Highway corridor. As a result, this route variation would have a substantial quantity of developed (low intensity) and barren land within the proposed ROW (Table 5.3-2). The Denali National Park Route Variation would remove approximately half of the forest acreage and 25 percent of the wetland acreage as the corresponding proposed MP 540 to MP 555 Project segment (Table 5.5-7). Thus, fewer habitats important to wildlife and birds would be removed or altered with the Denali National Park Route Variation.

Operation

General operational impacts associated with the Denali National Park Route Variation would be similar to those described for the corresponding mainline segment. Approximately 70.2 acres of forested vegetation within the permanent ROW would be permanently converted to a scrub/shrub or herbaceous vegetation (Table 5.5-7). This represents less than half of the forest acreage (165.8 acres) that would be permanently removed for the corresponding MP 540 to MP 555 Project segment (Table 5.5-7).

Due to its co-location with the George Parks Highway, it is more likely that construction personnel and equipment would encounter non-native or invasive plants along the Denali National Park Route Variation than they would from MP 540 to MP 555. Thus, the risk of the spread of non-native or invasive plants is greater for this alternative than it is for the corresponding mainline segment. Non-native and invasive plants often have little use or value for wildlife and displace native vegetation, resulting in degraded wildlife habitats. The AGDC would develop a Stabilization, Rehabilitation, and Restoration Plan and a NIP Prevention Plan to reduce the establishment of invasive species. This plan would be developed in consultation with BLM and would follow ADNR’s Plant Materials Center Revegetation Manual for Alaska.

5.5.3 Mitigation

The AGDC has developed the following mitigation measures to avoid and minimize potential Project-related impacts to wildlife (AGDC 2011):

- Avoid locating pipeline facilities in sensitive wildlife habitats to the maximum extent practicable;
- Schedule construction activities to avoid effects during sensitive periods in the life cycle of wildlife to the extent practicable, including scheduling excavation activities during times of the year when major movements across the ROW occur (i.e., migrations);
- Minimize the duration of open-ditch construction activities to mitigate the risk of animal entrapment in an open ditch;
- Develop systems or mechanisms to facilitate escape of wildlife from the pipeline trench in the event wildlife becomes trapped (e.g., escape ramps);
- Develop a Blasting Control Plan as identified in Section 7.6.3 in accordance with ADF&G blasting standards to protect wildlife. A Blasting Control Plan is particularly necessary if blasting is required in sensitive areas or during sensitive life stages for wildlife;
- Ensure construction camp operations and pipeline facility construction activities comply with measures that avoid attracting wildlife;
- Adopt motor vehicle and aircraft procedures that minimize disturbances to wildlife;
- Identify and then avoid or minimize situations where wildlife may be killed in defense of life or property;
- Avoid or minimize construction and operational activities during sensitive periods in life cycles such as moose and caribou calving, bear denning, raptor nesting, and nesting migratory birds;
- Limit public accessing to ROW for recreation or hunting by blocking entry areas with large boulders, berms, or fencing;
- Rehabilitate pipeline construction access roads in a manner that allows public access and consistent safe operation of the pipeline system and that is in accordance with the plans of the landowner/land manager; and
- Where VSM are used to elevate pipe, a minimum of 7 feet of clearance from ground surface to the bottom of pipe will be maintained for wildlife movement.

The AGDC will also develop the following plans prior to construction activities to be followed during construction and operations activities to minimize impacts to wildlife (AGDC 2011):

- Wildlife Interaction and Habitat Protection Plan;
- Blasting Control Plan which follows ADF&G standards protective of wildlife;
- Bear Avoidance and Human Encounter/Interaction Plan;

- Comprehensive Waste Management Plan; and
- Hazardous Materials Emergency Contingency Plan.

In addition to the AGDC's proposed mitigation measures, the following additional measures would further reduce impacts to wildlife from construction of the proposed Project:

- Coordinate rail and road traffic to minimize total number of trips required;
- Avoid extensive train traffic or develop alternative mitigation during periods when snow depths indicate large numbers of moose may be hit by trains carrying pipeline; construction materials, and supplies;
- Prevent construction personnel from keeping firearms or pets on the construction ROW;
- Contract a qualified biologist to conduct a survey of breeding bird habitat within 330 feet of proposed surface disturbance activities that would occur during the breeding season. The biologist would document active nests, bird species, and other evidence of nesting (e.g., mated pairs, territorial defense, and birds carrying nesting material or transporting food). If the biologist documents an active nest for a species that is designated as a migratory bird during the survey, the AGDC would work with the USFWS to identify measures to comply with the MBTA; and
- Conduct breeding raptor surveys by a qualified biologist prior to construction activities and during the raptor breeding season, through areas of suitable nesting habitat to identify any potentially active nest sites in the Project area. If raptors are identified within 0.5 mile of the construction ROW, the AGDC would work with the USFWS and state agency wildlife biologists to determine whether additional mitigation is needed to protect raptors. These measures would be implemented on a site-specific and species-specific basis, in coordination with the USFWS and state agency wildlife biologists.

The AGDC would provide construction maps that identify seasonal restrictions and special construction restrictions to contractors, so that contractors would be informed and take the necessary precautions to protect natural resources during construction.

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5.6 FISHERIES

This section describes the fish species present within the construction and operational footprint of the proposed Project area. Resident and anadromous fish species and essential fish habitat will be discussed in detail to illustrate the affected environment, environmental consequences and mitigation of the proposed Project.

5.6.1 Affected Environment

The proposed Project area extends approximately 737 miles from a point near Prudhoe Bay in the North Slope Borough south to the Matanuska-Susitna (Mat-Su) Borough near the Cook Inlet (Figure 5.6-1). The Fairbanks Lateral would diverge from the proposed mainline at approximate MP 458 (MP FL 0.0) in the Yukon Koyukuk Census Area and extend approximately 35 miles east through the Fairbanks North Star Borough (FNSB). Freshwater habitat throughout the Project area includes lakes, ponds, wetlands, streams (ephemeral and perennial) and large and small rivers. Fish habitat provides spawning, foraging, rearing, refuge, migration and overwintering purposes.

Three main types of fish are included in the waters transected by the Project area; anadromous, resident and amphidromous fish species. Fish that spend most of their lives at sea, and return to freshwaters only to spawn, are termed anadromous fish. These species primarily include salmon. Fish that reside in freshwater for their entire lifecycle are called resident fish, which include: Arctic grayling, burbot and lake trout (Reynolds 1997). Species that spend the summer feeding at sea, and move to freshwater rivers and streams in late summer and fall to spawn and live for the winter, are called amphidromous fish. These fish include: Dolly Varden, Arctic char, Arctic cisco, and Broad whitefish. Amphidromous species will be lumped into the anadromous species category and streams will either be defined as having resident or anadromous fish present from this point forward.

Anadromous fish spawn in fresh water but spend part of their lives at sea. Anadromous fish species are afforded protection under AS 16.05.871. "Waters Important to Anadromous Fish" [5AAC 95.010] are defined by the Alaska Administrative Code as those waters important for spawning, rearing, or migrating anadromous fishes. *The Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas identify such waters. This catalog is divided by Alaska's six fish and game resource management regions. The volumes that encompass the arctic (Johnson and Blanche 2010), interior (Johnson et al. 2004) and Southcentral (Johnson and Klein 2009) management regions were used to identify waterbodies used by anadromous fish within the proposed Project area. Anadromous fish may be found in streams not designated as anadromous fish streams in the catalog. Waterbodies in the catalog represents less than 50 percent of the streams, rivers and lakes actually used by anadromous species (ADF&G 2011a).

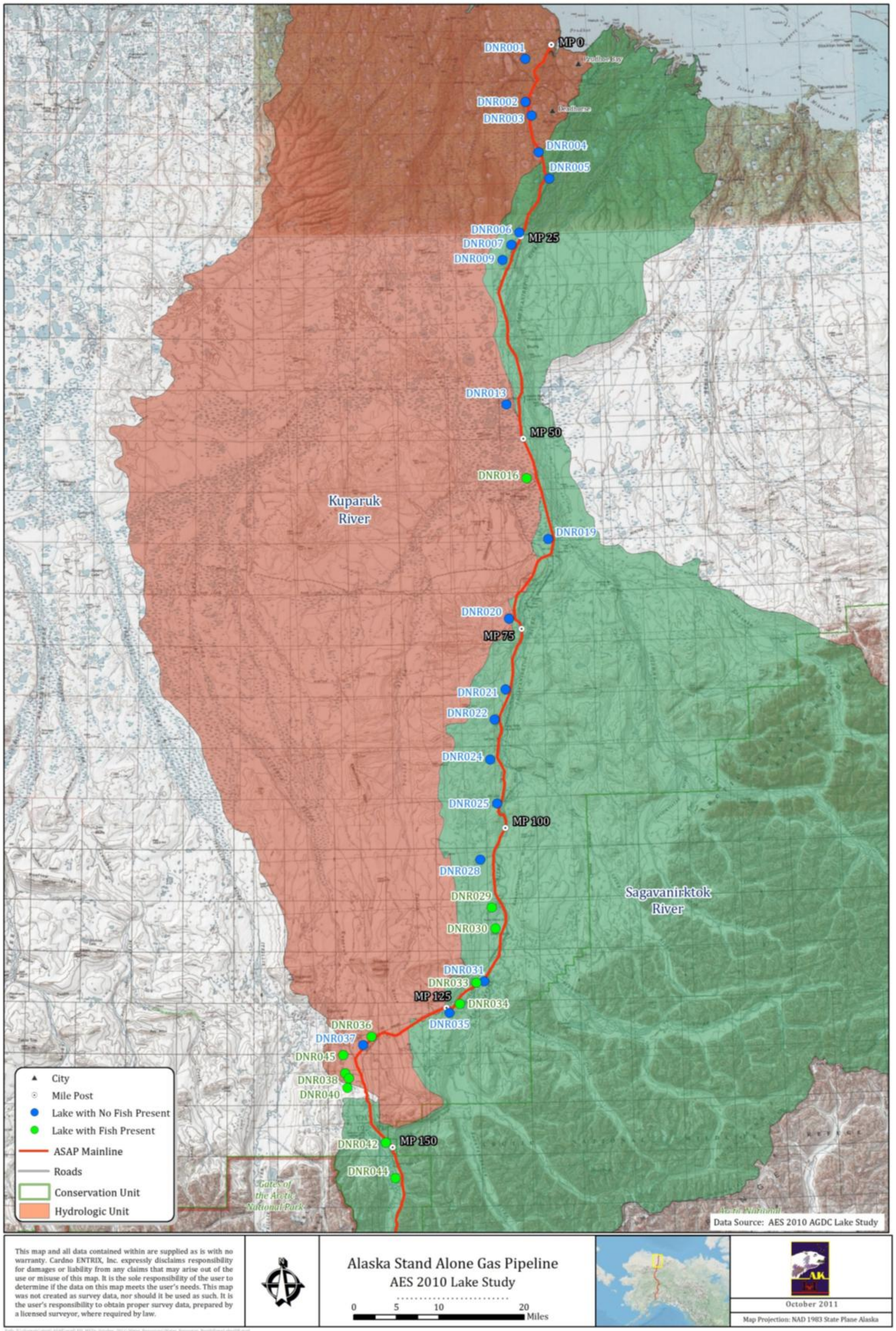


FIGURE 5.6-1 Lake Study Area

Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity.” Freshwater EFH in Alaska includes all the lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon (Pacific Fishery Management Council 2010). All federal agencies are required to consult with NMFS on all actions or proposed actions permitted, funded, or undertaken by the agency that may adversely affect EFH.

Fish sensitivity is determined by spawning and incubation periods as well as fry emergence, rearing, overwintering, and migration periods. Fish are considered particularly sensitive during their spawning, egg incubation and fry emergence periods (Weber-Scannell and Duffy 2007, Kyle and Brabets 2001). Overwintering habitat in the Arctic and subarctic regions of the Project area are also of particular concern. Ice depth in the Arctic can approach 6.5 feet thick, and freshwater fish must migrate to waters (deeper than 6.5 feet) that do not freeze entirely in order to risk being killed (Truett and Johnson 2000). Many of the waterbodies in the Arctic are too shallow to support fish during the winter (Truett and Johnson 2000). Fish must concentrate in waterbodies that do not freeze entirely and are stressed by cold temperatures and low food availability (BLM 2002). Perennial springs are critical overwintering habitat in Arctic regions because much of the drainage freezes solid (Reynolds 1997). These sites are usually quite localized, providing small, stable discharges (less than 3 feet per second) of groundwater well above freezing (39.2˚F to 42.8˚F) (Reynolds 1997). Consequently, if flow is altered in an overwintering area or water quality is degraded, a large portion of a fish population can be impacted (BLM 2002).

5.6.1.1 Project Area

For fish resources, the Project area consists of three major hydrologic regions: 1) North Slope region, Project area north of the Brooks Range including the northern portion of GCF to MP 540 Segment (Sagavanirktok River drainage), 2) Interior Alaska, Project area from the Brooks Range to the Alaska Range including southern portion of GCF to MP 540 Segment; MP 540-MP 555; northern portion of MP 555 to Cook Inlet; Fairbanks Lateral; and Denali National Park Route Variation (Yukon and Tanana River drainages), and 3) Southcentral Alaska, Project area south of the Alaska Range, including the southern portion of MP 555 to Cook Inlet (Susitna River drainage) (Figure 5.6-1).

The proposed Project would cross 516 streams throughout these regions. Eighty-two of the stream crossings have been confirmed to possess anadromous fish, and the majority of these streams are located in the Southcentral region of Alaska (Table 5.6-2). Confirmed anadromous species and the stage in their life cycle at each stream crossing are listed by hydroregion in Appendix E. Confirmed resident fish species at each stream crossing are presented in Appendix E. None of the fish species are considered to be Sensitive Species by the Bureau of Land Management (BLM Pers. Comm. 2010).

Thirty species of fish have been confirmed or have the potential to occur throughout some part of their lifecycle within the proposed Project area (Table 5.6-1) (ADF&G 2010). Anadromous species have been identified within the proposed Project area at specified stream crossing locations which are included in Appendix E. Stream crossings were determined to support anadromous fish if they: 1) are cataloged anadromous waters (Johnson and Blanche 2010, Johnson et al. 2004, and Johnson and Klein 2009); 2) if they are connected to a cataloged anadromous water; or 3) if stream sampling along the proposed Project during the summer of 2010 yielded anadromous fish.

A thorough freshwater fish inventory has not been conducted for the majority of the stream crossings along the proposed ROW south of Livengood to the Cook Inlet. Appendix E identifies all stream crossings that have been confirmed to possess resident fish. Existing resident fish information was utilized from stream sampling results along the TAPS Corridor and the ADF&G Freshwater Fish Inventory (AFFI) (BLM 2002, ADF&G 2011b). The TAPS corridor coincides with the proposed ROW from Prudhoe Bay to Livengood. AFFI data was the only information available for the proposed ROW area south of Livengood to the Cook Inlet. These data are not complete and are intended only for planning purposes. The information that does exist for resident fish does not include temporal habitat use. Site specific hydrologic information such as water depth, water chemistry, and the presence of flowing water during the winter months are needed at each stream crossing. This information is required to determine the method and timing of construction to minimize impacts to the extent most practicable to fish and their habitat. The AFFI information is not sufficient and detailed studies would be required for specific sites intended for intensive uses (ADF&G 2011b). The AFFI represents the best available data for the proposed Project south of Livengood.

TABLE 5.6-1 Species of Fish within the Proposed Project Area

Family Name / Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	South-central		
Arctic lamprey	*Lampetra japonica*	X	X	X	Yes	Occur from Arctic coast to Kenai Peninsula; Yukon River into Yukon Territory, Kuskokwim and Tanana river drainages. Adults feed at sea or in lakes; spawn in clear streams. Ammocoetes (lamprey larva) in muddy margins and backwaters of rivers and lakes.
Pacific lamprey	*Lampetra tridentata*			X	Yes	Occur along coastal areas from Nome down to California. Remain as an ammocoetes for 4-5 years then metamorphose and move to sea. Feed at sea for approximately 1 year, then return to fresh water in the fall and spawn the following spring.
Lake chub	*Couesius plumbeus*		X		No	Found throughout the Yukon River upstream of Nulato and in its tributaries, including the Tanana drainage. Found most often in shallow, silty lakes and streams in Alaska. Spawns in shallow waters with gravelly bottoms during summer.
Longnose sucker	*Catostomus catostomus*	X	X	X	No	Found throughout mainland Alaska in lakes and streams with clear cold water. Spawns in streams, lakes, or ponds with gravel bottoms and cold water in late spring or early summer.
Northern pike	*Esox lucius*		X	X	No	Occurs in the Colville, Yukon, and Susitna River Basins. Prefers clear vegetated lakes, quiet pools and backwaters of creeks and rivers; spawns in marshy areas. Voracious predator on juvenile salmonids The northern pike is native to most of Alaska, but is considered an invasive species south and east of the Alaska Range except for a small population near Yakutat.
Alaska blackfish	*Dallia pectoralis*		X	X	No	Occurs throughout mainland Alaska west of Colville River along Arctic coast, also in the Yukon-Tanana drainage and lakes in the Anchorage area. Bottom-dwelling fish found in heavily vegetated swamps and ponds, lakes and rivers. Migrates to deep waters in winter. Natives have used blackfish extensively for food.
Pond smelt	*Hypomesus olidus*	X		X	No	Found in Beaufort Sea drainages and the Copper River drainage. Found in middle and surface water of ponds, lakes and streams. Occasionally enters brackish waters.
Rainbow smelt	Osmerus mordax	X			Yes	Occur throughout coastal Alaska. Ascend freshwater streams only a few hundred yards to a mile to spawn.
Eulachon	*Thaleicchthys pacificus*			X	Yes	Found in the Copper River Delta; also the Susitna, and 20-mile rivers in Cook Inlet. Spawn during spring in the lower reaches of rivers or streams with sandy gravel bottoms. Grow to maturity in the sea where they feed mainly on krill. Important as a personal use and subsistence species.
Inconnu (sheefish)	*Stenodus leucichthys*		X		Yes	Found in the Yukon river drainages along the proposed ROW. Minto Flats and Upper Yukon River populations are year round residents. Spawn in rivers with a fast current over a bottom composed of differentially-sized gravel; sheefish may live to spawn several times.

TABLE 5.6-1 Species of Fish within the Proposed Project Area

Family Name / Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	South-central		
Least cisco	*Coregonus sardinella*	X	X		Yes	Found from Arctic coast to Bristol Bay and in most lakes and streams north of the Alaska Range and throughout the Yukon and Kuskokwim drainages. Anadromous and landlocked freshwater forms exist. Anadromous forms have an annual migration from freshwater winter habitats to saltwater summer feeding habitats. Mature fish migrate upstream in the fall to spawn in clear streams with gravel bottoms north of the Alaska Range.
Arctic cisco	*Coregonus autumnalis*	X	X		Yes	Occur from the Point Barrow area eastward along the Beaufort Sea coast to the Canada border, occurring mainly in the Colville River area, with limited distributions in the Sagavanirktok and Putuligayuk Rivers. Tolerant of high salinity and often found in estuaries. One of the most abundant and valued subsistence species along Alaska's North Slope.
Bering cisco	*Coregonus laurettae*	X	X		Yes	Found in the Yukon River upstream to Ft. Yukon. Primarily freshwater and coastal marine; winter in salt or brackish water near river mouths; undergo extensive spawning migrations up the Yukon River where they spawn in fast-flowing water near beds of loose gravel.
Broad whitefish	*Coregonus nasus*	X	X		Yes	Found in the Yukon and Kuskokwim river drainages and in the Bering, Chukchi, and Beaufort Sea river drainages. Primarily found in streams, less often in lakes and estuaries. Spawn over a gravel bottom in the fall. In the Yukon River, broad whitefish are important for local consumption and for commercial purposes. Both spawning and overwintering populations occur in the Sagavanirktok River and Yukon River drainages.
Lake whitefish	*Coregonus clupeaformis*			X	No	Occur in the Copper and Susitna river drainages. Found in the deeper, colder areas of lakes and rivers in summer. Moves to shallower areas to spawn in fall.
Humpback whitefish	*Coregonus pidschian*	X	X	X	Yes	Found in all drainages north of the Alaska Range as well as in the Copper and Susitna rivers. Spawn during the fall at the upper reaches of rivers over a gravel bottom at 4-5 years of age. Important in the subsistence economy of rural Alaskans.
Round whitefish	*Prosopium cylindraceum*	X	X	X	No	Widespread on mainland Alaska from North Slope to Taku River. Occur in shallow areas of lakes and clear rivers and streams; rarely in brackish water. Spawn over gravel shoals of lakes and at river mouths.
Arctic grayling	*Thymallus arcticus*	X	X	X	No	Widespread on mainland Alaska; both migratory and resident population occur. Winter primarily in cold waters of medium-sized to large rivers and lakes; migrating to rocky streams to breed in spring and then continuing to separate summer feeding grounds.
Lake trout	*Salvelinus namaycush*	X	X	X	No	Inhabit clear, mountain lakes in the Brooks Range, Alaska Range, and central Arctic coastal plain. Found in turbid glacial lakes on the north side of the Chugach Range and Kenai

TABLE 5.6-1 Species of Fish within the Proposed Project Area

Family Name / Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	South-central		
						Peninsula. Spawn over clean, nearshore rocky shoals in fall.
Dolly Varden	*Salvelinus malma*	X	X	X	Yes	Locally abundant in all coastal waters of Alaska. Anadromous and freshwater resident varieties exist. Mature sea-run Dolly Varden spend their lives migrating from wintering fresh water to saltwater summer feeding areas, then back to freshwater rivers to spawn in the fall. One of Alaska's most important and sought-after sport fish.
Rainbow trout (steelhead)	*Oncorhynchus mykiss*		X	X	Yes	Resident and anadromous forms exist. Occur naturally in the coastal waters of the Upper Cook Inlet and the Copper River drainage. Hatchery-reared fish occur in specific lakes and streams in the Tanana River drainage. Spawn in shallow gravel riffles or suitable clear water streams. One of the most respected and sought after of Alaska's native game fishes.
Pink (humpback) salmon	*Oncorhynchus gorbuscha*	X		X	Yes	Occur along Alaska's coasts. Spawn between late June and mid-October, usually within a few miles of the coast or in the intertidal zones. Young run to sea right after emerging from gravel where they remain for 2 years before returning to spawn. Important to commercial and sport fisheries and to subsistence users in Alaska.
Coho (silver) salmon	*Oncorhynchus kisutch*		X	X	Yes	Found in coastal waters of Southeast and Southcentral Alaska and in the Yukon River to the Alaska-Yukon border. Occur in nearly all accessible bodies of fresh water; avoid riffles. Spawn in streams from July to November. Young migrate to sea between 1 and 4 years, remaining at sea for 2-3 years. Premier sport fish of Alaska occurs in both fresh and salt water from July to September.
Chinook (king) salmon	*Oncorhynchus tshawytscha*		X	X	Yes	Abundant from the southeastern panhandle to the Yukon River. Major runs in the Yukon, Susitna, and Copper River drainages. Spawning occurs from May through July. Fish hatch in fresh water, spend 3-7 years in the ocean, and then return to spawn in their natal streams. Chinook salmon are the most highly prized sport fish in Alaska.
Chum (dog) salmon	*Oncorhynchus keta*	X	X	X	Yes	Most abundant commercially harvested salmon species in the Arctic, northwestern, and Interior Alaska. Spawn in small side channels and other areas of large rivers where upwelling springs; young run to sea right after emerging from gravel. Important year-round source of fresh and dried fish for subsistence and personal use purposes in the Arctic, northwestern and Interior Alaska.
Sockeye (red) salmon	*Oncorhynchus nerka*		X	X	Yes	Occur in the North Pacific and Arctic oceans and associated freshwater systems. Spawn in rivers, streams, and upwelling areas along lake beaches after spending one to four years in the ocean. After hatching in winter, juvenile sockeye salmon may spend up to four years in fresh water before migrating to sea. One of the most important commercial and sport

TABLE 5.6-1 Species of Fish within the Proposed Project Area

Family Name / Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	South-central		
						fisheries in the state and remain an important mainstay of many subsistence users.
Burbot	*Lota lota*	X	X	X	No	Occupy large clear and glacial rivers and many lakes throughout most of Alaska. Adults are voracious predators, feeding mostly on fish. Burbot spawn under the ice in late winter. The most popular fishing areas are the Yukon and Tanana rivers.
Ninespine stickleback	Pungitius pungitius	X	X	X	Yes	Widespread, occupying marine, brackish, and freshwaters. Prefers shallow vegetated areas in lakes, ponds and pools in slow streams; marine populations most often in marshes and estuaries near shore. Spawns in freshwater during summer months.
Threespine stickleback	Gasterosteus *aculeatus*	X		X	Yes	Occur primarily along the coastal regions of Alaska south of Nome in marine, brackish, and freshwaters. Anadromous and resident freshwater forms exist. Found in shallow vegetated areas of lakes, ponds, rivers and streams. Nests built on sandy bottom.

[a] BLM 2002.

[b] Truett and Johnson 2000.

[c] Mecklenburg et al. 2002.

TABLE 5.6-2 Stream Crossings by the Proposed Project by Hydroregion

	Arctic	Interior	Southcentral	Total Crossings
Anadromous Stream Crossings[a,b,c,d]	6	24	52	82
Stream Crossings with resident fish[e,f,g]	49	95	10	154
Total Stream Crossings	116	322	78	516

[a] Streams that have been nominated as anadromous were considered anadromous.

[b] Johnson and Blanche 2010.

[c] Johnson et al. 2004.

[d] Johnson and Klein 2009.

[e] Resident fish data is incomplete.

[f] ADF&G 2011b.

[g] BLM 2002.

Arctic Slope Region

The Sagavanirktok River is the only major river drainage along the proposed Project in the Arctic Slope region. The Sagavanirktok River is approximately 180 miles long, originating on the north slope of the Brooks Range and flowing north to the Beaufort Sea near Prudhoe Bay. The Dalton Highway roughly parallels the river from Atigun Pass to Deadhorse. Six stream crossings were documented with anadromous fish present in the Arctic region of the proposed Project area (Table 5.6-4, Appendix E). Dolly Varden and broad whitefish are the most common anadromous species known to occur in areas that will be crossed by streams in the Arctic Region of the Project area (Johnson and Blanche 2010). The main channel of the Sagavanirktok River is considered critically sensitive from May to June because Arctic grayling spawn in tributaries that feed it and from August through October when the Dolly Varden migrate through the Sagavanirktok River and spawn in its spring-fed tributaries (ADNR 2006). Arctic grayling and ninespine stickleback are the most widespread resident fish found in streams in Arctic Alaska (Truett and Johnson 2000).

Sport fishing pressure along the Sagavanirktok River drainage is low compared to subsistence fishing and sport fishing elsewhere in Alaska (Scanlon 2010). Sport fishermen in this region harvest Dolly Varden, Arctic grayling, burbot, and whitefish (ADF&G 2010). Most sport fisheries for Dolly Varden target overwintering populations in the fall as the fish return to freshwater or in the spring as they move toward the sea to feed (Scanlon 2010). No commercial fishing occurs in the Sagavanirktok River drainage (Scanlon 2010).

Most freshwater Arctic fish populations are limited by the availability of wintering habitat (Truett and Johnson 2000). Lakes at least 6.5 feet deep provide fish with open water habitat throughout the winter and prevent eggs from freezing (Craig 1984, Truett and Johnson 2000). Although numerous smaller lakes occur in the vicinity of the proposed Project area on the North Slope, they are often too shallow (i.e., less than 6.5 feet deep) to support winter fish populations. However, if these shallow lakes are connected to a fish bearing stream or river, they will support fish during the summer months. Winter's onset is a period of environmental change that almost always results in migration, either within a given habitat, among habitats of the same system, or among systems (Reynolds 1997). Craig (1989) postulated that the small amount of over-wintering habitat available could be the most important factor limiting population size and causing cyclical fluctuations in fish species abundance (Truett and Johnson 2000). Lake trout, Arctic char, Arctic grayling, Alaska blackfish, northern pike, broad whitefish, round whitefish, Arctic whitefish, ninespine stickleback and burbot can be found in lakes deep enough to support overwintering fish (ADF&G 2010).

Interior Alaska

Major rivers along the proposed Project area in Interior Alaska include the Yukon and the Tanana Rivers. Sport fishing pressure is generally light throughout the region. Subsistence and commercial fishing are allowed in the Yukon and Tanana Rivers.

Anadromous fish are known to occur in twenty-four stream crossings within the Project area in Interior Alaska (Table 5.6-2). The Yukon River and the South Fork of the Koyukuk River have the most species of anadromous fish for this region (Johnson et al. 2004).

The Yukon River

The Yukon River is the longest river in Alaska and the Yukon Territory, and it has one of the longest salmon runs in the world. Presently all populations of fish in the Yukon River drainage are wild; no stocking to enhance fish populations occurs in this area. Chinook, chum and coho salmon are harvested in the subsistence, commercial, personal use, and sport fisheries along the Yukon River. The Yukon River chum salmon run consists of an earlier summer run and a later fall run. Run times for spawning salmon on the Yukon River occur from June to August for Chinook salmon, September to November for Coho salmon, and June to December for chum salmon (Table 5.6-3)

Subsistence fishing has the highest priority among all uses of the resource in the State of Alaska, and whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258). The villages along the Yukon River have historically and continue to rely on salmon for their cultural, subsistence, and commercial needs. Salmon are traditionally dried, smoked, and frozen for both human and sled dog consumption. Common methods of fishing on the Yukon River include set gill nets and fish wheels (Busher et al. 2009).

The proposed Project occurs within ADF&G Yukon District 5C. Subsistence harvest for this district averaged 1,862 Chinook salmon, 1,057 chum salmon, and 50 coho salmon annually from 2000 to 2009 (ADF&G Pers. Comm. 2010). During the past decade, subsistence harvest was highest for Chinook salmon from 2002-2004 in this District (ADF&G Pers. Comm. 2010). Low returns in recent years caused the subsistence harvest of Chinook salmon on the Yukon to be restricted in 2008 and 2009. Since 1993, wide swings in productivity have occurred in the Yukon fall chum run. In 2001, only 176 chum salmon were harvested by subsistence users whereas in 2006, 5,918 chum salmon were harvested (ADF&G Pers. Comm. 2010). In 2009, the fall chum salmon subsistence harvest was 1,024 fish for the Yukon District 5C (ADF&G

Pers. Comm. 2010). Important subsistence fisheries for whitefish and lamprey also occur in this area.

Commercial harvests in Yukon District 5 have historically been dominated by chum and more recently, by king salmon, with the commercial harvest of Coho salmon being mostly incidental to the fall chum salmon fishery. In years with average returns and run timing, the first commercial fishing period usually occurs between July 1 and July 7 for the area of the Yukon River crossed by the proposed Project. The fall chum commercial fishing period typically occurs in mid-August. Between 2000 and 2009, an average of 151.3 Chinook salmon and 1010 fall chum salmon were commercially harvested annually from the Tanana River in Yukon River District 5C (ADF&G Pers. Comm. 2010).

Unfortunately, there has been high variability in the Chinook salmon run strength in the Yukon River during the past decade (United States and Canada Yukon River Joint Technical Committee 2010). Commercial harvest of Chinook salmon was closed due to poor run strength during 2000, 2001, 2008, and 2009. Runs for commercially harvested Chinook salmon in District 5C were highest in 2006 with 481 fish more than tripling the 10 year annual average (ADF&G Pers. Comm.). Due to reduced abundance, Chinook salmon returning to the Yukon River is currently listed as a "Stock of Yield Concern" (United States and Canada Yukon River Joint Technical Committee 2010)."

In general, sport fish salmon in the Yukon River drainage is minor compared to commercial and subsistence harvests (Burr 2009). Pacific salmon (all species combined) comprise only about nine percent of the total sport harvest in this area (Burr 2009). Sport harvest in the Yukon River drainage is dominated by Arctic grayling, northern pike, and sheefish. Fishing pressure is generally light and there are widespread opportunities throughout this region to fish for Arctic grayling, Dolly Varden, northern pike, burbot and lake trout (Burr 2009). Broad whitefish and Bering cisco are also important fisheries in the Yukon River drainage.

Tanana River

The Tanana River drains an area of approximately 45,155 square miles and is the second largest tributary system that feeds the Yukon River. The main branch of the Tanana River is a glacial river flowing northwest for 570 miles to the Yukon River and formed by the confluence of the Chisana and Nabesna rivers near Tok and the Alaska-Canada border.

The proposed Project would cross the Tanana River within the Lower Tanana Management Area (LTMA) and would occur within ADF&G Yukon River District 6B. There are 18 fish species native to the Tanana River drainage. Chinook salmon, Coho salmon, Arctic grayling, burbot, lake trout, and northern pike are the species most sought after by sport fishermen in this area (Brase 2009). Fish species present, but not often targeted by sport anglers, include chum salmon, Dolly Varden, sheefish, least cisco, humpback, broad, and round whitefish, longnose suckers, Alaska blackfish, lake chub, slimy sculpin, and Arctic lamprey (Brase 2009). In addition, although rainbow trout are not native to the Tanana River drainage, the ADF&G raises them in hatcheries and stocks many locations in the Tanana River drainage. Native hatchery raised Arctic char, coho salmon, Chinook salmon, and Arctic grayling are also stocked in selected waters of the Tanana River drainage (Brase 2009).

Commercial and subsistence harvest of Chinook, chum, and Coho salmon occurs along the Tanana River, with commercial and subsistence fishing periods typically opened concurrently. Run times for spawning salmon on the Tanana River occur in July for Chinook salmon, September to November for Coho salmon, and June to November for chum salmon (Table 5.6-3). Summer commercial fishing periods usually occur in late July and into August, depending on run strength and buyer capacity. The first fall season commercial chum salmon fishing period normally occurs in early to mid September. Between 2000 and 2009, an average of 421.6 Chinook salmon, 9,848.8 fall chum salmon and 11,888.0 Coho salmon were commercially harvested annually from the Tanana River in Yukon River District 6B (ADF&G Pers. Comm 2010). Between 2000 and 2009, an average of 999.6 Chinook salmon, 9,170.3 chum salmon and 6,396.3 coho salmon were harvested annually by subsistence users in Yukon River District 6B (ADF&G Pers. Comm. 2010). Important subsistence fisheries for whitefish also occur in this area, although data for these fisheries is limited (ADF&G Pers. Comm. 2010).

Sport fishing in the Tanana River drainage occurs throughout the year as anglers fish through the ice on stocked lakes and in the rivers for burbot and northern pike. Rivers important for sport fishing in or near the Project area include Chatanika and Nenana Rivers. In addition, the Minto Flats State Game Refuge occurs within the Tanana River drainage. This refuge was established in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of public uses within the area.

Southcentral Alaska

The Southcentral Alaska region of the proposed Project area is dominated by the Susitna River drainage systems. More anadromous stream crossings occur along the proposed Project in the Southcentral region than in the Interior and Arctic regions combined (Table 5.6-2). Fifty-two stream crossings in this region support anadromous fish species (Table 5.6-2). Run times for spawning salmon on the Susitna River primarily occur from May to August for Chinook salmon, June to early October for sockeye salmon, July to early October for coho salmon, July to August on even years for pink salmon, and July to September for chum salmon (Table 5.6-3).

TABLE 5.6-3 Salmon Fish Spawning Run Timing within the Project Area

Salmon and Streams	May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.		
Chinook salmon																								
Yukon				Present	Present	Present	Peak	Peak	Peak	Present	Present	Present												
Tanana							Peak	Peak	Peak															
West Susitna	Present	Present	Present	Peak	Peak	Peak	Peak	Peak	Peak	Present	Present	Present												
Sockeye Salmon																								
Yukon																								
Tanana																								
West Susitna				Present	Present	Present	Peak	Peak	Peak	Peak	Peak	Peak	Present	Present	Present	Present								
Coho Salmon																								
Yukon													Present	Present	Present	Peak	Peak	Peak	Present	Present	Present			
Tanana													Present	Present	Present	Peak	Peak	Peak	Present	Present	Present			
West Susitna							Present	Present	Present	Peak	Peak	Peak	Present	Present	Present	Present								
Pink Salmon (even yrs.)																								
Yukon																								
Tanana																								
West Susitna							Peak	Peak	Peak	Present	Present	Present												
Chum Salmon																								
Yukon				Present	Present	Present	Peak	Peak	Peak	Present	Present	Present	Present	Present	Present	Present	Present	Present	Peak	Peak	Peak	Peak	Peak	Peak
Tanana							Peak	Peak	Peak	Present	Present	Present				Present	Present	Present	Peak	Peak	Peak			
West Susitna							Peak	Peak	Peak	Peak	Peak	Peak	Present	Present	Present									

Salmon present

Peak availability

Source: ADF&G (http://www.sf.adfg.state.ak.us/statewide/runtim/runtim.cfm)

Susitna River

The Susitna River originates in glaciers of the Alaska and Talkeetna Mountain ranges and flows about 200 miles in a southerly direction before entering the Cook Inlet near Anchorage. A barrier in Devil's Canyon prevents upstream migration in the Susitna River, and the upper Susitna River drainage has no anadromous salmon. However, the lower Susitna River drainage system supports extensive and diverse recreational fisheries for five species of Pacific salmon. The lower Susitna drainage area also has the most aggressive lake stocking program in the state, where more than 90 of the area lakes are stocked with rainbow trout, Arctic grayling, Arctic char, landlocked coho and Chinook salmon (ADF&G 2011a). The two most sought-after salmon species are the Chinook and coho salmon. Chinook spawning runs peak during June and July; sockeye runs peak in July and August; and coho runs peak during August of each year (Table 5.6-3). The Upper Susitna River drainage supports the northern most range of wild Rainbow trout in North America. Excellent fishing opportunities also occur for wild stocks of rainbow trout, Dolly Varden, Arctic grayling, and Northern pike (ADF&G 2011c). Limited sport fishing opportunities occur for burbot, Arctic char, and lake trout in nearby lakes.

No commercial or subsistence fisheries exist in the freshwaters of the Susitna River drainage. A freshwater eulachon (hooligan) Personal Use dip net fishery exists in the Susitna River from April 1 through June 15. The proposed Project would parallel the Susitna River where this Personal Use fishery occurs.

TABLE 5.6-4 Critical Time Periods for Anadromous and Resident Fish by Lifestage

Species / Lifestage	Location	Stage Time Period											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dolly Varden, Arctic char, Whitefish, Inconnu and Burbot													
Spawning Area	At Crossing								C	C	C	C	
	Above Crossing								S	S	S	S	
	Below Crossing								C	C	C	C	
Incubating Eggs and Emergence - Alevins	At Crossing	C	C	C						C	C	C	C
	Above Crossing	NS	NS	NS						NS	NS	NS	NS
	Below Crossing	C	C	C						C	C	C	C
Fry / YOY	At Crossing			S	S	S	S						
	Above Crossing			NS	NS	NS	NS						
	Below Crossing			S	S	S	S						
Juvenile Rearing (Age 0+, Age 1+, Age 2+)	At Crossing				S	S	S	S	S	S	S		
	Above Crossing				NS	NS	NS	NS	NS	NS	NS		
	Below Crossing				S	S	S	S	S	S	S		
Juvenile Migration / Outmigration (Age 0+, Age 1+, Age 2+)	At Crossing				S	S	S	S	S	S			
	Above Crossing				NS	NS	NS	NS	NS	NS			
	Below Crossing				S	S	S	S	S	S			
Adult Holding Areas	At Crossing						S	S	S	S	S	S	
	Above Crossing						NS	NS	NS	NS	NS	NS	
	Below Crossing						S	S	S	S	S	S	
Adult Migration	At Crossing						S	S	S	S	S	S	
	Above Crossing						S	S	S	S	S	S	
	Below Crossing						S	S	S	S	S	S	

C = Critical Sensitive

S = Sensitive

NS = Non-sensitive

Source: ASRC 2011.

5.6.2 Environmental Consequences

5.6.2.1 No Action Alternative

Under the No Action Alternative the Project would not be developed and no impacts would occur to fishery resources.

5.6.2.2 Proposed Action

Preconstruction Activities

Water Withdrawals

Water withdrawn from permitted lakes and reservoirs would be used for ice road construction and for temporary work camps. The ADF&G authorizes Title 16 permits for projects potentially affecting fish habitat and the ADNR authorizes Temporary Water Use Permits (TWUP) which is needed to withdrawal water from lakes. The permitting process regulates water withdrawal, to prevent degradation of water quality within the water source during the winter months. The TWUP establish the amount of water allowed to be withdrawn from each lake source. The amount of water permitted for winter withdrawal (either in the form of water or ice chips) depends mainly on fish species present and lake depth and water volume in each lake. Sensitive fish refer to those species that cannot tolerate low dissolved oxygen concentrations; whereas non-sensitive fish species can tolerate a lower dissolved oxygen level concentration in the waters they are found. If sensitive fish species are present, the withdrawal of water and ice chips is limited to 15 percent of the lake volume deeper than 7 feet of water depth. When only non-sensitive fish species are present, up to 30 percent of the water volume deeper than 5 feet of depth may be used. For non-fish bearing lakes and ponds, a maximum of 20 percent of the total lake volume is available for water and ice chips.

At least 1,007.4 million gallons of water would be required to support construction activities for the proposed Project (AGDC 2011a). For Construction Spread 1, from the GCF to the Chandalar Shelf, 435.04 million gallons of water would be needed for ice chip use for ice road construction and ice workpads which minimize environmental damage to North Slope construction sites (AGDC 2011a, 2011b). Lake studies conducted by the AGDC in 2010 identified the maximum recommended water withdrawal based on volume and fish species from all lakes along the proposed route from Prudhoe Bay to Galbraith Lake (Table 5.6-5). Fish species considered to be sensitive to dissolved oxygen concentrations in this area include: Arctic grayling, Arctic char, lake trout, broad whitefish, round whitefish, burbot and slimy sculpin (AGDC 2011b). Ninespine stickleback was the only non-sensitive fish species found in these lakes (AGDC 2011b). Table 5.6-4 identifies all lakes in which sensitive and non-sensitive fish species were found and includes the maximum recommended water withdrawal limit. Alternative construction techniques would be evaluated if sufficient water is not available. Supplemental site-specific fishery data for lakes south of Galbraith Lake where water would be withdrawn are not yet available. Additional site-specific data for each lake would be required to meet ADF&G and ADNR permit requirements.

Impacts to water quality from water withdrawals include decreased oxygen concentrations, increased organic matter, turbidity and changes to pH (AGDC 2011b). To minimize impacts to fishery resources, water would be withdrawn only from designated, permitted, surface-water sources with the capacity to supply the desired volumes without adverse effects on aquatic habitat and associated biota (particularly overwintering fish).

Potential impacts to fish, invertebrates, and fish habitat from water withdrawal include:

- Lower oxygen concentration levels in lakes from fluctuating water levels which can seriously stress or kill fishes (Cott et al. 2008). Fish are particularly susceptible to decreased oxygen levels from water withdrawals during winter months when lakes are covered by ice which limits the amount of available habitat for overwintering fishes compared with open water conditions (Cott et al. 2008). Maintaining openings in the ice to pump water would allow for increased oxygen exchange at the lake surface.
- Water level fluctuations can alter fish behavior, distribution, and growth (Cott et al. 2008). Incubating eggs exposed by lowered water levels may cause eggs to desiccate or freeze (Cott et al. 2008). Flow regulation can be especially influential on the natural dispersion of larval and juvenile fish to rearing areas. Water withdrawals should consider the biology of the fish species present in each lake to ensure that fish are not adversely affected (Cott et al. 2008).
- Fish and invertebrates could be killed or injured through mechanical stress, entrainment in withdrawn waters, impingement on intake structures, or being frozen to ice road surfaces on discharge (National Academy of Sciences, 2004). Permit stipulations would limit water withdrawals from fish-bearing water bodies and regulate intake screen sizes, which would minimize the potential for entrainment.
- Aquatic invertebrates can be significantly impacted by water level variations outside of normal seasonal conditions (Cott et al. 2008). Changes to the macrovegetation community from fluctuating water levels can drastically reduce invertebrate populations because aquatic invertebrates often depend on specific types of vegetation for food, shelter and egg deposition (Cott et al. 2008). Lakes that experience unusual water level fluctuations often initially experience a partial or complete reduction in invertebrate species, which may take several years to recover, and then with a different species assemblage (Cott et al. 2008). This reduction and redistribution of the aquatic invertebrate community reduces food sources for many fishes (Cott et al. 2008).

TABLE 5.6-5 Maximum Recommended Water Withdrawal from Lakes along the Proposed Route from Prudhoe Bay to Galbraith Lake

Lake Name	Surface Area (acres)	Maximum Depth (feet)	Total Volume (gallon)	Sensitive Fish Species Present	Non-Sensitive Fish Species Present	Maximum Recommended Winter Withdrawal (gallon)
DNR016	259.82	-7.75	399,420,065.75	None	Ninespine Stickleback	14,576,457.05
DNR029	56.50	-20.00	143,790,053.50	Grayling / Broad Whitefish		6,985,991.28
DNR030	17.52	-10.50	20,416,055.97	Grayling		108,088.24
DNR033	17.91	-9.50	30,069,711.90	Grayling		345,205.40
DNR034	8.00	-24.00	24,914,220.09	Arctic Char		1,645,375.70
DNR036	27.06	-44.00	155,079,627.72	Arctic Char / Slimy Sculpin		15,039,197.68
DNR038	19.86	-23.00	55,297,456.50	Grayling/Round Whitefish		2,589,682.23
DNR039	22.63	-64.00	177,271,163.33	Lake Trout / Grayling		19,379,404.48
DNR040	87.80	-55.00	825,864,900.32	Lake Trout / Grayling / Round Whitefish / Broad Whitefish		95,052,883.57
DNR042	15.19	-27.00	66,185,146.34	Round Whitefish		5,127,219.78
DNR044	10.51	-43.00	71,551,279.14	Lake Trout / Grayling		7,459,333.33
DNR045	44.89	-26.00	146,102,468.56	Lake Trout / Grayling / Round Whitefish / Burbot / Slimy Sculpin		9,954,879.69
Galbraith Lake	NA	NA	NA	Lake Trout / Grayling / Round Whitefish / Burbot		NA

Source: AGDC 2011b.

Ice Roads

Ice bridges could form and persist across rivers and streams from ice road construction methods and compaction from vehicle use. Ice bridges would melt slower than the surrounding ice; however, standard ice road mitigation includes slotting the ice at stream crossings and outlets before breakup to allow streams to flow as the snow pack melts, allowing for fish passage. Potential impacts to fish and invertebrates from ice roads include the following:

- Fish movements could be altered due to delayed melting of bridging ice;
- Grounding of ice may occur at ice road crossings resulting in flooding which could affect the riparian habitat, flow and habitat availability temporarily for fish;
- Fish habitat could become stressed from restricted ice cover and low stream flow, cold water temperatures and limited dissolved oxygen supply;

- Stream crossings should avoid upwelling areas which could be preferred overwinter areas for resident fish and locations for redds (incubating embryos); and
- Hydrologic alteration of water withdrawal for ice road development could affect sensitive invertebrate taxa.

Vessel Use

Thirty-five vessels would be required at the Port of Seward (POS) and six vessels at West Dock to deliver all materials (pipe, GCF modules and equipment) for Project construction. Vessel traffic through marine waters, especially the discharge of ballast waters at ports has the potential to spread aquatic invasive species and organisms which can spread diseases from one region to another. The ports currently used for delivery of cargo to the POS and West Dock are the same ports proposed for the Project. No additional exposure of non-native aquatic invasive species would be expected to occur from Project development. The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal shipping activities currently occurring at the POS and West Dock.

Ten Pacific salmon stocks listed under the ESA are included under Evolutionarily Significant Units (ESUs), and inhabit Alaskan marine waters at some part of their life history (feeding and migration). These include: five Chinook salmon stocks associated with the Columbia and Snake rivers; and five steelhead stocks from the Columbia, Snake and Willamette River drainages. These species move into marine waters to grow and mature, potentially moving large distances from their natal streams ranging throughout North Pacific waters, including the Gulf of Alaska, Cook Inlet, and Prince William Sound (NMFS 2011a). It would be unlikely that Pacific west coast ESU Chinook salmon and steelhead would migrate near the POS during vessel operations. Therefore, there would be no effect to ESA listed Chinook salmon or steelhead from construction or operation activities of the proposed Project.

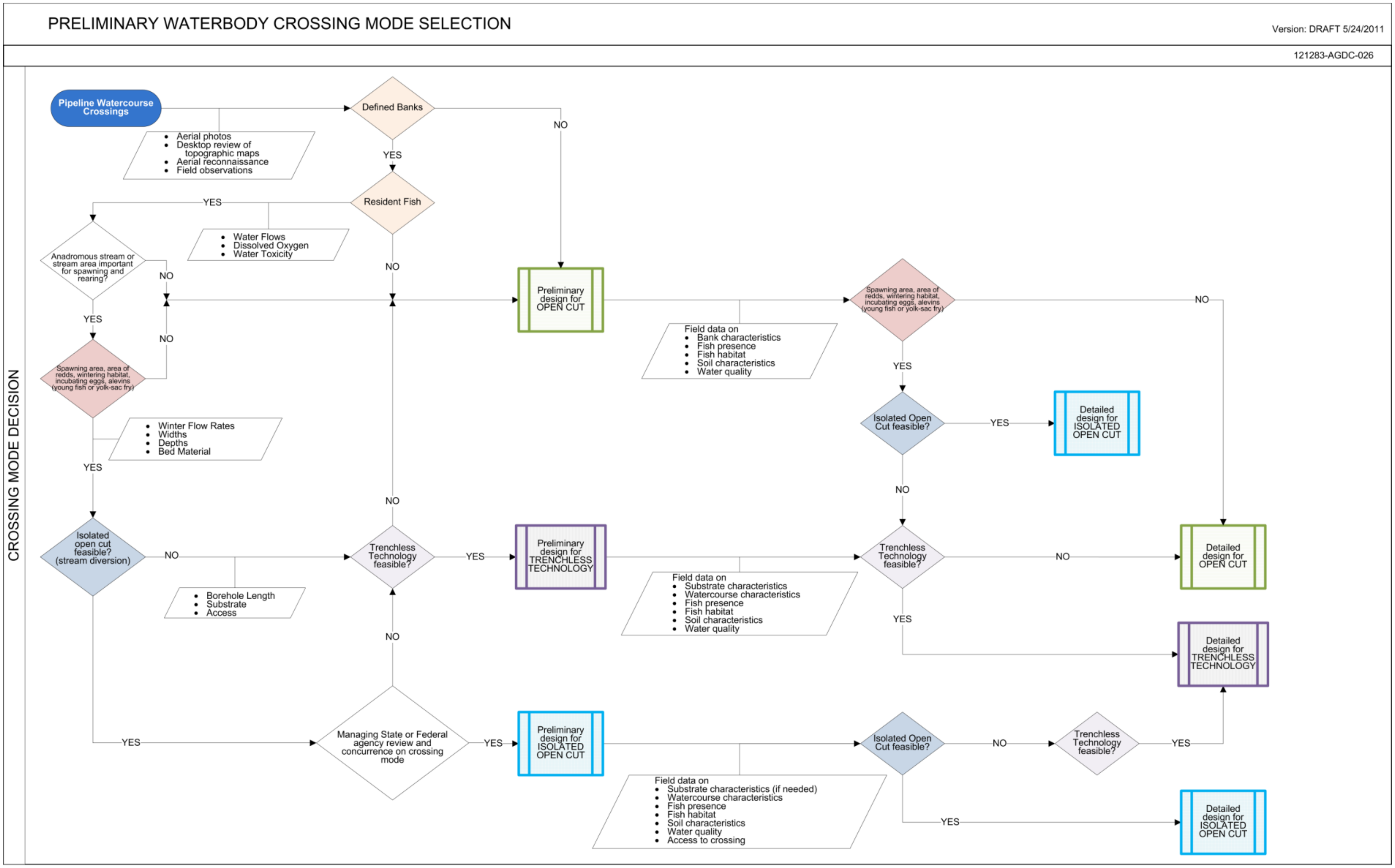
Pipeline Facilities

Construction

Construction of the right-of-way (ROW) would extend 737 miles and cross approximately 516 streams as noted above. Installation of the buried pipeline across fish-bearing streams during construction is likely to have the greatest potential effect to the fishery resources in the Project area. The ADF&G requires a permit under Alaska Statutes (AS), Title 16, which protects freshwater habitat in streams and rivers that support anadromous and resident fish. Each stream crossing would be individually permitted and work would be performed to comply with permit stipulations. Each crossing would be evaluated for fishery resources, and the proposed crossing technique would be developed cooperatively with the ADF&G to avoid adverse effects to fish and fish habitat. Construction activities in known overwintering areas for fish would likely be allowed only during open-water seasons or with trenchless technologies such as horizontal directional drilling that do not require in-stream water work. Figure 5.6-2 illustrates how the AGDC would determine the type of crossing mode to be used at each stream crossing.

Stream crossings would be constructed using one of four methods: open-cut, open-cut isolation, trenchless technology using horizontal directional drilling (HDD) or horizontal bores, or bridge crossings (Section 2.2.3.2). The degree of construction-related impacts to fish would depend on the type of crossing method used, the timing of construction, duration of in-stream activity, life stage and type of fish present and the mitigation measures implemented. Potential temporary impacts to fishery resources that would occur during construction include: in-stream habitat alteration (substrate, water depth, flow, water quality, sedimentation/turbidity), and channel profile. Permanent impacts could include riparian vegetation loss, stream morphology and alteration to the hyporheic zone.

Each subsurface stream crossing would be constructed in a manner and during a time period that would avoid or minimize potential fishery effects the most practicable. Figure 5.6-2 illustrates how the AGDC would determine the type of crossing mode to be used at each stream crossing. The total length of time expected for in-stream pipeline construction to occur for each waterway crossing is anticipated to be completed in 1 to 3 days.



T:\121283 - AGDC In State Gas Pipeline\04 - Project Documents\02 - Design Basis\watercourse selection process (AGDC-026)\vDraft 5-24-2011 Waterbody xg mode decision (AGDC-026).vsd

FIGURE 5.6-2 Preliminary Waterbody Crossing Mode Selection

Stream Crossing Methods

Open-Cut Method

The open-cut method is the most common crossing method used to construct in the stream channel and this technique does not divert the water. This method involves excavation of the pipeline trench across the waterbody, installation of a prefabricated segment of pipeline, and backfilling of the trench with native material (Section 2.2.3.2). Open-cut methods can be either dry or wet. Dry open-cut stream crossings occur when the entire stream width is seasonally dry (i.e., ephemeral stream) or frozen to the bottom (i.e., shallow streams during winter construction). The wet open-cut method is constructed as the stream or river continues to run through the construction zone. For all construction methods, the pipeline would be buried across these streams to a depth that provides a minimum of 5 feet of cover for all stream crossing modes except bridges (AGDC 2011a).

Open-cut crossings impact fisheries resources by increasing sediment loads downstream during and shortly after the period of construction. Wet open-cut methods would most likely have the largest sediment loads and corresponding impacts to fishery resources. The benefits of open-cut methods are low costs and have a short completion time. The primary disadvantages include: increased sedimentation and erosion of the stream bank, loss of riparian vegetation, and greater alteration to channel morphology than what occurs with other stream crossing methods.

The dry open-cut method may reduce direct impacts to fish during construction compared to other methods, but fish habitat would be altered the same as noted above. Trenching, even under dry conditions, may reduce the productivity of streams by altering the habitat and substrate characteristics of the stream bank and channel (Fisheries and Oceans Canada 2007). Trenching may also alter stream hydrology by causing the proportion of surface and subsurface flows to shift (Fisheries and Oceans Canada 2007).

Open-Cut Isolation Methods

Open-cut isolation crossing methods are used when a wet open-cut is prohibited due to the presence of overwintering or spawning fish, or when stream flow conditions make open-cut impractical (AGDC 2011). Open-cut isolation methods isolate by placing a dam or flume across the stream and divert it around the pipeline (Section 2.2.3.2). The trench is then excavated, the pipe is installed, and the stream is stabilized.

Open-cut isolation methods would have similar impacts on fish and fish habitat as the methods noted above. However, open-cut isolation methods usually have less sediment yield during both summer and winter construction than a wet crossing (Reid et al. 2004, Reid and Anderson 1999). However, poor containment of turbid water pumped from the isolated workspace, insufficient pump capacity, and the installation and removal of the dam could cause high releases of sediment (Reid et al. 2004, Reid and Anderson 1999). Additional problems with isolation methods could arise from the following factors: leakage around/underneath dam, dam failures, flume failures, insufficient pump storage, and inadequate maintenance (Reid et al.

2004). Some fish species or life stages may be more susceptible to injury when diverting water around the construction area of the drainage.

Blasting

Some open-cut and open-cut isolation crossings may require drilling or blasting to install the proposed Project pipeline. Streamside blasting could indirectly affect fish and aquatic invertebrates by causing increased sedimentation, noise, vibrations, and/or alteration of channel morphology (Wright and Hopky 1998). Blasting in or near waterbodies can cause direct negative impacts on fish populations due to shockwaves propagating through the water causing mortality (Wright and Hopky 1998). Shock waves of sufficient size and strength traveling through the water column (either from underwater blasts or from waves transmitted from on-shore blasts) can have a wide range of effects on fish. Larger fish may be startled by the waves, and smaller fish can be injured or killed when their internal swim bladder is ruptured. Small fish can also be stunned temporarily by shock waves making them more susceptible to predation (ADF&G 1991). Blasting would occur when needed to fracture frozen soils or rock; however, a Blasting control Plan would be developed to mitigate blasting in environmentally sensitive areas near fish habitat (AGDC 2011).

Horizontal Directional Drilling

HDD is a trenchless crossing method that may be used to avoid direct impacts to waterbodies by directionally drilling beneath them. HDD involves installation of the pipeline beneath the ground surface by pulling the pipeline through a pre-drilled bore hole. HDD requires an entry and exit box, placed on either side of the feature to be crossed. This method works best for large water bodies or in areas with exceptionally vulnerable ecosystems. The AGDC proposed to use trenchless methods (likely HDD) at 41 waterbody crossings (Section 2.2.3.2).

Impacts to fishery resources from HDD could occur if drilling fluids are unintentionally released into surface waters due to site geological conditions (a frac-out) or if drilling muds are not properly contained or disposed (76 FR 22745). No synthetic or potentially toxic drilling fluid additives would be used for the proposed Project. A frac-out could release bentonite drilling mud into the aquatic environment. Containment of frac-outs in aquatic environments are often difficult because drilling mud readily disperses in flowing water and quickly settles in standing water. Suspended bentonite may reduce viability of fish and aquatic invertebrates by inhibiting respiration due to fouled gills during the short-term. If benthic invertebrates, larval fish or incubating eggs are covered, they may suffocate due to fouled gills and/or lack of oxygen.

Bridge Crossings

Four river crossings are proposed that would result in the aerial placement of the pipeline in association with three existing bridges, in addition to potentially utilizing the existing E.L. Patton Yukon River Bridge Option (see section on Yukon River Crossing Options below). These bridges would be utilized for pipeline placement at the Chulitna River, Coal Creek, and Hurricane River (Section 2.2.3.2).

Hydrostatic Testing

Upon completion of construction activities, an estimated 78.7 million gallons of water would be needed for hydrostatic testing for the Mainline Route to confirm that the pipeline meets design criteria and is leak-free (AGDC 2011). Water sources have not been identified and thus impacts to fisheries cannot be fully analyzed. However, water for hydrostatic testing would be withdrawn only from designated, permitted, surface-water sources with the capacity to supply the desired volumes without adverse affects on aquatic habitat and associated biota (particularly overwintering fish). The AGDC would also assure water withdrawal use appropriately-sized fish screens and other state and federal guidelines for fish protection. Hydrostatic testing would most likely be done using untreated, heated water approximately 36°F to 38°F under most conditions. In winter, water would be freeze-protected, or compressed air would be used to test the pipe. Any freeze point depressant used would be returned to the supplier or disposed of in a waste disposal well or according to applicable government regulations. Freeze depressants would not be discharged into streams.

Discharge locations have also not been identified and thus impacts to fisheries cannot be fully determined. Test water releases would be confined to designated, permitted upland locations and would be diverted to settling basins as necessary to comply with discharge permit limitations. Personnel would be trained in proper use of freeze depressant during hydrostatic testing and would implement hydrostatic testing in a manner that would not allow freeze depressants to be discharged to any streams.

Operation and Maintenance

Maintenance of the ROW

During operation of the proposed Project, vegetation would be maintained along the ROW to a non-forested state. Vegetation maintenance and control may be accomplished through mechanical methods. Maintenance of the ROW would include mowing the riparian (vegetation that grows along river banks and streams). Riparian vegetation has many crucial functions in fluvial systems. The primary functions include: promoting bank stability, maintaining water quality, providing structure and food for fish and other aquatic organisms, water temperature control, flood control, and providing habitat (cover) for fish and wildlife (STB 2011, Brown et al. 2002). The viability of the stream at crossing locations would depend on the level of erosion that may occur from regular vegetation maintenance of the ROW or in-stream construction effects. This issue would be addressed in an Erosion and Sediment Control Plan. The AGDC would also develop a non-native invasive plant Prevention (NIP) Plan to address procedures to reduce or eliminate the spread of non-native invasive plants into the riparian area prior to Project construction. For more information on vegetation control impacts and mitigation, refer to Section 5.3 (Vegetation).

Project Segments

Proposed stream crossing methods and timing of construction of 516 streams are provided in Appendix E and summarized in Table 5.6-7. Eighty-two stream crossings are known to contain anadromous fish (Table 5.6.7). One hundred and fifty-four stream crossings are known to contain resident fish (Table 5.6-7). The 516 waterbodies would be crossed using the following methods: 471 waterbodies via open-cut methods (open-cut and open-cut isolation); 41 waterbodies via HDD, and 4 waterbodies via new or existing bridges (Table 5.6-7). The AGDC has not identified which waterbodies would be crossed via open-cut or open-cut isolation crossing methods. A summary of construction crossing method and timing for all stream crossings containing anadromous fish is presented in Table 5.6-8.

TABLE 5.6-7 Stream Crossing Methods by Segment

Segment	Open-Cut	HDD	Bridge	Total Crossings	Anadromous Streams[a,b,c,d]	Resident Fish Streams[e,f,g]
GCF to MP 540	388	11(12)[h]	1(0)[h]	400	29 [b,c]	142
MP 540 to MP 555	6	0	0	6	0 [b]	1
MP 555 to End	57	30	3	90	53 [c,d]	11
Fairbanks Lateral	20	0	0	20	0[b]	0
Total	471	41	4	516	82	154

[a] Streams that have been nominated as anadromous were considered anadromous.

[b] Johnson and Blanche 2010.

[c] Johnson et al. 2004.

[d] Johnson and Klein 2009.

[e] Resident fish data is incomplete.

[f] ADF&G 2011b.

[g] BLM 2002.

[h] Yukon River will either be crossed with a bridge or HDD.

GCF to MP 540

Construction

The majority of the stream crossings (400) would occur between the GCF and MP 540, and 388 would be open-cut and 11 of them would be constructed using the HDD method (Table 5.6-7). The Yukon River would either be crossed with a new bridge, use the existing bridge, or with the HDD method. Twenty-nine of the stream crossings are anadromous (Appendix E, Table 5.6-8). Two anadromous stream crossings would be constructed during the summer months using open-cut methods (Table 5.6-8). All other stream crossings containing anadromous fish would be constructed during the winter months (Table 5.6-8).

Resident fish are known to occur at 142 stream crossings in this segment (Appendix E, Table 5.6-9). Overwintering fish and their habitat are of particular concern in this region. A Title 16 permit is required from the ADF&G for construction activities in known fish overwintering areas. Construction activities in known overwintering areas for fish typically require activities to be conducted during open-water seasons. Water withdrawals in fish overwintering areas require a Title 16 permit from the ADF&G and a Temporary Water Use Permit (TWUP) from the ADNR. Refer to the Section on Water Withdrawals for a detailed description of water withdrawal impacts to overwintering fish.

Operations

Impacts to fisheries resources from operations and maintenance of the ROW from the GCF to MP 540 would be the same as what is noted above under mainline pipeline operations and maintenance.

TABLE 5.6-8 Anadromous* Stream Crossing Construction Method by Segment[a,b,c,d]

Segment	Open-Cut		Horizontal Directional Drill		Bridge		Total
	Summer	Winter	Summer	Winter	Summer	Winter	
GCF to MP 540	2	18	0	8(9)[e]	0	1(0)[e]	29
MP 540 to MP 555	0	0	0	0	0	0	0
MP 555 to End	4	21	3	23	0	2	53
Fairbanks Lateral	0	0	0	0	0	0	0
Total	6	39	3	31	0	3	82

[a] Streams that have been nominated as anadromous were considered anadromous

[b] Johnson and Blanche 2010

[c] Johnson et al. 2004

[d] Johnson and Klein 2009

[e] Yukon River will either be crossed with a bridge or HDD.

TABLE 5.6-9 Resident Stream Crossing Construction Method by Segment[a,b,c]

Segment	Open-Cut		Horizontal Directional Drill		Bridge		Total
	Summer	Winter	Summer	Winter	Summer	Winter	
GCF to MP 540	29	107	0	5(6)[d]	0	1(0)[d]	142
MP 540 to MP 555	1	0	0	0	0	0	1
MP 555 to End	1	6	0	4	0	0	11
Fairbanks Lateral	0	0	0	0	0	0	0
Total	31	113	0	9	0	1	154

[a] Resident fish data is incomplete.

[b] ADF&G 2011b.

[c] BLM 2002.

[d] Yukon River will either be crossed with a bridge or HDD.

Yukon River Crossing Options

Construction

The Project proposes to cross the Yukon River in one of three ways, via a suspension bridge to be constructed (Option 1), via the existing highway bridge (Option 2), or via HDD (Option 3) as noted above. Impacts to fishery resources from Option 1 could include large vessel use in the Yukon River to construct the suspension bridge. The potential for contamination could occur due to oil and fuel leaks from vessels and cranes. These impacts would not likely adversely impact water quality in the Yukon River. No permanent structures such as footings would be placed below the ordinary high water mark, which would result in minimal impacts from constructing a suspension bridge. Impacts from Option 2 would be negligible since there would be no surface water disturbance. For Option 3, there would also be no adverse effects to fishery resources since there would be no in-stream construction for the HDD method. However, impacts to fishery resources from HDD could occur during a frac-out as noted above. Removal of riparian vegetation on either side of the River bank where HDD or the suspension bridge construction would occur could contribute to erosion increasing sedimentation and potentially reducing hydrology and fish habitat.

Operations

Impacts from operations and maintenance of the ROW on either side of the Yukon River would include maintenance of the ROW by mowing the vegetation to a non-forested state as noted above. Impacts to fisheries would be the same as noted above under mainline pipeline operations and maintenance.

Fairbanks Lateral

Construction

The Fairbanks Lateral would diverge from the proposed mainline at approximate MP 458 (MP FL 0.0) and extend through the Yukon-Koyukuk Census Area and Fairbanks North Star Borough, crossing 20 streams along its route (Table 5.6-7). The stream crossings along the Fairbanks Lateral have not been confirmed to contain anadromous or resident fish (Tables 5.6-8 and 5.6-9). All crossings are proposed to be constructed using open-cut methods during the summer months (Appendix E, Table 5.6-7). Impacts to fish from open-cut methods are listed previously in Section 5.6.2.2. Upon completion of construction activities, an estimated additional 0.88 million gallons of water would be needed for hydrostatic testing for the Fairbanks Lateral to confirm that the pipeline meets design criteria and is leak-free (AGDC 2011a).

Operations

Impacts to fisheries resources noted above from operations and maintenance of the ROW would include maintenance of the ROW by mowing the vegetation to a non-forested state. Impacts to fisheries resources include effects from riparian habitat removal as noted above.

MP 540 to MP 555

Construction

Six streams would be constructed during the summer by open-cut methods between MP 540 and MP 555 (Table 5.6-7). None of these streams have been confirmed to contain anadromous fish (Table 5.6-8), but one crossing has been confirmed to contain resident fish (Table 5.6-9). Additional fish sampling may be required in this segment of the proposed Project to confirm fish species presence and their life stage.

Operations

Impacts from operations and maintenance of the ROW would include the same impacts to fisheries resources as noted above.

MP 555 to End

Construction

Ninety streams would be crossed between MP 555 and the Cook Inlet NGLEP Facility. The majority (53) of the streams in this segment have been confirmed to contain anadromous fish (Table 5.6-7, Table 5.6-8). Twenty-five of these anadromous fish-bearing streams would be constructed using open-cut methods, 26 would use HDD methods, and two stream crossings would use existing bridges (Table 5.6-7, Appendix E). Most crossings containing anadromous fish would be constructed during the winter months, although four open-cut crossings and three HDD crossings are proposed to be conducted during the summer months. Eleven stream crossings are known to contain resident fish; seven of these streams would be crossed using open-cut methods and four by HDD (Appendix E, Table 5.6-9). Construction would occur during the winter months at ten of the stream crossings known to contain resident fish (Table 5.6-9).

Operations

Impacts from operations and maintenance of the ROW would include mowing the vegetation to a non-forested state. Impacts to fisheries would be the same as what is noted above under mainline pipeline operations and maintenance.

Aboveground Facilities

Construction

Minimal direct impacts to fisheries would be expected from construction of aboveground facilities because they would not be constructed over or directly adjacent to waterbodies. Contaminants from runoff could leach into neighboring drainages, altering water quality, but this would be minimal and localized due to strict spill prevention rules and regulations on work pads. Aboveground facilities would be constructed according to site-specific requirements and waste disposal would be performed in accordance with appropriate regulations and permits. Fuel storage, equipment refueling, and equipment maintenance operations would be located at least 100 feet from surface waters (AGDC 2011a).

Operations

Contaminants from runoff could leach into neighboring drainages, altering water quality over time from operations and maintenance at facilities. Water use in reservoirs that hold fish in the Arctic Coastal Plain may indirectly impact fish that inhabit the reservoirs used for water use for the CGF. These impacts would be unlikely to adversely affect fisheries resources.

Support Facilities

Construction

Support facilities would not be built over waterbodies; therefore, minimal impacts are expected to occur to fisheries resources. Contaminants from runoff could leach into neighboring drainages, altering water quality; however, this would be a negligible impact. Support facilities would be constructed according to site-specific requirements and waste disposal would be performed in accordance with appropriate regulations and permits. Fuel storage, equipment refueling, and equipment maintenance operations would be located at least 100 feet from surface waters.

Operations

Contaminants from runoff could leach into neighboring drainages, altering water quality over time from operations and maintenance at facilities. These impacts would be negligible to fisheries resources.

Access Roads

Construction

Nineteen streams would be crossed by new roads developed to access aboveground and support facilities. Five of the stream crossings would be new permanent roads and two would be new temporary roads. The number of new permanent access roads would be minimized by winter construction using ice roads and using existing roads whenever possible. No new access roads to aboveground facilities that cross streams have been confirmed containing anadromous fish. Resident fish data are known to occur at 2 of the 19 streams crossed by access roads (ST_108 and ST_114), but for many of these streams fish data is not available. A Title 16 Fish Habitat Permit would be required for roads crossing fish-bearing streams.

Construction methods, timing, and design of new access roads across streams have not been developed. New access roads would require bridges or culverts to cross streams, which would result in long-term habitat alteration for fish. During road construction, in-stream habitat would be temporarily lost from water diversion to facilitate installation of culverts. Culvert installation could cause the loss of rearing, foraging and spawning habitat in that reach of the stream. Implementing stream simulation culverts under all roads in tributary streams would alleviate many impacts to fish from geomorphologic alteration. Stream simulation culverts replicate the geomorphology of the stream by maintaining stream width, slope, velocity, channel structure, hydraulic conditions and bed composition. Stream simulation culverts are limited in use because they are only applicable for small (narrow) streams. Bridge placement would be the preferred crossing structure when considering fish passage, habitat and longevity. Free spanning bridges that cross moderate sized streams (second order) can be built to keep all structures (piles) out of the stream above the ordinary high water mark. Instream impacts to fish and their habitat from bridge construction would be minimal and temporary. Long term impacts from bridge placement would include a loss of riparian vegetation at the bridge crossing, and sedimentation from road use. Dust and gravel would be deposited in the stream channel on either side of the bridge. Run off could potentially bring contaminants from the road affecting water quality in the stream. Bridge construction would not adversely affect fish populations.

Operations

Impacts to streams from access road development would be permanent and include dust deposition which may alter water quality in the stream. Contaminants on roads from vehicle leakage may runoff into drainages also affecting water quality. Bridges and culverts as noted below would have additional impacts. Providing access for humans to utilize streams or reaches previously inaccessible could potentially increase fishing pressure in local streams. Roads also require a buffer of vegetation to be cleared which would increase riparian vegetation removal along waterways near roads.

5.6.2.3 Route Alternatives and Variations

Denali National Park Route Variation

Construction

The impacts to fishery resources anticipated under this route variation are similar in magnitude and duration to those described in Section 5.6.2.2. Pipeline construction would result in short-term disturbance and habitat alteration at stream crossings. Each crossing would be evaluated for fishery resources, and the proposed crossing technique would be developed cooperatively with the ADF&G to avoid adverse effects to fish and their habitat (AGDC 2011a).

The Denali National Park Route Variation would have two stream crossings across the Nenana River. The Nenana River is considered an anadromous stream containing chum, Coho and Chinook salmon. These crossings would include HDD and utilize the existing pedestrian foot bridge. The mainline route from MP 540 to MP 555 has six stream crossings that would all be constructed via open-cut methods. The stream crossings along the mainline route have not been confirmed for the presence of anadromous species (Table 5.6-10). Impacts to fishery resources from construction of the gas pipeline cannot be determined until what species are present and timing of construction are known.

Operations

Vegetation maintenance of the ROW in the Denali National Park Route Variation would likely reduce riparian function along the stream crossing where the HDD method would occur along the Nenana River. Utilizing the existing pedestrian bridge would not contribute any additional impacts during the operations of the Project. Impacts would be negligible at the two crossings on the Nenana River for project operations.

The potential impacts noted above under the mainline pipeline facilities operations and maintenance would apply to the mainline route between MP 540 and MP 555. Potential impacts would include reduced riparian habitat and therefore function along the six stream crossing locations. Impacts to fisheries resources would be considerable compared to impacts expected from the Denali National Park Route Variation.

TABLE 5.6-10 Comparison of Denali National Park Route Variation to Main Route from MP 540 – MP 555

	MP 540 – MP 555	Denali National Park Route Variation
Total Number of Stream Crossings	6	2
Anadromous Streams	0	2
Resident Fish Streams	1	0

Stream Crossing Impacts to Fisheries Resources

Changes to the Existing Thermal Regime

Maintaining the existing thermal regime of the waterbody is an important factor in limiting impacts to fishery resources. A chilled buried pipeline may reduce the water temperature and flow in the stream creating ice damming on stream beds or form aufeis (thick layers of ice by successive freezing of stream overflow). This could result in a reduction of water flow downstream, or divert water outside of existing stream channels (AGDC 2011a). This altered environment for fisheries resources may affect behavior, survival and productivity. Changes in the water temperature, and sediment composition of the hyporheic zone could cause a delay in hatching or direct mortality of embryos.

The pipeline would be buried to a depth that provides a minimum of five feet of cover for all streams (AGDC 2011a), and would be maintained at an ambient temperature as much as practicable. The pipeline would be operated at an ambient temperature closely approaching seasonal temperatures of the surrounding ground at the extent most practicable (AGDC 2011a). Pipeline temperatures would be maintained below freezing temperatures in permafrost terrains and above freezing temperatures in thawed ground settings to prevent frost bulbs from forming around the pipe. Frost bulbs could lead to frost heave displacement of the pipeline or adverse hydraulic impacts on drainages crossed by the pipeline (AGDC 2011a). Engineering controls such as insulation and non-frost susceptible fill would be used to control the thermal signature of the pipeline to minimize effects on the existing thermal regime of the surrounding soils.

Direct Mortality

Direct mortality could occur to fish and embryos from excavation in the stream bed. Eggs and fry may be impacted at the construction site or downstream where increased sedimentation may reduce viability by causing gill irritation and behavioral modifications of fish and/or smother eggs (Reid et al. 2004). In addition, water diversions and temporary dewatering during construction may cause desiccation or freezing of developing eggs and pre-emergent fry. Potential fuel or hazardous material spills that occur during construction may also lead to direct mortality.

Barriers to Fish Movement

Construction-related activities could temporarily impede fish passage. Open-cut methods that require water diversions during the open-water construction period could create temporary physical barriers to fish passage or alter stream flows sufficiently. This could create either high or low water flows that prevent fish movements to rearing or spawning habitats. Juvenile salmonids are particularly dependent upon connectivity between tributaries and mainstem habitats (STB 2011, Bramblett et al. 2002). Spawning fish that are unable to reach optimal spawning habitat may be required to use alternative suboptimal spawning habitat, which could result in reduced survival of eggs, larvae, and juvenile fish (STB 2011). The likelihood of these impacts occurring would be minimal because the AGDC anticipates that in-water work would be complete between 1 to 3 days from initiation (Section 2.2.3.2). Thus this time period would not likely cause a substantial barrier for spawning, rearing or migrating fish.

In-stream and Riparian Habitat Loss and/or Alteration

Fish habitat at the crossing location could be altered directly through excavation and backfilling of the pipeline trench changing substrate and stream bank conditions and removing riparian vegetation. Changes in habitat can result in a variety of impacts to fish, including direct mortality and changes in population size and structure, reproduction, and growth rate (BLM 2002). Riparian vegetation is extremely important for fish as noted above (STB 2011, Brown et al. 2002). The roots of riparian trees and shrubs prevent erosion by holding stream banks in place as well as trapping sediment and pollutants which help maintain water quality. During high stream flow periods, riparian vegetation and woody debris slows and dissipates flood waters which help to prevent or minimize erosion that can damage fish spawning areas and aquatic invertebrate habitats. Loss of riparian vegetation also reduces shading which can cause: increased water temperature, reduced dissolved oxygen, reduced nutrient input, and increased predation of certain fish species due to reduced cover (STB 2011, Brown et al. 2002). Loss of riparian vegetation and disturbance to the bank and substrate can also alter benthic communities, changing prey availability for fish (Brown et al. 2002). As logs and woody debris land in the stream, they provide fish habitat by forming cover and slow water velocity areas for juveniles as refuge.

Degradation of Water Quality

Construction activities (excavation, clearing vegetation and grading) and access road development would expose soil to erosion processes (wind, rain, and stream flow). Erosion causes increased sedimentation and turbidity which can degrade water quality, reduce fish habitat quality and fish productivity (Waters 1995). Impacts from increased sedimentation on fish include: decreases in fish feeding efficiency, reduced levels of invertebrate (prey) species, smothering of incubating eggs, and decreases in fish spawning success (Reid and Anderson 1999). Due to their relative immobility, egg and larval life stages may be at greatest risk to be negatively affected by increases in suspended sediment concentration and sediment deposition (Reid and Anderson 1999). Although most fish populations can withstand short-term changes in turbidity and sedimentation, long-term adverse impacts can occur if sediment loads are extremely high or occur for extended periods of time (BLM 2002).

Pollutants could also potentially be introduced into waterbodies during construction. Fuel leaks during construction would reduce water quality, potentially resulting in toxic effects to fish and aquatic invertebrates. Spills and leaks could enter the water either directly from in-stream equipment or indirectly from runoff from adjacent road beds.

Alteration of Stream Hydrology

The hyporheic zone is the region beneath a stream bed where there is mixing of shallow groundwater and surface water. Hyporheic flow and groundwater upwelling (springs) are important for developing salmon eggs (STB 2011, Brown and Mackay 1995, Baxter and McPhail 1999). Construction activities may cause changes in flow patterns of the hyporheic zone by dislodging fine sediments that can clog interstitial spaces or compact substrates (STB 2011, Sear 1995, Huggenberger et al. 1998). As noted above, stream hydrology may also be altered by ice bridges

Introduction of Non-native Species

Introduced non-native species compete for food and space with native species and can transmit diseases (e.g., whirling disease [*Myxobolus cerebralis*]), that could adversely impact fish and sensitive life stages. Invasive aquatic plant species can be introduced into waterways and wetlands and spread by improperly cleaned vehicles and equipment operating in water, stream channel, or wetlands (Cowie and Robinson 2003, Fuller 2003). Alaska has had relatively few problems with invasive, non-native aquatic plants in the past. However, invasive aquatic plants are increasingly posing a threat to native aquatic communities in Alaska (Portland State University 2009). Actions taken to detect and prevent the introduction and spread of invasive aquatic plants in Alaska are needed to avoid the environmental and economic harm invasive plants have caused in other parts of the United States (Portland State University 2009). Riparian and aquatic invasive species that are a concern for freshwater streams in Alaska include, but are not limited to: Canadian waterweed (*Elodea canadensis***)**, didymo (*Didymosphenia geminata*), white sweetclover (*Melilotus alba*), and reed canarygrass (*Phalaris arundinacea*). If heavy equipment is being shipped to Alaska from the continental United States, other invasive species such as hydrilla (*Hydrilla verticillata)*, Eurasian watermilfoil (*Myriophyllum spicatum*), and New Zealand mudsnails (*Potamopyrgus antipodarum*) are also of concern.

5.6.3 Mitigation

The proposed Project would incorporate the combined efforts of fish life history stage timing considerations, construction impact mitigation, site specific crossing techniques, seasonal conditions, contingency plans, thermal regime considerations, water quality testing, and water quality compliance; the construction and normal operation of the proposed Project is unlikely to have long-term adverse effects on fisheries resources.

The following mitigation measures would be implemented by the AGDC to minimize impacts on fishery resources:

- Pipeline construction would be conducted in a manner and during a time period that avoids or minimizes potential effects on fishery resources.
- Each stream crossing would be individually permitted and all in-stream pipeline crossing construction methods would be coordinated with the anadromous and resident fish migration and spawning time periods for in-stream work.

- Construction activities would be scheduled in cooperation with the ADF&G to minimize impacts to fishery resources.
- In-stream pipeline construction would be completed in one to three days from initiation.
- The proposed Project would primarily be co-located within existing ROWs, thereby minimizing the need for riparian clearing.
- The AGDC would consult with the BLM and follow ADNR's Plant Materials Center Revegetation Manual for Alaska. The Stabilization, Rehabilitation, and Restoration Plan stipulate seed mixes for different geographic areas, seed application methods, and application rates (if any) for fertilizers.
- To minimize erosion, after the design grade is obtained, cut slopes would be stabilized immediately and stream banks would be returned to as near pre-construction conditions as possible.
- The AGDC would collaborate with the ADFG to apply appropriate instream bank erosion structures (coir logs, willow cuttings) to mitigate for post-construction bank instability.
- The AGDC would develop an Erosion Sediment Control Plan and SWPPP prior to the commencement of construction, which outlines erosion control best management practices (BMPs) to minimize the potential for upland sediment from entering waterbodies. As part of this, bank and bed scour protection would be installed after the pipeline is installed as part of the trench backfilling.
- To protect stream banks and beds from scour erosion, BMPs would be determined based on scour and erosion potential at each site. BMPs likely to be used include geotextiles, rock armoring, coir fiber mats, plant cuttings and combinations of these and possibly other materials and methods.
- The AGDC would have an approved Spill Prevention and Control Plan (SPCP) prior to construction. The SPCP would be developed in accordance with all pertinent regulations and would follow BMPs. The SPCP would identify material handling procedures and storage requirements and outline the actions to reduce spill potential.
- A Spill Prevention and Control and Countermeasure Plan (SPCC) must be developed for each storage facility able to store at least 1,320 gallons of fuel to prevent petroleum spills from reaching navigable waters. The SPCC would be maintained on site.
- The AGDC would develop a Non-native Invasive Plant Prevention Plan to address procedures to reduce or eliminate the spread of non-native invasive plants.
- Open-cut isolation methods using flumes would only be used in waterbodies with flows that would not exceed the capacity of the flume.
- Open-cut isolation crossings using pumps would only be used for stream crossings where pumps can adequately transfer streamflow volumes around the work area and there are no concerns about sensitive species passage.

- For open-cut isolation methods, appropriate fish screening to minimize entrainment of fishes would be used.
- A Fish Habitat permit from the ADF&G could be required for any blasting operations that occur either in or near the banks of a fish bearing waterbody. A Blasting Control Plan would be developed in accordance with ADF&G blasting standards to protect adult fish, juvenile fish and developing fish eggs when blasting activities occur in or near streams.
- Stream crossings using HDD would have the entry and exit workspaces set back at least 50 feet from the waterbody to reduce the risk of drilling mud from entering the stream.
- HDD drilling mud and slurry would be stored away from the waterbody in tanks, behind earthen berms, or by other methods that would prevent it from flowing off the work area.
- HDD activities would be constantly monitored to immediately detect if any inadvertent release of drilling mud has occurred.
- After installation of the pipeline, the HDD drilling mud would be disposed of according to applicable regulations.
- If a new bridge is built, no permanent structures associated with the bridge, such as footings, would be installed within ordinary high water of the Yukon River.
- Stream simulation culverts would be implemented at all road crossings that are too small to feasibly construct a bridge as per ADFG consultation.

In addition to the Applicant's proposed mitigation measures, the following mitigation measures should be included to protect fishery resources along the proposed Project.

- The AGDC should work with agencies as needed to gather information such as water depth, water chemistry, and upwelling's and whether flowing water occurs at each stream crossing during winter months, to further define sensitive life stages of fish at each stream crossing. To the maximum extent practicable, construction should be timed to avoid sensitive periods of fish at each stream crossing.
- Develop and implement contingency plans for HDD operations. The contingency plan should include instructions for downstream monitoring for any signs of drilling fluid during drilling operations and would describe the response plan and mitigation in the event that a release of drilling fluids occurred. Drill cuttings and drilling mud would be disposed according to environmental permitting.
- Develop an HAACP plan in accordance with ADF&G and USFWS standards for the prevention and/or spread of aquatic invasive species.
- Prior to any construction activities, thoroughly decontaminate all equipment upon entering the State of Alaska and any equipment stored in Alaska.
- All equipment and gear used by personnel (including boots, waders, etc.) should be decontaminated between watersheds to ensure invasive species are not inadvertently spread between work sites along the proposed Project.

- The Applicant shall comply with the reasonable requirements of Alaska Statutes (Alaska Stat. §16.05.841, Fishway required, and Alaska Stat. §16.05.871, Protection of Fish and Game) regarding project-related winter ice bridge crossings and summer ford crossings of all anadromous and resident fish streams. If necessary for winter ice bridge crossings, natural ice thickness could be augmented (through snow removal and water to increase ice thickness, or other techniques) if site-specific conditions, including water depth, are suitable for a crossing that would protect fish habitat and maintain fish passage.
- For riparian vegetation clearing, vegetation should be cut off at ground level to leave the existing root systems in place to provide streambank stability. In riparian areas, the pulling of tree stumps and rooting for grading activities should be limited to the area directly over the trench line.
- Where conditions allow, riparian vegetation should be restored with native plant species.
- Routine inspections should be used to identify areas of erosion, exposed pipeline and nearby construction activities to allow for early identification of bank stability problems and would minimize the potential for continuing environmental effects during pipeline operation.
- No freeze depressants should be discharged into any streams.
- Each stream crossing for access roads should be individually permitted and work should be performed to comply with Title 16 permit stipulations. Each crossing for access roads should be evaluated for fishery resources and the proposed crossing technique should be developed cooperatively with the ADF&G to avoid adverse effects to fish and fish habitat. The AGDC should gather information such as water depth, water chemistry, and whether flowing water occurs at each stream crossing during winter months to further define sensitive life stages of fish at each stream crossing. Construction of stream crossings for access roads should be timed to avoid sensitive periods to the maximum extent practicable.
- To minimize potential effects on fishery resources, the AGDC should comply with all ADEC water quality regulations during construction.

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5.7 MARINE MAMMALS

This section discusses the marine mammals that are not listed as endangered, threatened or candidate species under the Endangered Species Act (ESA) of 1973, that may occur within or adjacent to the proposed Project areas. There are three potential Project areas proposed for vessel activity for Project construction: the Port of Seward, Port of Anchorage and West Dock that will be discussed in detail below. The ESA listed and candidate species are included in Section 5.8 (Threatened and Endangered Species, T&E).

All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972 as amended. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The National Marine Fisheries Service (NMFS) has regulatory authority for all marine mammals relevant to the proposed Project with the exception of the sea otter, Pacific walrus and the polar bear, which are under the U.S. Fish and Wildlife Service's (USFWS) responsibility.

The affected environment, species descriptions by Project area, environmental consequences of the proposed Project, and mitigation measures are discussed in detail below.

5.7.1 Affected Environment

The proposed Project area includes the temporary use of up to three Alaska based port sites for the construction period (2 years) of the proposed Project. The Project areas in the marine environment include the areas expected for vessel use. The primary ports include the West Dock Port in the Northern Project area at Prudhoe Bay, and the Port of Seward (POS) in Resurrection Bay in Southcentral Alaska. The Port of Anchorage (POA) in Cook Inlet could be used to supplement vessel traffic with the POS (Figures 5.7-1 to 5.7-4).

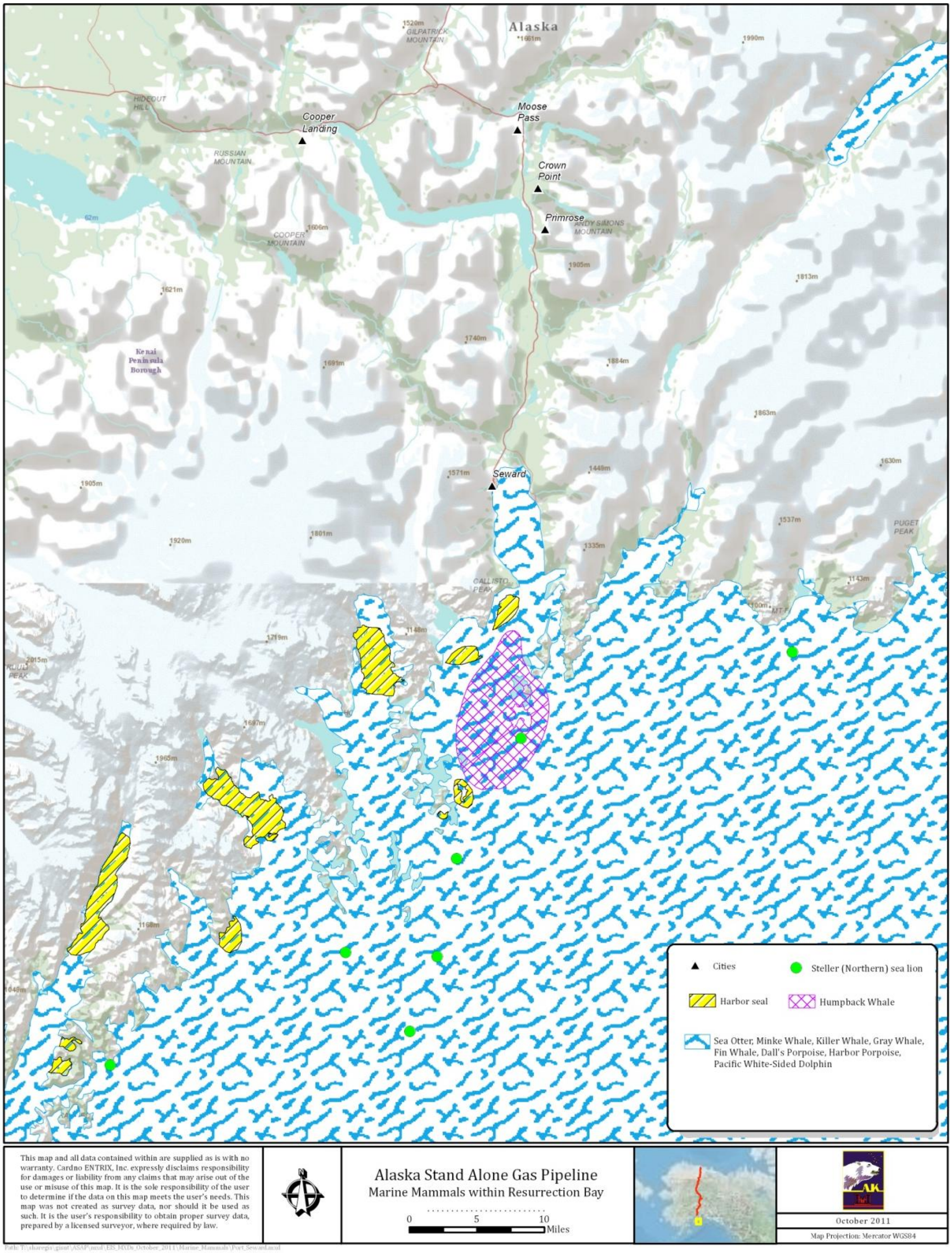

FIGURE 5.7-1 Marine Mammals within the Port of Seward in Resurrection Bay.

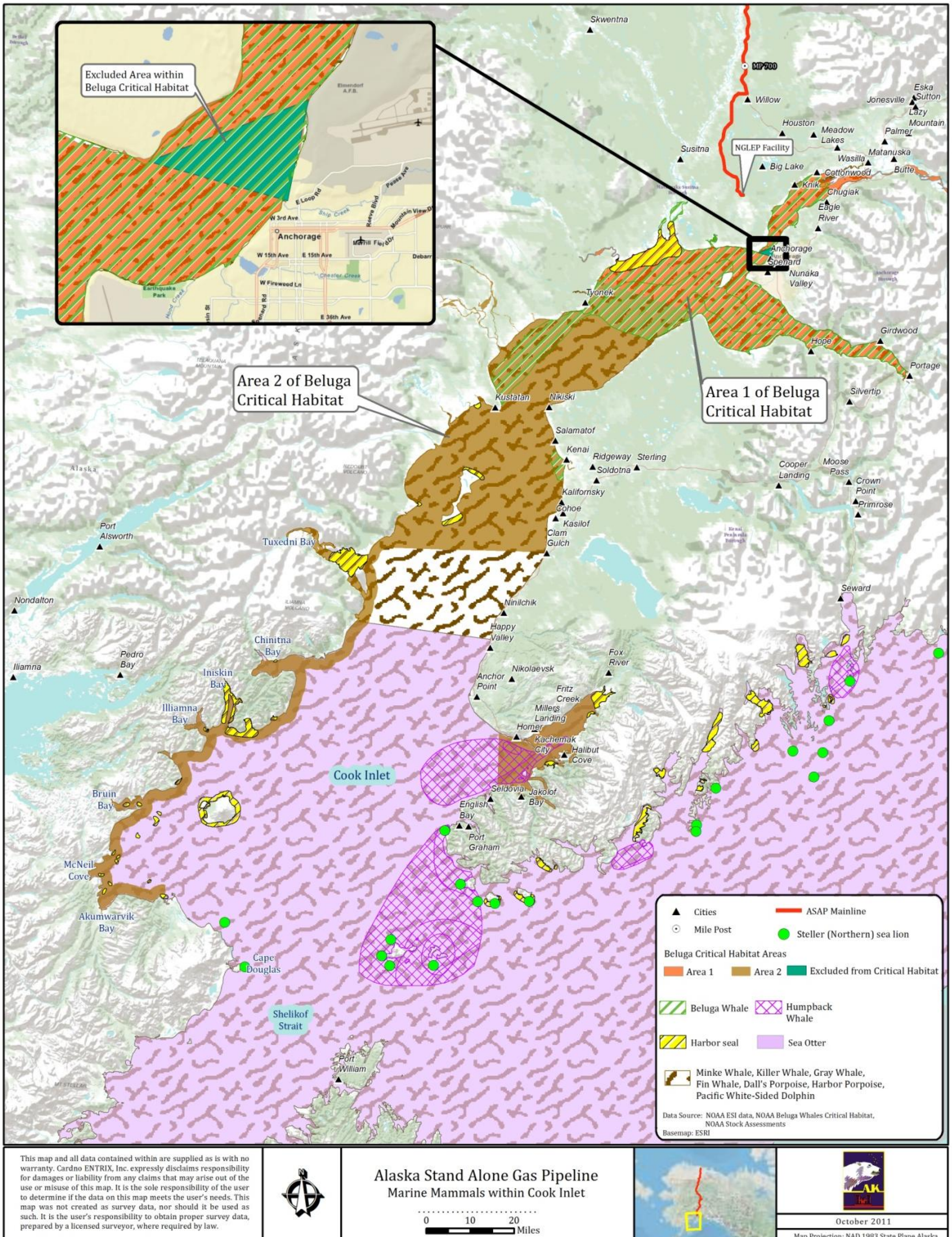

FIGURE 5.7-2 Marine Mammals within Cook Inlet.

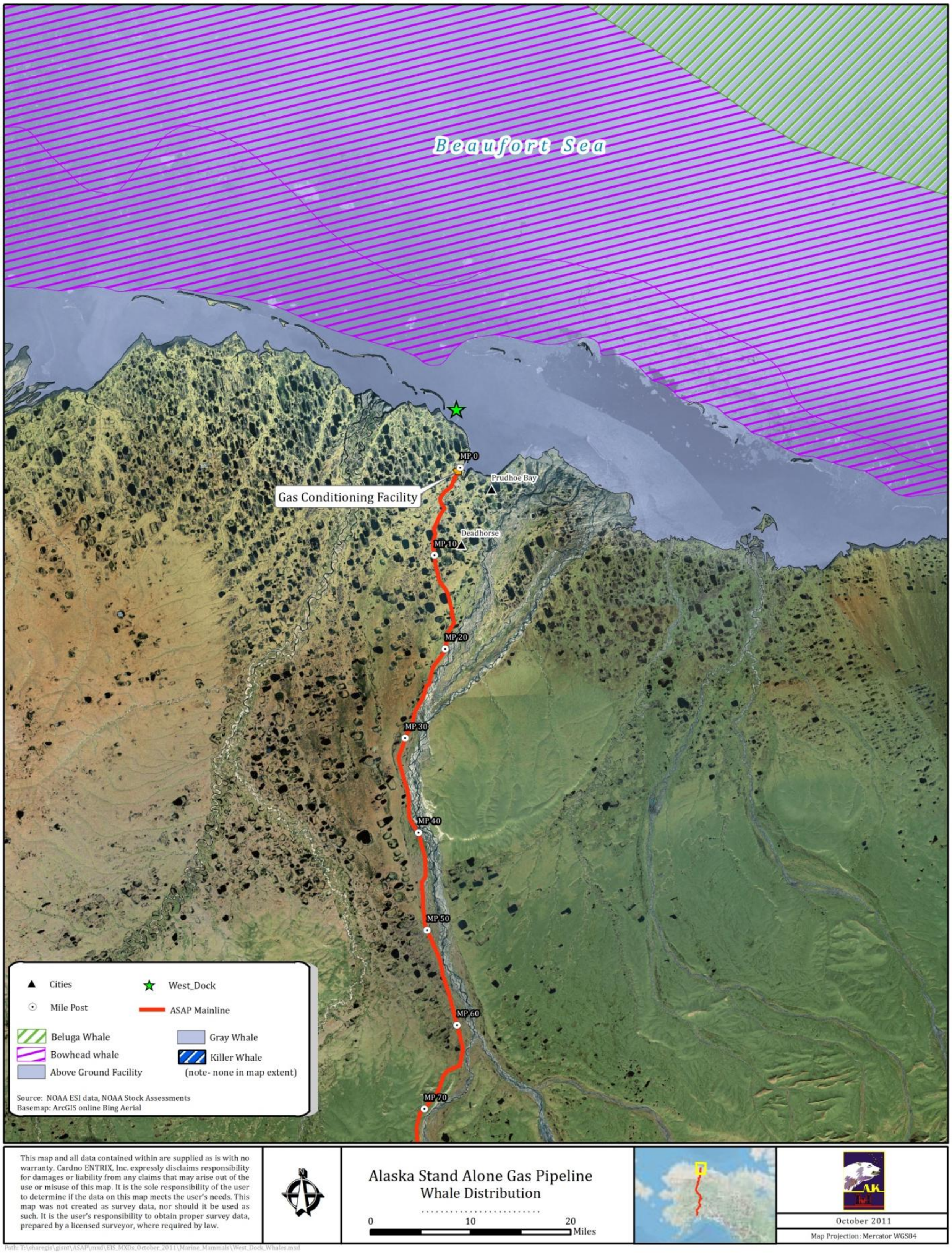

FIGURE 5.7-3 Whale Habitat near West Dock Port in Prudhoe Bay.

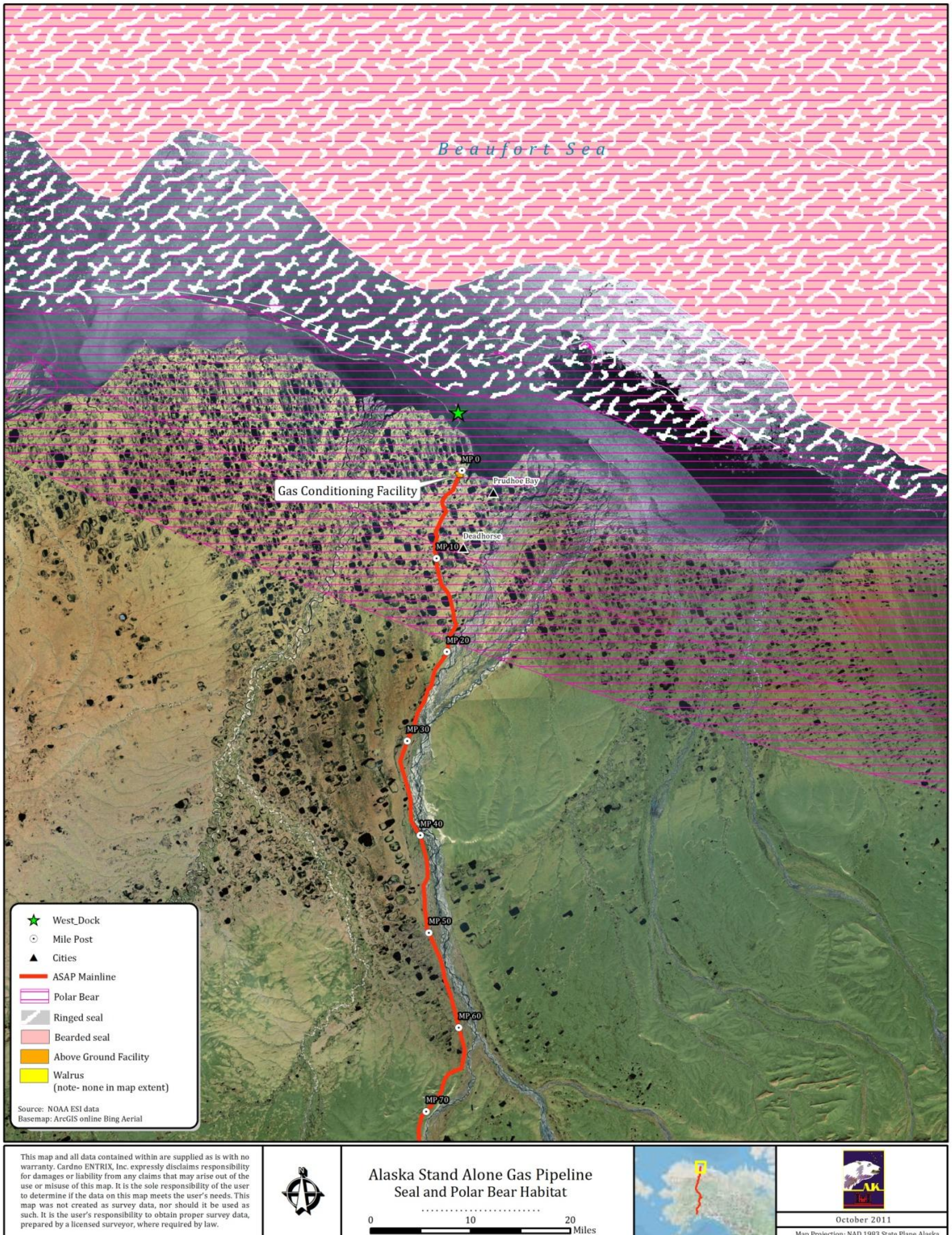

FIGURE 5.7-4 **Seal and Polar Bear Habitat near West Dock Port in Prudhoe Bay.**

Marine mammals that are not endangered, threatened, or candidate species, and were identified by the NMFS as potentially occurring within or adjacent to the proposed Project area are included in Table 5.7-1 below.

TABLE 5.7-1 Non-endangered and Non-threatened Marine Mammals That May Occur in or near the Proposed Project Area

Species	Occurrence in or Adjacent to Project Area	Primary Habitat	Primary Season of Use	Potential to Adversely Affect
West Dock Port				
Gray whale (*Eschrichtius robustus*)	may occur	shallow coastal	summer	no
Beluga whale (*Delphinapterus leucas*)	unlikely	coastal and offshore near ice	summer	no
Killer whale (*Orcinus orca*)	unlikely	coastal and offshore	summer	no
Port of Anchorage				
Harbor seal (*Phoca vitulina*)	may occur	haul out areas and near rivers	summer	no
Cook Inlet				
Minke whale (*Balaenoptera acutorostrata*)	may occur	inshore & offshore	summer	no
Gray whale (*Eschrichtius robustus*)	unlikely	inshore coastal	summer	no
Killer whale (*Orcinus orca*)	may occur	deep water inlet	year round	no
Harbor seal (*Phoca vitulina*)	likely	haul out areas	year round	no
Harbor porpoise (*Phocoenoides phocoena*)	may occur	shallow water inlet	year round	no
Dall's porpoise (*Phocoenoides dalli*)	unlikely	deep water inlet	year round	no
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	unlikely	deep water inlet	year round	no
Port of Seward				
Harbor seal (*Phoca vitulina*)	may occur	haul out areas	year round	no
Minke whale (*Balaenoptera acutorostrata*)	may occur	inshore & offshore	summer	no
Gray whale (*Eschrichtius robustus*)	unlikely	inshore coastal	summer	no
Killer whale (*Orcinus orca*)	may occur	fjords, coastal and offshore	year round	no
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	unlikely	deep water	year round	no
Dall's porpoise (*Phocoenoides dalli*)	unlikely	deep water	year round	no
Harbor porpoise (*Phocoenoides phocoena*)	unlikely	shallow water	year round	no

5.7.1.1 Species Descriptions by Project Area

Summaries of marine mammals that have the potential to exist in or adjacent to the Project areas are described below under the port area where they could occur. The information used to write the summaries below, was obtained primarily from the Biological Assessment (2011), NOAA Fisheries Office of Protected Resources online information, and NOAA Marine Mammal Stock Assessment Reports. The potential for the species to occur in or adjacent to the Project area was categorized as likely, unlikely, or may occur from documentation noted above (Table 5.7-1). Categorizing a species as "likely" to occur in the Project area was determined when regular habitat use and distribution overlapped with the proposed Project area. A species was categorized as "unlikely" to occur in the proposed Project area if the species does not inhabit the area. Categorizing a species that "may occur" in or adjacent to the proposed Project area would include some habitat use in the area; the species is not common to the area, but low numbers could exist near the proposed Project area.

Port of Seward

The POS is located at the north end of Resurrection Bay in Prince William Sound in Southcentral, Alaska (Figure 5.7-1 Map 1). All marine mammals identified by the NMFS that may occur in or adjacent to the POS Project area are described below. ESA species including the fin whale, humpback whale, sea otter and Steller sea lion are discussed further in Section 5.8 (T&E Species).

<u>Harbor Seal</u>

Harbor seals are true seals that are widely distributed across the North Pacific and North Atlantic Oceans. There are five subspecies of harbor seal; however, the Alaska population would be the only stock to potentially occur near the POS. The Alaska stock inhabits the temperate coastal waters from Southeast Alaska to the Bering Sea. Adult harbor seals are approximately 6 feet long, weigh 245 pounds, and are a blue gray color with light spots or rings. They primarily eat fish (salmon, eulachon), shellfish and other invertebrates in shallow and deep water areas. Harbor seals give birth (pup) during the summer, and use rocks, beaches, ice, and reefs to haul out to rest, to pup, and for thermoregulation.

The harbor seal is one of the most common marine mammals in Prince William Sound. The Prince William Sound area has numerous fiords, bays, islands and coastline, which provides optimal habitat for harbor seal haul out areas. The Gulf of Alaska population is still relatively small compared to its previous stock size in the 1970s and 1980s (NOAA 2011). The current population estimate for Alaska harbor seals is 180,017 (NOAA 2011), and the Gulf of Alaska stock population is estimated at 45,975 (Allen and Angliss 2011).

<u>Minke Whale</u>

Minke whales are the smallest species of the baleen whales, and have dark, sleek bodies with a white underside reaching up to 35 feet in length and 20,000 pounds in weight. They usually occur in small groups of 2-3 whales when feeding, but can occur in loose aggregations of up to

400 animals. Minke whales feed primarily on plankton, crustaceans (krill), and small fish (herring, capelin, sand lance, and cod). Minke whales calve in the winter and mother and calf pairs remain in the lower latitude areas of their range during the overwinter period.

Minke whales have a wide distribution of habitat, from polar (summer) to tropical (winter), and coastal and offshore waters. They are relatively common in the Bering Sea, Chukchi Sea and inshore waters of the Gulf of Alaska (Allen and Angliss 2010). Older whales will migrate higher in latitude to feed during the summer, and immature whales will stay in lower latitude areas. There are four distinct populations of minke whales. Two distinct populations in U.S. waters are the Alaska Stock and the California-Washington-Oregon Stock. The Alaskan Stock is considered migratory and the California-Washington-Oregon Stock is resident. It is unknown what the estimated population is for Alaska minke whales due to insufficient data (Allen and Angliss 2009). However, the most recent minke whale abundance was estimated to be 1,233 for the Gulf of Alaska to the Central Aleutian Islands areas (Zerbini et al. 2006).

Gray Whale

The gray whale is a large baleen whale with a mottled gray color, and has small eyes. They can grow up to 50 feet long and weigh 80,000 pounds. They are benthic filter feeders that sift through mud on the sea floor to feed on amphipods. Unlike most other whales, gray whales do not have a dorsal fin, but possess a dorsal hump. Gray whales travel solitary or in small groups; however, they have been found in large groups on breeding grounds or in concentrated feeding areas. Due to their feeding behavior, gray whales inhabit shallow (less than 60 meters) coastal waters (Moore and DeMaster 1997).

There are two populations of gray whale: the Eastern North Pacific gray whale that exists in Alaska, and the western North Pacific that inhabits the waters along eastern Asia. The Eastern North Pacific population was delisted from the T&E Species list in 1994 due to rebounding population size (NOAA 2011). Gray whales spend their summers feeding primarily in the northern and western Bering and Chukchi Seas, and winter off the west coast of Baja, California. Gray whales calve in lagoons typically less than 4 meters deep along the west coast of California in January and February before migrating north to Alaskan waters. The most recent abundance estimate (2006/2007) for the Eastern Pacific Stock gray whales is 19,126 (Allen and Angliss 2011).

Killer Whale

Killer whales are a medium size toothed whale with a black back and white undersides. They are sexually dimorphic, and males can reach 32 feet long and weigh 22,000 pounds; females can reach 28 feet long and weigh 16,500 pounds. Their diet can range from fish to marine mammals, depending if the population is “resident” or “transient.” The Eastern North Pacific resident killer whales feed primarily on salmon; transient populations in the same region feed on harbor seals, porpoise, gray whale calves, Steller sea lions and other whales.

Killer whales are the most widely diverse of the whales, inhabiting oceans all over the world, but are found in higher densities in colder waters. Killer whales are highly social and depend heavily on underwater sound for communication, feeding and orientation. Killer whales have specific vocalization types, and multiple dialects are known to exist within the same population among different pods in the Eastern North Pacific (i.e., residents, transients, and offshore). Each has different morphology, ecology, genetics and behavior. Resident and transient whales differ by the shape of the dorsal fin, skin pigmentation, primary prey (fish or marine mammals) and social group size and stability. Transient killer whales have a more erect dorsal fin, a different patterned pigmentation, and feed entirely on marine mammals and form small, and stable long term social groups compared to resident killer whales.

The AT1 transient population of killer whale is considered depleted under the Marine Mammal Protection Act. This population was first identified as a separate group of whales in the early 1980's in Prince William Sound. Since then, individual whales have been photo identified and re-sighted in Prince William Sound frequently through annual research efforts. This pod of killer whales were some of the most frequently sighted killer whales, in comparison to the Gulf of Alaska transient killer whales that are rarely seen in Prince William Sound. These whales are acoustically and genetically different than other transient killer whale pods which make them discrete from the "Gulf of Alaska" transients (Allen and Angliss, 2011). They also have a more limited range (200 miles); however, they have been identified in Resurrection Bay and Aialik Bay year round. The estimated population for the AT1 killer whales is currently 7 (Allen and Angliss 2011).

Pacific White-sided Dolphin

Pacific white-sided dolphins have a robust body with a short beak and large curved dorsal fin. The body is black with gray sides, dorsal fin and flippers. Their underside is white, and they have two long white stripes that extend from either side of their beak to the tail. Adult males can reach up to 8 feet long, and females are 7.5 feet long and male and females weigh 300-400 pounds. The Pacific white-sided dolphin is an extremely social animal, usually seen in schools of 10 to 100; however, they can occasionally be observed in large groups (thousands). They feed primarily on squid, small fish (capelin, sardines, and herring) and often hunt as a team to herd prey. Calving occurs in the summer months, and females give birth less than every other year (NOAA 2011).

Pacific white-sided dolphins inhabit temperate waters from the continental shelf to offshore waters. Two stocks have been identified for this species; the North Pacific Stock and the California-Oregon-Washington Stock. The North Pacific Stock inhabits the offshore and coastal areas from the Gulf of Alaska, to the Aleutian Islands, and rarely inhabits the southern Bering Sea. The current estimated population for the North Pacific Stock is 26,880 (Buckland et al. 1993).

Dall's Porpoise

Dall's porpoise are the fastest swimmers of all cetaceans (NOAA 2011). They are black or dark gray with white on their dorsal fin, tail and sides. They can reach up to 8 feet long and weigh 480 pounds. There are two morphs of this species; the "*truei"* is commonly associated with the Western Pacific Ocean stock, and the "*dalli*" is common in the Eastern Pacific population. The morphological difference is the location and size of the white thoracic patches. The Northeast Pacific area also possesses relatively common hybrids of Dall's and harbor porpoise (NOAA 2011). The Dall's porpoise are similar to the Pacific white-sided dolphin, in that they typically form groups of 2-20, but can be found in groups as large as thousands.

Dall's porpoise feed primarily at night on small fish (herring, smelts, and anchovies), squid, octopus, crabs, and shrimp. They can also dive to depths of 1,640 feet when feeding, and prefer to inhabit temperate waters more than 600 feet deep. Calving occurs between June and September, and calves will remain with their mothers less than a year. Dall's porpoise occur throughout the North Pacific; however, the Eastern North Pacific population is distributed from Baja California to the Bering Sea. Two stocks have been identified within this population; the Alaska Stock and the California-Oregon-Washington Stock. The estimated population for the Alaska Stock is 83,400 (Allen and Angliss 2011). There is a distribution gap in Alaska waters in the Upper Cook Inlet and the shallow eastern flats of the Bering Sea (Allen and Angliss 2011). Dall's porpoise are present all months of the year throughout their range in the eastern North Pacific.

Harbor Porpoise

Harbor porpoise have a small, dark grey, robust body with white undersides, and can reach up to 5.5 feet in length and range from 135 to 170 pounds. They exist in small groups of 2-5 animals, and feed primarily on small fish (herring, capelin), squid and octopus. Harbor porpoise inhabit coastal and offshore water in temperate and subarctic waters; however, they are primarily found in bays, fjords, and estuaries less than 650 feet deep (NOAA 2011). The harbor porpoise have a discontinuous distribution which includes the North Atlantic (west Greenland to Cape Hatteras), from Barents Sea to West Africa, and from Japan to the Chukchi Sea and Monterey Bay, California to the Beaufort Sea.

There are 10 stocks of harbor porpoise in U.S. waters; the Gulf of Alaska Stock is the stock that we will focus on below. Harbor porpoise in the Gulf of Alaska are commonly found in coastal waters less than 300 feet deep (Allen and Angliss 2011). Areas of high density use have been observed at Glacier Bay, Icy Strait, Yakutat Bay, Copper River Delta and Sitkalidak Strait (Dahlheim et al. 2000). It has been recommended to separate the Alaska Stock into 3 separate stocks; however, there is insufficient data to justify this at present. The Gulf of Alaska harbor porpoise latest abundance estimate is 31,046 (Allen and Angliss 2011).

Northern Project Area – West Dock Port

The West Dock Port is located approximately 2.7 miles offshore from Prudhoe Bay in the Beaufort Sea (Figure 5.7-3 and 5.7-4). West Dock is used regularly to support oil development in the Prudhoe Bay area. The bowhead whale, Pacific walrus, ringed seal and bearded seal which inhabit the Project area are discussed in Section 5.8 (T&E Species). There are three marine mammals that are not T&E listed that may occur in or adjacent to the proposed Project area at West Dock. These include: the beluga whale, gray whale, and killer whale. Brief summaries of each species are included below.

Gray Whale

Gray whales as described above are large baleen whales that feed in shallow waters along the coast of Alaska in the summer, and winter off the coast of California. Most gray whales feed along the coast of the Chukchi and Bering Sea but some travel along the Beaufort Sea coastline to feed. Gray whales were observed during the summer in the Alaskan Chukchi and Beaufort Seas primarily in 40 m water depths and area with less than 1 percent ice cover (Moore and DeMaster 1997). Shallow coastal and offshore shoals may provide habitat rich in prey for gray whales which may be important feeding areas for gray whales (Moore and DeMaster 1997). The estimated population for the Eastern North Pacific gray whales is 19,126 (Allen and Angliss 2011).

Beluga Whale

Beluga whales are medium sized, reaching 14 feet long, toothed whales that weigh approximately 3,000 pounds and inhabit Arctic and sub-Arctic areas. The adults are white, and calves are dark gray when born. Beluga whales do not have a dorsal fin, but possess a dorsal ridge, and feed on numerous prey items (fish, octopus, crab, clams, mussels, cod, sand worms, and flounder). Beluga whales have a unique trait in which their cervical vertebrae are not fused, which allows them to move their heads side to side and up and down. Beluga whales molt in the summer, and utilize gravel substrates near the confluence of rivers and estuaries to rub off the old skin. Beluga whales give birth to one calf in the spring (May to July) in estuaries and bays in relatively warm water (NOAA 2011). Calves will be nursed for 2 years and may remain with their mothers for a considerable time after.

Beluga whales are very social animals and have highly developed hearing, echolocation, and produce a variety of sounds and calls. They often travel in groups of 10 to several hundred. The Beaufort Sea beluga whales winter in the offshore waters of the Bering Sea near ice leads and polynyas (Allen and Angliss 2011). Polynyas are open water areas surrounded by sea ice. This population may migrate several thousand miles to reach overwinter areas. Beluga whales in the Beaufort Sea primarily feed in the deeper waters in the summer along the ice front; however, small numbers of belugas have been seen along the coastal waters of the Beaufort Sea. The Beaufort Sea beluga whale population estimate is 39,258 (Duval 1993). Five beluga whale stocks exist in Alaska, and the Cook Inlet Stock is considered the only strategic stock of beluga whale (NOAA 2011).

Killer Whale

Killer whales exist along the entire Alaskan coast. The Alaska resident killer whales are found distributed from southern Alaska to the Aleutians and Bering Sea. The population estimate for Alaska resident killer whales is 2,084 (Allen and Angliss 2011).

The transient stock of killer whales inhabits the area from Prince William Sound through the Aleutian Islands and Bering Sea. Transient killer whales that inhabit the northern Bering Sea and Beaufort Sea have been lumped into one population that includes the “Gulf of Alaska” transients. Although genetic information confirms there are three distinct communities of transient killer whales, there is insufficient data to resolve transient populations of killer whales.

The most current population estimate for the Gulf of Alaska transient killer whales is 552 (Allen and Angliss 2011).

Port of Anchorage and Cook Inlet

The POA is located in the Upper Cook Inlet, north of Ship Creek at the mouth of the Knik Arm in Southcentral Alaska (Figure 5.7-2). The Cook Inlet beluga whale, sea otter, Steller sea lion, humpback whale, and fin whale are ESA-listed species that will be discussed in Section 5.8 (T&E Species). Seven species of marine mammals that are not ESA-listed which may occur in or adjacent to the Project areas are: harbor seal, minke whale, gray whale, killer whale, Pacific white-sided dolphin, Dall's porpoise, and harbor porpoise. Brief summaries of each species are included below.

Harbor Seal

Cook Inlet harbor seals give birth (pup) from June through August, and peak in early August (Boveng et al. 2007). Harbor seals haul out on beaches, islands, mudflats and at mouths of rivers in the Cook Inlet to pup and feed on available prey. Their summer distribution is primarily along coastal waters of the Cook Inlet, and overwinter areas include the lower half of the Cook Inlet and the Gulf of Alaska (Boveng et al. 2007). Results of a study conducted by Montgomery et al. (2007) indicate that harbor seals were found to haul out near available prey and to avoid areas high in anthropogenic (human made) disturbance. The current population estimate for harbor seals in the Gulf of Alaska is 45,975 (NOAA 2011).

Minke Whale

Minke whales are considered migratory in the upper areas of their range (Allen and Angliss 2011). They are relatively common in the inshore waters of the Gulf of Alaska, but not considered abundant in any other part of the eastern Pacific Ocean (Allen and Angliss 2011).

Gray Whale

The Eastern North Pacific stock of gray whales primarily feeds in the northern and western Bering and Chukchi Seas during the summers, but whales have also been reported feeding near Kodiak Island, Southeast Alaska, and south along the Pacific Northwest (Allen and Angliss 2011). Gray whales head south to wintering grounds in November and December, and return northbound after the winter in mid-February to May with newborn calves.

Killer Whale

General biological information on killer whales is noted above in the POS Project area description. Specific population information on transient and resident killer whales inhabiting the Cook Inlet and Gulf of Alaska area is discussed below.

Killer whales have existed in the Lower Cook Inlet for thousands of years (Sheldon et al. 2003). The Cook Inlet population of killer whale is thought to be a mix of resident and transient individuals. Matkin et al. (1999) determined that of the 291 killer whales (photo identified) in Southcentral Alaska (Prince William Sound, Kenai Fjords, and Cook Inlet), 54 were transient.

Most of the confirmed sightings of killer whales in the Cook Inlet were located in the lower inlet area. There have been only 18 sightings of killer whales in the Upper Cook Inlet within the past 27 years (Sheldon et al. 2003). The small pod size and physical characteristics noted above for transient killer whales was observed in the Upper Cook Inlet, indicated that they were transient killer whales.

Two transient killer whale pods exist in the Gulf of Alaska, the "Gulf of Alaska" transients, and the "AT1" transients. The Gulf of Alaska transients are seen throughout the Gulf of Alaska including occasional sightings in Prince William Sound. The AT1 transients primarily inhabit the Prince William Sound and the Kenai Fjord areas. As noted earlier, the population estimate for transient killer whales is 552 (Allen and Angliss 2011). The Alaska resident population of killer whale includes whales that inhabit areas from Southeast Alaska, to the Aleutian Islands and Bering Sea. As listed above, the population estimate for Alaska resident killer whales is 2,084 whales (Allen and Angliss 2011).

Pacific White-sided Dolphin

Little information is known about the distribution of the Pacific white-sided dolphin in the Cook Inlet or the Gulf of Alaska. Pacific white-sided dolphins would be expected to inhabit the lower Cook Inlet more than the Upper Cook Inlet, near the POA due to the prey they eat and their pelagic habitat distribution (NOAA 2011).

Dall's Porpoise

Dall's porpoise have been sighted across the North Pacific and eastern North Pacific; however, there is a distribution gap in the Cook Inlet area and the shallow eastern flats of the Bering Sea (Allen and Angliss 2011).

Harbor Porpoise

The harbor porpoise in the Cook Inlet is the same population that inhabits the Prince William Sound and POS discussed above. Little information exists on harbor porpoise use of the Cook Inlet area. An aerial survey was conducted between 1993 and 1994 in the Cook Inlet to determine abundance of harbor porpoise. This study estimated that the population of harbor porpoise in the Cook Inlet was around 136 animals (Dahlheim et al. 2000). Preliminary data collected by Small (2010), detected harbor porpoise echolocations during a Cook Inlet beluga whale acoustic study conducted between 2007 and 2010. Harbor porpoise presence was especially prevalent in the lower inlet even with the short sampling periods. However, this species was also briefly detected in the upper inlet at Cairn point and Beluga River.

5.7.2 Environmental Consequences

5.7.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed and there would be no affects to marine mammals.

5.7.2.2 Proposed Action

Construction Phase

The proposed Project would require the temporary use of up to three port sites during the construction phase of the proposed Project to transport materials and equipment required for Project development. The 2-year construction period would be the only time that port activity would be required for the proposed Project. The proposed Project would also be further limited to port use during the open water season for the northern Project area at West Dock in the Beaufort Sea. Shipping would not occur during periods of sea ice development in the Arctic. The POS would be the planned port of entry for pipe and equipment delivery due to Alaska Railroad (ARR) access, available storage, and year round accessibility.

Vessel Activity

Vessel use is the only construction activity that would occur in the marine environment for the proposed Project. Pipe would be shipped using Small Handy Class cargo ships which are capable of carrying up to 10,000 tons per shipment (AGDC 2011). The potential impacts that could occur to marine mammals from vessel use in or near the proposed Project areas are included below.

Disturbance

Disturbance to marine mammals from vessel activity could be in the form of noise, movement, or a potential collision. Vessel noise would be the likeliest impact with the potential to disturb marine mammals and will be discussed in detail. The audibility of a sound is determined by radiated acoustic power, propagation efficiency, ambient noise, and the hearing sensitivity of the marine mammal receiving the sound (Richardson et al. 1995). Sound propagation can be affected by many variables in the marine environment including: bathymetry, substrate, frequency, intensity, and pressure of the sound. Underwater noise received from the source can depend on direction, source depth, receiver depth as well as distance. For example, a sound produced in the same area at different times may be detected at highly varied distances depending on regional and temporal changes altering the sounds propagation conditions. A moderate sound level transmitted over an efficient pathway could be received at the same distance and level as a higher level sound source due to attenuation. The way in which a species hears a sound also has many variables, which makes it difficult to determine how vessel noise affects marine mammals.

Sounds levels and frequency characteristics are roughly related to ship size and speed, but there is significant individual variation among vessels of similar classes (Richardson et al. 1995). Vessels produce low frequency underwater noise (less than 180 dB) from their engines which could cause some temporary avoidance behavior of marine mammals. As noted above, there are many variables involved in determining how underwater sound characteristics affect marine mammals. The low frequency noise produced could attribute disturbance more to baleen whales that communicate at low frequencies (10 Hz to 31 kHz) compared to other marine mammals (Richardson et al. 1995). Marine mammal exposure to high noise levels could result in a temporary threshold shift which can last from minutes to days (Richardson et al. 1995). The magnitude of the temporary threshold shift depends on the level and duration of noise exposure in addition to other factors. Negative effects include the temporary inability for marine mammals to hear natural sounds for communication, locating predators and prey, and navigation. Noise produced from the expected increase in vessel activity along transportation routes would be considered relatively temporary, and localized. Marine mammals could be displaced temporarily if they are found in the vicinity of vessel activity. It is expected that marine mammals would swim away from the noise source until a comfortable distance has been reached and return to natural behavior. Marine mammals would likely be habituated to the existing regular vessel traffic use of these shipping lanes and port use throughout the year.

Cargo vessels primarily travel in a relatively slow, forward, linear direction, with minimal course changes. The consistent pattern and speed of travel would enable marine mammals to predict and avoid the path of vessel movement. Vessel strike information collected between 1978 and 2006 indicates that small (less than 15m) vessels were responsible for the largest number of whale-vessel collisions (Gabriele et al. 2007). Jensen and Silber (2003); however, have determined that all type and size of vessels pose a threat for whale collisions. Collisions can also be specific to the species (fin and humpback whales). Fin and humpback whales are the victims of most vessel collisions due to feeding behavior along near shore areas that overlap with the majority of small boat and cruise ship activity. Sixty-two collisions were reported in Alaskan waters between 1978 and 2006; the majority (74 percent) were humpback whales and occurred in Southeast Alaska (Gabriele et al. 2007).

Five whale collisions (8 percent) out of the 62 were reported between 1978 and 2006 from Gabriele et al. (2007) in the area proposed for vessel use for the proposed Project. Two of the vessels were very large (>600 feet long), one container ship at the POA and one cruise ship at the POS and the remaining three vessel collisions with whales reported were a charter boat and commercial fishing vessel (each 27 feet long) and a tour boat (87 feet long). Vessel activity proposed for the Project would not significantly increase the volume of marine traffic in the port areas. No small handy class sized cargo vessels within the proposed Project area have been reported to cause whale collisions based on the data noted above. Current information indicates that collisions with whales are not a substantial source of injury or mortality (NMFS 2008).

Masking

Masking is the potential for vessel sounds to “mask” or obscure whale sounds needed for communication and detection of their environment. Masking can impede echolocation which is necessary for marine mammals to hear and function in the marine environment. Vessel movement would be transitory through the Project areas, which would produce minimal and temporary impacts to local whales associated along the transportation corridors and port locations.

Other Impacts

Vessels could unintentionally transport aquatic invasive species on hulls or within ballast waters, which could lead to reduced habitat suitability for marine mammals. Routine vessel operations could result in small leaks of fuel and lubricants that are toxic to marine mammals. Marine mammals that frequent harbor areas such as harbor seals or Steller sea lions would be most likely to be exposed to chronic leaks and spills. This would be a near negligible impact when considering the relatively minimal vessel activity this Project would produce in relation to regular vessel traffic in the Project area. Loss of power and grounding of transport vessels could lead to rupture of fuel tanks and larger accidental spills that are toxic to marine mammals. Most marine mammals would avoid areas with active fuel spills, but some exposure could occur.

Description of Use by Project Area

Port of Seward

Thirty-five shipments would be required during the construction phase of the Project to fulfill pipe delivery to the POS (AGDC 2011). The 2010 port calls at the ARR freight dock was 200 (146 freight vessels and 54 cruise ships) at the POS (ARR 2011). The expected increase in vessel activity within the POS ARR freight dock from Project construction would be approximately 17 percent. In addition to the ARR freight dock, various size vessels arrive and depart the POS small boat harbor daily throughout the year. These vessels include wildlife tour boats, commercial fishing boats, and recreational boats. Most marine mammals would likely be conditioned or habituated to the regular vessel activity and associated noise in the POS area and Prince William Sound. Table 5.7-2 includes a summary of the species, primary habitat, likelihood of occurrence and potential to adversely be affected by increased vessel traffic.

Harbor Seals

Harbor seals are year round residents in the Prince William Sound area, and are curious creatures. Few harbor seals would be likely to occur at the POS; most harbor seals would occur near haul out areas. Individual seals that inhabit the POS area would likely be habituated to the existing vessel activity. Harbor seals that would come in contact with vessel traffic would swim or dive away from vessel noise. Harbor seals would not be adversely affected from the increase in vessel traffic created from construction activities of the proposed Project.

Minke Whales

Minke whales primarily inhabit the Prince William Sound fjord areas in the summer to feed on schooling fish and krill. They are not known to frequently inhabit the north end of Resurrection Bay near the POS. Vessel noise and movement would potentially cause disturbance to minke whales which would alter whale feeding behavior temporarily. Minke whales would swim away from the source of disturbance until a comfortable distance has been reached and continue feeding. Vessel traffic produced from Project construction activity would not adversely affect minke whales at the POS.

Gray Whales

Gray whales are not known to inhabit the POS area or Prince William Sound because they feed primarily along the shallow waters of the northern and western Bering and Chukchi Seas. Vessel traffic from the proposed Project would not adversely affect gray whales near the POS or Resurrection Bay.

Killer Whales

The transient killer whales (AT1 and Gulf of Alaska stocks) are the primary killer whale stocks that would come in contact with additional vessel traffic in Prince William Sound, if vessel activity occurred in the summer. However, if vessel activity occurred in the fall through spring, up to seven resident killer whales pods could be utilizing the same area (Yurk et al. 2010). Killer whales are not known to frequent the POS area; however a 5-year acoustic study conducted by Yurk et al. (2010) detected seven distinct resident killer whale pods in Prince William Sound between September and May. As stated earlier, sightings of the AT1 stock have been rare in recent years, and the population includes an estimate of 7 individuals (Matkin et al. 1999). Killer whales would react to vessel activity similar to other whales. Natural behavior would be disturbed temporarily until the vessel was at a comfortable distance for the whales to return to normal behavior. It is unlikely that killer whales would be adversely affected by a 17 percent increase in vessel traffic at the POS.

Pacific White-sided Dolphin, and Dall's Porpoise

The Pacific white-sided dolphin and Dall's porpoise are often associated together and inhabit the offshore and coastal areas of the Gulf of Alaska and Prince William Sound. These species are fast, agile swimmers that have the ability to escape any potential disturbance from vessel traffic. These species are not known to utilize the habitat at the POS, and would likely be habituated to vessel traffic in the Prince William Sound. Dall's porpoise in particular are known for bow riding vessels in the Prince William Sound area. An increase in vessel traffic at the POS would be not adversely affect Pacific white-sided dolphin or Dall's porpoise.

Harbor Porpoise

Harbor porpoise are coastal species that prefer to inhabit bays, estuaries, fjords and harbors less than 100 meters deep. Areas of known high densities include Glacier Bay, Icy Strait, Yakutat Bay, Copper River Delta and Sitkalidak Strait (Dahlheim et al. 2000), where prey are concentrated. Cargo vessel traffic utilizes shipping lanes and routes in Prince William Sound, which are not typically located within shallow near shore waters. Few harbor porpoise if any would be associated with the POS area due to the 150-300 meters water depth in Resurrection Bay (Suleimani et al. 2009) as they prefer shallower waters. Harbor porpoise would not be adversely affected from the proposed additional vessel activity.

Northern Project Area – West Dock

Nine shipments would be required to complete delivery of all materials and equipment to the Northern Project area for ROW and GCF development at Prudhoe Bay (AGDC 2011). The 2010 port calls for commercial barges at West Dock was 182 vessels (W. Nash Pers. Comm. 2011). This vessel count does not include barges that land at the beach heads or the hovercraft usage to Northstar Island. Hovercraft is the primary mode of transportation to Northstar Island; however, its use is wave and weather dependant. The frequency of hovercraft use can range between 3 to 7 round trips a day depending on the activity on the island (W. Nash Pers. Comm. 2011). Vessel activity for the Project construction period would increase vessel traffic at the West Dock Port by 5 percent or less compared to 2010 vessel use noted above. For further information on the summary of the species, primary habitat, likelihood of occurrence and potential to adversely be affected by increased vessel traffic see Table 5.7-2 on page 22.

Gray Whales

Most of the Eastern North Pacific gray whale population spends the summer feeding in the northern and western Bering and Chukchi Seas (Rice and Wolman 1971, Nerini 1980). Minimal information exists on gray whale use in the coastal waters of the Beaufort Sea; however, Maher (1960) indicated that gray whales inhabit the western coastline of the Beaufort Sea as far as Barter Island. In 1980, Rugh and Fraker (1981) observed three gray whale sightings in the eastern Canadian Beaufort Sea. Overall, gray whales are not expected to be abundant in the area. The slow movement and shallow water feeding behavior of the species may coincide with areas of near shore vessel activity along the transportation route. Moore and Clarke (2002) illustrated that gray whales respond to continuous broadband noise when sounds levels exceed 120dB[2] and to intermittent noise when levels exceed 170dB by changing their swimming course to avoid the noise source. The few gray whales that may exist in the proposed Project area would show avoidance to vessel activity and move away from the disturbance. A 9-shipment increase in vessel traffic over the 2-year construction period would not cause adverse impacts to gray whales.

Beluga Whales

Beluga whales have not been documented to inhabit the West Dock area, but the possibility exists for a few whales to occur along the transportation route during their westbound migration in the fall. The Beaufort Sea beluga whale population primarily inhabits deep water areas along ice edges. Increased vessel traffic may temporarily disturb and cause masking effects to beluga whales if they were found in the transportation lanes to West Dock. The common reaction of beluga whales from vessel activity would be to swim away from the source of the noise. Beluga whales would not be adversely affected by vessel traffic in the West Dock area from construction activity.

Killer Whales

Little information is known about killer whale habitat distribution in the Beaufort Sea. Killer whales have not been documented inhabiting the shallow coastal waters of the West Dock area. Killer whales in the Beaufort Sea are likely transient whales, and would potentially inhabit areas where bowhead whales migrate with calves, or in areas where beluga whales are common. However, transient killer whales may also prey on gray whales which inhabit shallow water areas to feed. Few killer whales would be found within the transportation route to West Dock. Killer whales would avoid areas with anthropogenic noise by swimming away from the source, and would not be adversely affected by construction activities of the proposed Project.

Port of Anchorage

The POA receives approximately 500 port calls annually (POA 2011). These vessels primarily include container ships, dredges, oil barges, tugs, and oil tankers. It is undetermined what vessel use would occur at the POA from the proposed Project. The POA could be used as an additional port site to supplement the 35 vessel shipments expected for the POS. Table 5.7-2 includes a summary of the species, primary habitat, likelihood of occurrence and potential to be adversely affected by increased vessel traffic.

Harbor Seal

Harbor seals that occur in the POA area would likely be habituated to vessel activity. Relatively few harbor seals would be expected to occur in the area, and would potentially occur during the peak of salmon runs into Ship Creek, or the Knik Arm drainages. Harbor seals would avoid areas with anthropogenic sounds, by diving and swimming away from the source of noise. Harbor seals would not be adversely impacted by the additional vessel traffic in the POA from supply shipment for construction activities of the Project. Harbor seals in the Cook Inlet primarily pup, haul out and feed in the summer near river mouths where prey is plentiful. Harbor seals that inhabit Cook Inlet would not be adversely affected by increased vessel traffic.

Minke Whale

The minke whale would be the most likely to occur in lower Cook Inlet than the POA area, due to feeding behavior and habitat characteristics. Minke whales could occur in the vicinity of vessel activity during the summer along shipping lanes when vessels enter the Cook Inlet. Minke whales would avoid vessel activity by swimming away to utilize alternate feeding areas. Temporary habitat disturbance could occur, delaying feeding activities; however, no adverse affects would be expected from increased vessel use in the Cook Inlet from Project development.

Gray Whale

Gray whales would not be adversely affected by increased vessel traffic in Cook Inlet from Project construction activities. As noted above, gray whales primarily inhabit the west coastal areas of Alaska outside of the Cook Inlet.

Killer Whale

Resident and transient killer whales likely inhabit lower Cook Inlet, but the rare occurrence of transient killer whales has only been documented in upper Cook Inlet waters (Sheldon et al. 2003). Killer whales could occur in the vicinity of vessel shipping lanes in lower Cook Inlet; however, the potential increase in vessel activity would not adversely affect killer whales. Disturbance from vessel traffic would temporarily displace killer whales from feeding or travelling within the lower Cook Inlet.

Pacific White-sided Dolphin and Dall's Porpoise

The Pacific white-sided dolphin and Dall's porpoise overlap in their distribution and are therefore discussed together. These species could likely occur in the lower Cook Inlet waters and could potentially be associated with shipping lane areas. These species are playful, agile swimmers and are often found bow riding in the wake of boats. Pacific white-sided dolphins and Dall's porpoise would not be adversely affected by a potential increase in vessel activity in the Cook Inlet from Project construction.

Harbor Porpoise

Harbor porpoise inhabit relatively shallow water areas as stated before, and would not likely be found in the path of vessel traffic in lower Cook Inlet. Harbor porpoise also inhabit Upper Cook Inlet, and could occupy areas near the POA during periods when prey is available in Ship Creek or Knik Arm drainages. Harbor porpoise that inhabit the waters near the POA would likely be habituated to vessel traffic. Disturbance to harbor porpoise would result in the temporary change in behavior including swimming away or diving to get away from the source of noise. Harbor porpoise would not be adversely affected by a potential increase in vessel traffic from construction activities.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (1) construct a new aerial suspension bridge; (2) utilize the existing E.L. Patton Bridge; or (3) utilize HDD methods to cross underneath the Yukon River. Construction and operation of the proposed pipeline across the Yukon River would occur outside marine mammal habitats, and marine mammals would not be affected by any option.

Aboveground Facilities

Construction and operation of the aboveground facilities (Section 2.1.2) would not adversely affect marine mammals. All aboveground facilities would be located outside of marine environments, primarily on land or across freshwater drainages.

Operation Phase

No action is planned by the proposed Project at any port or docking locations during the operation and maintenance phases. Marine mammals would not be adversely affected by operation and maintenance of the proposed Project.

TABLE 5.7-2 Marine Mammal Occurrence, Stock Size, Habitat and Potential to be Adversely Affected by the Proposed Project

Species	Potential for Occurrence and Estimated Regional Stock Size				Primary habitat	Potential to be adversely affected
	West Dock	Cook Inlet	Port of Anchorage	Port of Seward		
Harbor Seal *(Phoca vitulina)*		45,975 likely to occur	45,975 may occur	45,975 may occur	haul out coastal areas rocks, beaches	no
Minke Whale *(Balaenoptera acutorostrata)*		1,233 may occur		1,233 may occur	bays, fjords and offshore	no
Gray Whale *(Eschrichtius robustus)*	19,126 may occur	19,126 unlikely to occur		19,126 unlikely to occur	coastal shallow water (<100m deep	no
Killer Whale *(Orcinus orca)*	2,084R unlikely to occur	552T ; 2,084R may occur		552T; 7T; 2,084R may occur	fjords, coastal and offshore	no
Pacific White-sided Dolphin *(Lagenorhynchus obliquidens)*		26,880 unlikely to occur		26,880 unlikely to occur	fjords, coastal and offshore	no
Harbor Porpoise *(Phocoena phocoena)*		31,046 may occur 136		31,046 unlikely to occur	coastal areas, shallow water <300 feet	no
Dall's Porpoise *(Phocoenoides dalli)*		83,400 unlikely to occur		83,400 unlikely to occur	fjords, coastal and offshore	no
Beluga Whale (*Delphinapterus leucas*)	39,258 unlikely to occur				coastal water, and offshore near ice	no

T = Transient

R = Resident

Sources: Allen and Angliss 2011; Dalheim et al. 2000

5.7.2.3 Route Alternatives and Variations

Denali National Park Route Variation

Construction and operation of the Denali NPP Route Variation would occur outside of the marine environment. The Denali NPP Route Variation would not adversely affect marine mammals.

5.7.3 Mitigation

In order to reduce potential impacts to marine mammals, vessel shipments would be coordinated to minimize the frequency of shipments. A list of mitigation measures that could be included into BMPs to reduce adverse affects to marine mammals are:

- Reduce vessel speed when marine mammals are in the vicinity;
- Refrain from making multiple course changes;
- Vessel speed would be reduced during inclement weather to prevent the likelihood of a whale collision;
- Vessels operators would be mandated to follow state and federal laws when navigating near marine mammals;
- Permit stipulations would be adhered to, to minimize potential impacts to marine mammals;
- Update Health, Safety and Environment (HSE) and spill plans for regular vessel operations; and
- Conduct regular maintenance (gears replaced, oiled, check for leaks) on vessels before transit to reduce in water noise levels and reduce spills.

The AGDC has committed to comply with recommendations from the NMFS and the USFWS for vessel operations at West Dock, POS and the POA. Mitigation measures would be addressed by species and temporal habitat use of proposed Project areas before Project implementation.

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5.8 THREATENED AND ENDANGERED SPECIES

5.8.1 Background Information

This section addresses species[1] that are federally-listed as endangered, threatened, proposed for listing, candidates for listing (U.S. Fish and Wildlife Service [USFWS] 2010), and state-listed endangered species (ADF&G 2011). The U.S. Army Corps of Engineers (USACE), as the lead federal agency for this Project, is responsible for initiating Section 7 consultation with USFWS and the National Marine Fisheries Service (NMFS) pursuant to the Endangered Species Act (ESA) to determine the likelihood of affects on federally-listed species. The USACE, or the Alaska Gasline Development Corporation (AGDC, the applicant), as a non-federal party, is required to consult with the USFWS and NMFS to determine whether listed or proposed ESA species or their designated critical habitat occurs in the vicinity of the proposed Project. The USACE determined that federally-protected species or habitats may be affected by the proposed Project, and a Biological Assessment (BA) was prepared. The BA identified the nature and extent of adverse impacts and recommended mitigation measures that would avoid or reduce impacts to the habitat and/or species to acceptable levels (Appendix I). A consultation letter was produced from the USFWS and NMFS that addressed the ESA, the Fish and Wildlife Coordination Act (FWCA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), the Marine Mammal Protection Act (MMPA), and the National Environmental Policy Act (NEPA). A list of ESA species with the potential to occur in the proposed Project area were identified and are discussed in detail below.

5.8.2 Federally-Protected, Candidate and Delisted Species

The USFWS and the NMFS are responsible for ensuring compliance with the ESA for species under their jurisdictions. The purpose of the ESA is to conserve species and their habitats. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range, and a species is considered threatened if the species is likely to become endangered in the future. Proposed species are federally protected candidate species that are found to warrant listing under the ESA as either endangered or threatened and have been proposed as such in the federal register. Candidate species are those species that are petitioned for listing as endangered or threatened under the ESA but that have not been proposed as such in the federal register. Candidate species are currently not federally protected, and are addressed in Section 5.8.3. Delisted species are species that were listed as threatened or endangered under the ESA, but have been formally removed from the listing. Delisted species are not federally-protected and are considered in assessments as state-listed species in Section 5.8.4.

[1] The text of this section primarily refers to species by their common name. Scientific names are provided for most species in Tables 5.8-1, and 5.8-2 of this section. Where animals or plants are not presented in these tables, the initial mention of the common name is immediately followed by presentation of the scientific name.

The State of Alaska maintains an ESA list of Alaskan species but no longer maintains a State Species of Special Concern list as of August 15, 2011. Therefore, these previously state-listed species have not been included in the analysis. Several federally-protected species under the jurisdiction of the USFWS could potentially be affected by the proposed Project and are addressed within this section. The Bureau of Land Management (BLM) Sensitive Species are addressed in Section 5.3 (Vegetation), Section 5.5 (Wildlife), and Section 5.6 (Fisheries).

5.8.3 Summary of Federally-Protected and Candidate Species in the Project Area

Federally-protected and candidate species that could occur in the Project area include: 10 marine mammals, 1 terrestrial mammal, and 4 birds. Critical habitat for two listed species occurs within the Project area; the Cook Inlet beluga whale under NMFS jurisdiction, and the polar bear under USFWS jurisdiction. No federal or state-listed plants are found to occur in the proposed Project area from inventories conducted to date. The federal status, critical habitat designation and the preliminary findings summary of each species are included in Table 5.8-1 below.

TABLE 5.8-1 Federally-Protected and Candidate Species Potentially Occurring in or near the Project Area

Common Name	Scientific Name	Federal Status	Critical Habitat Designated in/near Project Area	Preliminary Findings Summary[a]
Marine Mammals				
Bearded seal	*Erignathus barbatus*	Proposed	No	No Effect
Bowhead whale	*Balaena mysticetus*	Endangered	No	NLAA
Cook Inlet beluga whale	*Delphinapterus leucas*	Endangered	Yes	NLAA/ NAM
Fin whale	*Balaenoptera physalus*	Endangered	No	No Effect
Humpback whale	*Megaptera novaeangliae*	Endangered	No	No Effect
Pacific walrus	*Odobenus rosmarus divergens*	Candidate	No	No Effect
Polar bear	*Ursus maritimus*	Threatened	Yes	NLAA /NLAM
Ringed seal	*Phoca hispida*	Proposed	No	NLAA
Steller sea lion	*Umatopias jubatus*	Threatened	No	NLAA
Sea otter	*Enhydra lutris kenyoni*	Threatened	No	NLAA
Terrestrial Mammals				
Wood bison Potential reintroduction – Minto Flats State Game Refuge	*Bison bison athabascae*	Endangered/Proposed – Threatened & 10(j) Experimental Population Designation in Alaska	No	Proposed for listing status – no consultation required on BLM, state, or private lands
Birds				
Eskimo curlew	*Numenius borealis*	Endangered	No	No Effect (Considered Extinct)
Spectacled eider	*Somateria fischeri*	Threatened	No	LAA
Steller's eider	*Polysticta stelleri*	Threatened	No	NLAA
Yellow-billed loon	*Gavia adamsii*	Candidate	No	NA

Source: Biological Assessment, 2011

[a] LAA – May affect, likely to adversely affect.
NA – Not Applicable.
No Effect – No Effect.
NLAA – May affect, not likely to adversely affect.
NAM – No adverse modification (applies to Critical Habitat).
NLAM – Not likely to adversely modify (applies to Critical Habitat).
LAM – Likely to adversely modify (applies to Critical Habitat).
ESUs – Evolutionary Significant Units

5.8.4 Project Area

The proposed Project area for threatened and endangered species includes the 737-mile mainline pipeline right-of-way (ROW), Fairbanks Lateral, alternatives and variations, Yukon River crossing options and all associated aboveground facilities from Prudhoe Bay to MP 39 of the Beluga Gas Pipeline near the Upper Cook Inlet. Three existing port facilities in Alaska through which construction materials could be transported and an area ¼ mile seaward from ship docking facilities are also included. Most of the ESA species that could be affected by the proposed Project are found primarily or exclusively in the marine environment. Project area components within the marine environment of the proposed Project are identified below:

- Nine vessels would be required to complete shipment delivery to West Dock on the Beaufort Sea to develop the GCF and pipeline;
- Thirty-five small handy class cargo ships are planned to complete pipe and equipment delivery to the Port of Seward (POS) in Prince William Sound; and
- The Port of Anchorage (POA) in the Upper Cook Inlet may also be used to supplement vessel shipments planned for the POS, but this has not been confirmed.

5.8.4.1 Project Segments

All construction and operation activities for the land based facilities, infrastructure, alternatives and options would not be expected to impact marine mammals because they are located in the terrestrial environment. With the exception of ESA listed avian species and the polar bear that utilize terrestrial habitat at some point in their life history, these components of the Project will be discussed briefly below.

Mainline Pipeline and Fairbanks Lateral

The mainline ROW and Fairbanks Lateral ROW construction and operations would not impact ESA listed marine mammals, but could impact the polar bear, and avian species. Potential impacts will be described under the environmental consequences for the polar bear and avian species.

Aboveground and Support Facilities

Construction and operation of the aboveground and support facilities would occur in the terrestrial environment and thus would not affect marine mammals. Vessels associated with delivery of modules, equipment, pipeline materials and supplies that may be delivered to West Dock or the POS for construction of aboveground and support facilities would comply with recommendations from the NMFS and USFWS for vessel operations at those associated port sites. Potential impacts from aboveground facilities development will be described under the environmental consequences for the polar bear and avian species below.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (Option 1) construct a new aerial suspension bridge; (Option 2) utilize the existing E.L. Patton Bridge; or (Option3) utilize HDD methods. Construction and operation of the Yukon River crossing options would occur outside ESA, proposed and candidate listed species habitats for the proposed Project.

Route Alternatives and Variations

Denali National Park Route Variation

Construction and operation of the Denali NPP Route Variation would occur outside of the ESA listed, proposed and candidate species habitats for the proposed Project.

5.8.4.2 No Action Alternative

Under the No Action Alternative, the AGDC would not construct the proposed Project and there would be no direct or indirect impacts to the ESA listed, candidate or proposed species.

Species Descriptions

5.8.4.3 Bearded Seal

Affected Environment

The Beringia Distinct Population Segment (DPS) of the bearded seal occurring in the Bering, Chukchi, and Beaufort Seas was proposed for listing as a threatened species throughout its range on December 10, 2010 (75 FR 237:77496). No critical habitat has been designated for this species.

Bearded seals are the largest of the ice seals, weighing up to 750 pounds. They feed on benthic organisms on or in the sediments on the seafloor, including crabs, shrimp, and clams (NMFS 2010a). Single pups are born on drifting ice flow during late March through May (Kovacs, Lydersen, and Gjertz 1996). During summer months, bearded seals in the Beaufort Sea are found associated with fragmented multi-year ice over the continental shelf seaward of the scour zone (Funk et al. 2007). About 7 percent of seals observed during surveys east of Endicott which is about 14 miles west of West Dock were bearded seals; with an estimated summer density of 0.008 seals per square mile (Funk et al. 2007). Few bearded seals are expected to be present near West Dock. There are no reliable estimates of the bearded seal population in the Beaufort Sea; although uncorrected estimates of bearded seals in the eastern Beaufort Sea have been estimated at about 2,100 seals (NMFS 2010a).

The primary threat to bearded seals is the potential adverse effects of loss of sea ice habitat as a result of warming climate trends projected through the end of the century (NMFS 2010a).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for the gas conditioning facility (GCF) and other materials and supplies that may be delivered to West Dock during the summer months could disturb seals if they occurred near the West Dock facility on the Beaufort Sea. Disturbance could result in temporary movement away from the vessel, diving beneath the water surface, and/or diving into the water if hauled-out on floating ice; all of which would not result in adverse effects on an individual seal. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Few if any bearded seals would be expected near the dock, however, and the likelihood of vessel-related disturbance to bearded seals would be very low to none. The NMFS has previously determined that increased vessel traffic in the Beaufort Sea would have a negligible effect on ice seals (NMFS 2008b); and the incremental increase associated with the proposed Project would be within the range of normal activities currently occurring at West Dock.

Based on the unlikely presence of bearded seals at West Dock during vessel operations, and AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at West Dock, the proposed Project would have no affect on the bearded seal.

5.8.4.4 Bowhead Whale

Affected Environment

The bowhead whale was federally listed as endangered in June 1970 (35 FR 106:8491). No critical habitat has been designated. The Western Arctic stock of the bowhead whale, the only stock present in U.S. waters, occurs in the Project area during spring and fall migrations through the Beaufort Sea. Bowhead whales are large, filter feeding or baleen whales that are an important subsistence resource, feeding almost exclusively on zooplankton, which includes small to moderately sized crustaceans such as copepods, euphausiids, and mysids, as well as other invertebrates and fish (NOAA 2011). Bowhead whales reach sexual maturity at about the age of 20 years and females generally have one calf every 3 to 4 years (NOAA 2011). They migrate through the Beaufort Sea using openings, or lead systems, in the sea ice that form offshore of the barrier islands. They arrive on their summering grounds near Banks Island, Canada during mid-May to June (International Whaling Commission [IWC] 2005). Bowhead whales migrate back through the Alaska Beaufort Sea in August and September and are present in the Central Beaufort and Prudhoe Bay area from late August through late October (Moore and Reeves 1993). Acoustic monitoring indicates that over 95 percent of the bowhead whales recorded during fall surveys at the Northstar Facility just offshore of West Dock occurred an average of about 11 miles offshore (Blackwell et al. 2007). West Dock extends out from the shoreline a total distance of 2.7 miles to water depths of 7 feet. The occurrence of bowhead whales in the Project area is therefore highly unlikely. Most bowheads of the Western Arctic stock overwinter and congregate prior to migration in association with polynyas and the marginal ice zone in the central and western Bering Sea (Moore and Reeves 1993). Most calving occurs from late March to mid-June in the Chukchi Sea. There are an estimated 10,545 bowhead whales in the Western Arctic stock (Angliss and Outlaw 2008) that may occur within the Project area. The Western Arctic stock of bowhead whales increased at an annual rate of 3.4 percent between 1978 and 2001 (George et al. 2004).

Actions that have affected the bowhead whale include historic commercial whaling, subsistence hunting, oil and gas-related activities, non-oil and gas industrial development, research activities, marine vessel traffic and commercial fishing, pollution and contaminants baseline, and climate change. However, other than historic commercial whaling, there is little evidence that previous or current human activity has negatively affected bowhead whales or prevented their recovery (NMFS 2008b).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb bowhead whales if they occurred near the West Dock facility on the Beaufort Sea. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away, though a bowhead whale may begin swimming away at a further distance from the vessel than either fin or humpback whales. Bowhead avoidance of a vessel may begin at 0.6 to 2.5 miles (Minerals Management Service 2009a). After the disturbance has passed, bowhead whales would resume feeding or other behaviors within minutes to hours and displacement from the area would be short-term (Minerals Management Service 2009b). Bowhead whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies; masking calls can disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and would have little impact on bowhead whales. Cargo vessels and barges would travel at low rates of speed and are not likely to collide with bowhead whales. The potential for an oil spill could occur if a vessel went aground; however, would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Few if any bowhead whales would be expected near West Dock, however, and the likelihood of vessel-related disturbance to bowhead whales would be very low.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at West Dock. Based on the unlikely presence of bowhead whales at or near West Dock during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS or applicable subsistence avoidance measures for vessel operations at West Dock, the proposed Project may affect, but would not likely adversely affect bowhead whales.

5.8.4.5 Cook Inlet Beluga Whale

Affected Environment

The DPS of the beluga whale found in Cook Inlet was listed as a depleted stock under the MMPA on 31 May 2000 (65 FR 105:34590) and as endangered under the ESA on 22 October 2008 (73 FR 205:62919). Critical habitat has been designated within Cook Inlet; excluding the area around the POA (76 FR 69:20180).

Beluga whales are about 12 to 13 feet long, dark gray at birth and white in adulthood. Calves are born in the summer and beluga whales typically care for their calves for about two years. Beluga whales are opportunistic feeders and prey upon a variety of fish and invertebrates depending on their availability during the whale's seasonal movements between the upper and lower Cook Inlet. Beluga whales commonly use waters near the POA. During the late fall, beluga whales concentrate at the mouth of Ship Creek, commonly within 300 feet of the docks at the POA as they forage for salmon (Port of Anchorage 2009). Beluga whales follow the tidal influx and outflux close to the POA in October and November (Cornick and Saxon-Kendall 2009). Actions that may have affected the Cook Inlet beluga whale include subsistence hunting, oil and gas-related activity, non-oil and gas industrial development, research activities, marine vessel traffic, commercial fishing, pollution and contaminants, and climate change.

Environmental Consequences

<u>**Proposed Action**</u>

The POS was selected as the planned port of entry for pipe and equipment due to available storage and connection to the Alaska Railroad Corporation (ARRC) railroad (AGDC 2011). However, if barges are needed for the proposed Project for delivery of materials to the POA, vessel traffic could disturb Cook Inlet beluga whales. Disturbance could result in temporary movement away from the vessel and port facilities. Noise from vessels at the POA could interfere with behavior and communications by masking natural sounds or calls from other beluga whales, however most engine noise from vessels that would typically occur (5-500 Hz) is at frequencies below those used by beluga whales (10-100 kHz) (Blackwell and Greene 2002). Noise produced from vessel activity would be temporary, limited to the proximity of the vessel, and would not likely adversely affect beluga whales. Cargo vessels and barges travel at low speeds, in a linear and consistent movement pattern with minimal course changes and would not likely cause a collision but could result in a low level of disturbance to beluga whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Alteration of salmon streams due to construction of the pipeline through upper Cook Inlet drainages could reduce the amount of prey available for beluga whales; especially alterations to the Susitna River. However, the proposed Project would comply with best management practices BMPs and mitigation for stream crossing construction impacts and is not likely to result in reductions of salmon or the in-stream habitats upon which they rely.

The incremental vessel traffic associated with the proposed Project would be within the range of normal activities occurring at the POA. Based on this and the AGDC's commitment to comply with recommendations from the NMFS/USFWS, the proposed Project may affect, but would not likely adversely affect Cook Inlet beluga whales. The proposed Project would not adversely modify Cook Inlet beluga whale critical habitat.

5.8.4.6 Fin Whale

Affected Environment

The fin whale was federally listed as endangered in June 1970 (35 FR 106:8491). No critical habitat has been designated. The Alaska stock of fin whales can be found in the deep waters of Prince William Sound, the Bering Sea, and the Gulf of Alaska. The highest densities of Alaska stock fin whales can be found in the northern part of the Gulf of Alaska and southeastern part of the Bering Sea during the summer (May through October) (NMFS 2008b). Fin whales feed primarily on krill or euphausiids, as well as substantial quantities of fish (NMFS 2008b). After 11-12 months of gestation, females give birth to a single calf in tropical and subtropical areas during midwinter (NOAA 2011). Fin whales are frequently observed in the northern Gulf of Alaska and southeastern Bering Sea from May to October, but do not commonly occur in Upper Cook Inlet. The North Pacific population of fin whales is estimated at 15,000 whales (Angliss et al. 2001); and the population of fin whales present in Alaskan waters west of Kodiak Island is estimated at a minimum of 5,700 (Angliss and Allen 2009).

Actions that are assumed to have effects on fin whales include historic commercial whaling, subsistence hunting, oil and gas-related activity, non-oil and gas industrial development, research activities, marine vessel traffic and commercial fishing; however, other than historic commercial whaling, there is little evidence that previous or current human activity has negatively affected fin whale populations (NMFS 2008a).

Environmental Consequences

Proposed Action

Vessels associated with delivery of materials and supplies to Seward could disturb fin whales if they occurred near the POS. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away; fin whales' avoidance may begin at 1.2 to 2.5 miles from the vessel (Minerals Management Service 2009a). After the disturbance has passed, fin whales would resume feeding or other behaviors within minutes to hours; and displacement from the area would be of short-duration (Minerals Management Service 2009b). Fin whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies; masking calls can disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and would have little impact on fin whales. Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and would not likely collide with fin whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Few if any fin whales would be expected near Seward, however, and the likelihood of vessel-related disturbance to fin whales would be very low.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at the POS. Based on the unlikely presence of fin whales at or near the POS during vessel operation and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at the POS, the proposed Project would have no affect on fin whales.

5.8.4.7 Humpback Whale

Affected Environment

The humpback whale was federally listed as endangered in July 1970 (35 FR 106:8491). No critical habitat has been designated. The Central North Pacific and Western North Pacific stocks could occur within the Project area. Humpback whales feed primarily on small schooling fish and large zooplankton, mainly krill. Feeding occurs almost entirely in humpback whales' summer range. They also use the most diverse techniques to obtain their prey of any baleen whale. In Alaska, humpback whales are seasonal migrants and are found from southeastern Alaska, north and west through the Gulf of Alaska, Bering Sea, and into the southern Chukchi Sea. Most of the humpback whales that summer in Alaskan waters are thought to winter in the wintering grounds surrounding the Hawaiian Islands. Humpback whales are frequently observed in the lower Cook Inlet south of the Forelands during May–September (Minerals Management Service 1995), but only rarely occur in Upper Cook Inlet or the Anchorage area. Humpback whales frequent the Gulf of Alaska and lower Resurrection Bay where they have become habituated to vessel traffic, but are not expected to occur near the POS. The North Pacific population is currently estimated to be 12,000 whales. The Western Pacific population was last estimated at 394 individuals (Calambokidis et al. 1997); however, this may be an underestimate because of low sampling effort (Angliss and Allen 2009).

Actions that are known to have affected humpback whales include historic commercial whaling, subsistence hunting, oil-and-gas-related activity, non-oil and gas industrial development, research activities, marine vessel traffic and commercial fishing; however, other than historic commercial whaling, there is little evidence the previous or current human activity has negatively affected humpback whale populations (NMFS 2008b).

Environmental Consequences

<u>Proposed Action</u>

Vessels associated with delivery of materials and supplies that would be delivered to Seward or Anchorage could disturb humpback whales if they occurred near the POS or the POA. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away; humpback whale avoidance may begin at 1.2 to 2.5 miles from the vessel (Minerals Management Service 2009a). After the disturbance has passed, humpback whales would resume feeding or other behaviors usually within minutes or hours and displacement from the area would be short in duration (Minerals Management Service 2009b). Humpback whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies; masking calls can disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and would have little impact on humpback whales. Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and are not likely to collide with humpback whales. Humpback whales would be expected to occur near Seward and the lower portions of Cook Inlet and Project-related vessel traffic would be likely to encounter humpback whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event.

The incremental increase in vessel traffic associated with the Project would be within the range of normal shipping activities currently occurring at the POS and the POA. Based on the likely presence of humpback whales near the POS during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at the POS and the POA, the Project may affect, but would not likely adversely affect the humpback whale.

5.8.4.8 Pacific Walrus

Affected Environment

The Pacific walrus was determined to warrant protection as threatened or endangered under the ESA on September 10, 2009 (74 FR 174:46548), but was precluded from listing because of higher priority species and became a federal candidate species on February 10, 2011 (76 FR 28:7634). No critical habitat has been designated. The Pacific walrus is distributed over continental shelf waters in the Chukchi and Bering seas; ranging from the eastern East Siberian Sea to the western Beaufort Sea. Walruses feed most frequently on benthic clams, snails, and polychaete worms and prefer to forage in areas less than 262-feet-deep (Fay 1982). Pacific walruses depend on sea ice for breeding, calving, and haul out near foraging habitats. Low numbers of Pacific walrus occur in the Beaufort Sea and while some walruses have hauled-out onshore near Kaktovik (which indicates travel past the West Dock area), this is an infrequent event and walrus rarely occur in the Prudhoe Bay region (USFWS 2010). The potential for, but unlikely scenario, an oil spill could occur if a vessel went aground.

Actions that may have affected the Pacific walrus include historic commercial harvest, subsistence hunting, human disturbance to land-based haul-out areas, and climate change resulting in increased land-based haul out behavior. Projected loss of sea ice due to climate change and associated effects are considered a current threat to the Pacific walrus population. The largest changes in sea ice distribution and resulting walrus distribution are expected to occur in summer (June through August) and fall (October through November).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb Pacific walruses if they occurred near the West Dock facility. Disturbance could result in temporary movement away from the vessel, diving beneath the water surface, diving into the water if hauled-out on floating ice; all of which would not result in adverse effects on the individual walrus. Few, if any, Pacific walruses would be expected near the dock, and the likelihood of vessel-related disturbance would be very low to none. The incremental increase in vessel traffic associated with the Project would be within the range of normal activities currently occurring at West Dock. Based on the unlikely presence of Pacific walruses at West Dock during vessel operations, and the AGDC's commitment to comply with recommendations from the NMFS/USFWS for vessel operation at West Dock, the proposed Project would have no affect on the Pacific walrus.

5.8.4.9 Polar Bear

Affected Environment

The polar bear was federally listed as threatened in May 2008 (73 FR 95:28212). Critical habitat was designated for the polar bear in December 2010 (Lentfer and Hesel 1980). The three units designated as critical habitat for polar bear populations in the United States include: sea-ice habitat, terrestrial denning habitat, and barrier island habitat (Lentfer and Hesel 1980). All three of these units occur within the proposed Project area.

Polar bears are large white to yellow bears with black skin that occur throughout the ice-covered waters of the circumpolar Arctic. An estimated 1,500 polar bears occur in the Southern Beaufort Sea polar bear population (73 FR 95:28212). This population is considered to be declining and is predicted to continue to decline because of declining sea ice habitat (73 FR 95:28212).

In Alaska, polar bears remain on sea ice year-round over most of their range, although their distribution varies seasonally with the seasonal extent of sea ice cover and availability of prey (primarily ringed seals and bearded seals). In the fall, when the annual sea ice begins to form in the shallower water over the continental shelf, polar bears that had retreated north of the continental shelf during the summer return to the shallower shelf waters where seal densities are higher (Durner *et al.* 2009). Polar bears in the southern Beaufort Sea reach their peak weights during the fall and early winter period (Durner and Amstrup 1996). Thus, availability and accessibility of prey during this time may be critical for survival through the winter. Polar bears are active all winter moving to adjust to changing sea ice and seal distributions. During the winter period, when energetic demands are the greatest, nearshore lead systems and ephemeral (may close during the winter) or recurrent (open throughout the winter) polynyas (areas of open sea surrounded by sea ice) are important for seals, and are thus important foraging habitat for polar bears (Lentfer and Hesel 1980). Nearshore lead systems and the shore-fast ice zone are important hunting and foraging habitat for polar bears in the spring (Stirling et al.1993).

In Alaska, most land use is by maternal females in dens during the winter. Female bears use dens to give birth. They typically excavate dens in snow in November, give birth in late December, and emerge from their dens in March or April (Ramsay and Stirling 1988). Young bears stay with their mothers until they are weaned at about 2 years, and female bears may reproduce at 3-year intervals. Polar bears may also occur on shore when there is open water during summer and early fall. In recent years, the prolonged open water season has resulted in increased use of terrestrial coastal areas by polar bears for longer durations during the summer and early fall (Schliebe et al. *2*008).

In northern Alaska, denning habitat is more diffuse than in other areas such as Wrangel Island (located between the Chukchi Sea and East Siberian Sea) where high-density denning by polar bears has been identified (Amstrup 2003). Polar bears in the Beaufort Sea exhibit fidelity to denning areas but not to specific den sites (Amstrup and Gardner 1994). Barrier islands, river bank drainages, and coastal bluffs that occur at the interface of mainland and marine habitat that are able to accumulate snow in fall and early winter appear to be the preferred topographic features for denning polar bears in Alaska (Lentfer and Hesel 1980; Figure 5.8-1). Suitable macrohabitat characteristics of these topographic features were identified in the final critical habitat designation for polar bears (Lentfer and Hesel 1980) and include:

- Steep, stable slopes (mean = 40^{o}, SD = 13.5^{o}), with heights ranging from 4.3 to 111.6 feet (mean = 17.7 feet, SD = 24.3 feet), and with water or relatively level ground below the slope and relatively flat terrain above the slope;
- Unobstructed, undisturbed access between den sites and the coast; and
- The absence of disturbance from humans and human activities that might attract other polar bears.

Polar bears on land would be most likely to be affected by the proposed Project (i.e., maternal females in dens during the winter or polar bears on shore during open water in the summer and early fall). Typically, polar bears avoid humans. This is demonstrated by the areas where they choose to rest, their den site locations, and their avoidance of snow machines (Anderson and Aars 2008). Polar bears tend to avoid denning in areas where active oil and gas exploration, development, and production activities are occurring (Lentfer and Hesel 1980). However, if predictions of the continued loss of arctic sea ice due to climate change occur, it is expected that the number of polar bears denning on land in northern Alaska east of Barrow will continue to increase (Schliebe *et al.* 2008). This is supported by the recent increase in the number of bears using the coastal areas during the summer and early fall in northern Alaska (Schliebe *et al.* 2008). Increased use of terrestrial environments by polar bears would likely increase bear/human interactions in the future.

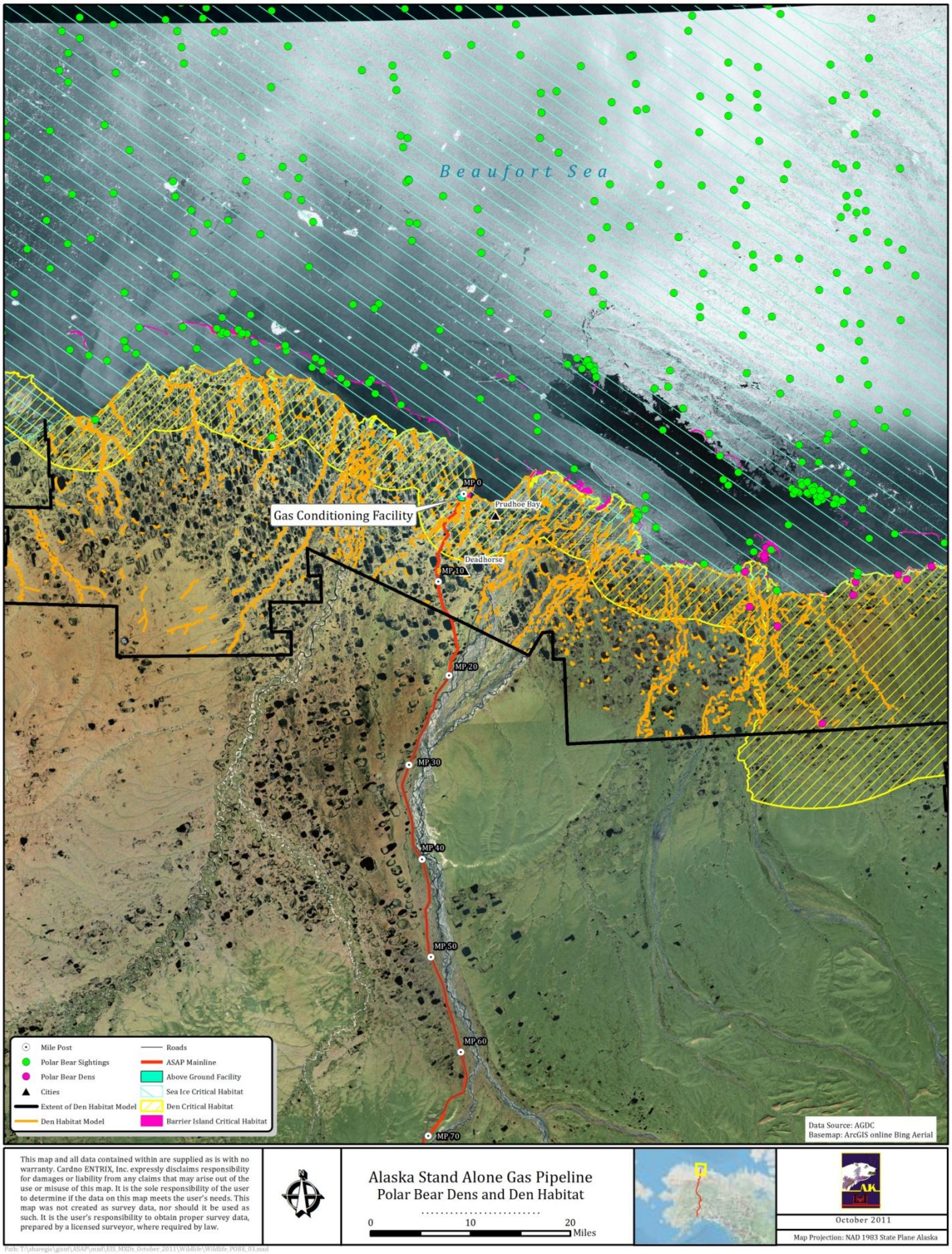

FIGURE 5.8-1 Polar Bear Den Habitat and Historical Den Locations in the Project Area

Environmental Consequences

Proposed Action

Oil and gas exploration, development, and production, and other associated human disturbance (vessel traffic) are potential sources of harm to polar bears and/or their critical habitat (Lentfer and Hesel 1980). Construction and operation of the GCF and the pipeline on the North Slope may cause disturbance to a few polar bears and potentially their prey (ringed and bearded seal) from increased vessel activity. Expansion of the network of roads, pipelines, well pads, and infrastructure associated with oil and gas activities may affect polar bears by forcing pregnant females into marginal denning locations (Lentfer and Hensel 1980). However, suitable terrestrial denning habitat is not limited on the North Slope.

The proposed Project area would include 55.3 acres of sea ice critical habitat, 16.4 acres of barrier island critical habitat, and 70.3 acres of denning critical habitat for polar bears (Figure 5.8-1, USFWS 2011). The only proposed Project component that would occur within the sea ice and barrier island critical habitats would be the transit of approximately 9 vessels in the summer to and from West Dock. The Project would not likely adversely modify or destroy the critical habitat.

Modification to areas of polar bear terrestrial denning critical habitat would occur for the proposed Project. The proposed location for the GCF would be located on flat topography with no ridges or banks that would be likely to support polar bear denning. Stream banks along the Putuligayuk River and tributaries near the proposed GCF location have been identified as containing macrohabitat characteristics described in the final critical habitat designation for denning polar bears (Lentfer and Hesel 1980, Figure 5.8-1). No polar bear dens have been located within the Project area in the past, potentially due to their proximity to human development which polar bears tend to avoid (Lentfer and Hesel 1980, Figure 5.8-1). As such, no polar bear dens are likely to be disturbed during construction or operation of the GCF or the pipeline. However, if arctic sea ice loss continues, due to climate change as predicted, it is expected that the number of polar bears denning on land will continue to increase in northern Alaska, east of Barrow (Schliebe *et al.* 2008). Increased use of terrestrial environments by polar bears combined with the expansion of oil and gas activities on the Alaskan north slope may cause pregnant female polar bears to den in closer proximity to oil and gas activities in the future.

Oil spills or discharges into the marine environment would also negatively impact polar bears and/or their critical habitat. Food waste, lubrication oils, and antifreeze can be both attractive and toxic to bears. All wastes would be contained and disposed of in a manner consistent with BMPs on the North Slope.

Polar bears would likely encounter the GCF and pipeline, and potentially project personnel during construction and operations. Regulations for oil and gas operations on Alaska's North Slope pertaining to interactions with polar bears would require that a bear interaction plan be developed and implemented in order to avoid injury to polar bears and humans due to encounters. Based on the presence of a small number of polar bears expected near the proposed Project facilities on the North Slope, a small number of bears would receive incidental interaction from Project activities. No mortality, or injury would likely occur, but temporary deflection and minor changes in bear behavior would be expected to occur primarily during construction activities. The proposed Project would not likely adversely affect the polar bear.

The GCF and the first 6.7 miles of the pipeline would be constructed within designated polar bear terrestrial denning critical habitat. No polar bear dens have been located within the proposed Project area in the past, and the Project footprint does not contain the suitable macrohabitat characteristics for denning sites. Den sites would not likely be chosen in the Project Area due to the flat terrain, previous human disturbance and ongoing oilfield activity. The proposed Project would not adversely modify or destroy polar bear critical habitat. The AGDC's commitment to comply with regulations pertaining to polar bears for North Slope oil and gas operations would minimize potential impacts to the polar bear and its critical habitat

Aboveground and Support Facilities

The only aboveground or support facility that would occur in polar bear habitat is the GCF, which would be built during the first winter of the Project schedule. Polar bears would be more common during the winter than the summer, especially non-denning bears. As noted above, the proposed Project area has not been known to inhabit any bear dens and the area does not possess preferred den habitat characteristics. Potential impacts to the polar bear from construction of the GCF would include disturbance from noise produced during construction activities. A bear could be startled and run away from the noise if found in the vicinity, or would circumnavigate the area entirely. Polar bears would likely avoid these areas with high levels of human activity.

Mitigation

In addition to the mitigation measures identified for wildlife in the Wildlife Section 5.5.3, additional mitigation measures recommended for polar bears include:

- Conduct preconstruction polar bear surveys (e.g., aerial surveys, FLIR (Forward Looking Infra-Red) aerial and ground surveys, and polar bear tracking via scent-trained dogs) to determine the presence or absence of dens or denning activity;
- If an active den is found, incorporate a 1 mile buffer surrounding known den with enhanced monitoring and/or flight restrictions; and
- Coordinate additional polar bear surveys with the USFWS.

5.8.4.10 Ringed Seal

Affected Environment

The Arctic subspecies of the ringed seal was proposed for listing as a threatened species on December 10, 2010 (75 FR 237:77476). No critical habitat has been designated for the ringed seal. Ringed seals depend on sea ice and excavate subnivean lairs in the snow above holes they maintain in the ice. Pups are born between March and April in the lair, where they remain to nurse for five to eight weeks. Ringed seals forage on arctic cod, saffron cod, shrimp, amphipods, and euphausiids (Reeves, Stewart, and Leatherwood 1992). Ringed seals typically remain associated with sea ice throughout the year (Angliss and Allen 2009), although in summer they are commonly observed alone or in small groups in open water (Harwood and Stirling 1992). Ringed seals are the most frequently observed seals in the Prudhoe Bay region (Simpkins et al. 2003); although large numbers are not expected near West Dock. A minimum estimate of 249,000 Arctic ringed seals are present in the Chukchi and Beaufort Seas (Angliss and Allen 2009); with a recent more comprehensive survey estimated as many as 1,000,000 seals (Kelly et al. 2010).

Actions that may have affected ringed seals include pollution and contaminants in the Arctic; subsistence hunting, offshore oil and gas exploration, development and production; and climate change. The primary threat to ringed seals is the potential adverse effects of loss of sea ice habitat as a result of warming climate trends projected through the end of the century (NMFS 2010b).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb seals if they occurred near the West Dock facility. Disturbance could result in temporary movement away from the vessel, diving beneath the water surface, diving into the water if hauled-out on floating ice; all of which would not result in adverse effects on the individual seal. Ringed seals would be expected to occur near the dock; the likelihood of vessel-related disturbance to ringed seals would be low. The Mineral Management Service (MMS) has previously determined that increased vessel traffic in the Beaufort Sea would have no more than a negligible effect on ice seals (NMFS 2008b); and the incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at West Dock. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Based on the likely presence of ringed seals near West Dock during vessel operations, and the AGDC’s commitment to comply with any recommendations from the NMFS/USFWS for vessel operation at West Dock, the Project may affect, but would not be likely to adversely affect ringed seals.

5.8.4.11 Steller Sea Lion

Affected Environment

The Steller sea lion was protected as a threatened species range-wide in April 1990 because of declining populations. The Western DPS (WDPS) inhabits an area of Alaska from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters (NOAA 2010a). Because of continual declines, the WDPS was listed as endangered on May 5, 1997

(62 FR 108:30772). Critical habitat has been defined for Steller sea lions as a 20-nautical-mile buffer around all major haul-outs and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas (58 CFR 165:45269). Steller sea lions occur throughout the North Pacific Ocean where they use haul-outs and rookeries on beaches (gravel, rocky, or sand), ledges, and rocky reefs (NOAA 2010b). Rookeries are occupied during the May to July breeding season where mating occurs and pups are born; although Steller sea lions continue to gather at both rookeries and haul-out sites outside of the breeding season (NMML 2010). Steller sea lions forage near shore and in pelagic waters feeding on a wide variety of fish, mollusks, and squid. Steller sea lions frequently occur at the POS within Resurrection Bay and in Cook Inlet. There are approximately 39,000 to 45,000 Steller sea lions in the WDPS which continued to decline at a rate of about 5.4 percent per year between 1991 and 2000, but increased between 2004 and 2008 at a rate of about 1 percent per year (NOAA 2010a; NOAA 2010b).

Actions that have effected Steller sea lions include pollution and contaminants; subsistence hunting, offshore oil and gas exploration, development and production; climate change; vessel disturbance; and commercial fishing. The primary current threats to Steller sea lions are thought to be competition with commercial fisheries and climate induced changes or regime shifts in prey availability (NOAA 2010a).

Environmental Consequences

<u>Proposed Action</u>

Vessels associated with delivery of materials and supplies to Seward or Anchorage could disturb Steller sea lions if they occurred near the POS or the POA. Steller sea lion reactions to occasional disturbances range from no reaction to complete and immediate departure from the haul-out area. Low levels of occasional disturbance may have little long-term effect on sea lions (Kenyon and Rice 1961). Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and are not likely to collide with or disturb Steller sea lions. The potential for an oil spill could occur if a vessel went aground in Resurrection Bay; however, this would be unlikely. A spill response plan would be required by vessel operators to mitigate for such an event. Steller sea lions would be expected to occur near Seward and the lower portions of Cook Inlet, and Project-related vessel traffic would be likely to encounter Steller sea lions.

The incremental increase in vessel traffic associated with the Project would be within the range of normal shipping activities currently occurring at the POS and the POA. Based on the likely presence of Steller sea lions near the POS during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operation at the POS and the POA, the proposed Project may affect, but would not likely adversely affect the Steller sea lion.

5.8.4.12 Sea Otter

Affected Environment

The southwest Alaska DPS of the northern sea otter was listed as threatened on August 9, 2005 (70FR 46366). The USFWS designated critical habitat for this population under the ESA of 1973 as amended on October 8, 2009 (74 F R 51988). Approximately 5,855 square miles of marine waters was designated as critical habitat. The northern sea otter is a 4 foot long, 65 lb densely furred marine mammal that inhabits the near shore coastal waters from southeast Alaska to the Aleutian Islands. They primarily inhabit waters approximately 40 m deep to feed on mollusks and crustaceans in the subtidal and intertidal zone. There are three sea otter stocks in Alaska which include the southeast, southcentral and southwest stocks. The range of the southcentral stock includes Prince William Sound and the eastern half of Cook Inlet area along the Gulf of Alaska. The range of the southwest Alaska stock includes the western half of Cook Inlet, the Alaska Peninsula and Bristol Bay coasts, Aleutian, Barren, Kodiak and Pribilof Islands.

The Northern sea otter is not typically migratory, and can dive up to 330 feet to forage along the sea floor. The potential threats posed to sea otters include: oil spills, habitat loss and degradation, disease, food limitation, fishing gear entanglement, and predation. Sea otters reached near extinction levels by the end of the Pacific maritime fur tradein the early 1900s. Populations rebounded until the 1990's when killer whale predation was thought to be the cause of the southwest sea otter population decline (58-68 percent) (Maldini et al. 2004).

Environmental Consequences

<u>Proposed Action</u>

Vessel activity that would occur in the POS from Project construction activities may cause temporary disturbance to sea otters that inhabit Resurrection Bay near the port. Temporary disturbance would occur from vessel noise and movement, or potentially an oil spill if a vessel went aground. Disturbance from vessel noise could be received from underwater or above water sounds when sea otters are diving, resting, feeding or preening. Temporary displacement from disturbance would result in diving or swimming away from the source of noise and resuming natural behavior when a comfortable distance is reached. It would be unlikely that a vessel would go aground in Resurrection Bay; however, a spill response plan would be required by vessel operators to mitigate for such an event. Sea otters would be expected to be habituated to the existing regular vessel traffic in Resurrection Bay and the POS. Sea otters primarily inhabit the lower Cook Inlet area, and would not be affected by increased vessel traffic at the POA. The increased vessel traffic at the POS and POA may affect, but would not be likely to adversely affect sea otters.

5.8.4.13 Wood Bison

Affected Environment

The wood bison is a large, wooly, dark brown bison or buffalo. The wood bison is one of two recognized subspecies of the bison in North America and was federally listed as a foreign endangered species in June 1970 (35 FR 106:8491) because the only known remaining populations occurred in Canada. In November 1998 the USFWS reviewed a petition to delist the wood bison and upheld the endangered designation (63 FR 227: 65164); although the USFWS is currently conducting a species review on a petition to reclassify the wood bison from endangered to threatened (74 FR 21:5908-5910). Critical habitat has not been designated for the wood bison.

The wood bison historically occurred throughout northwestern Canada and Alaska; while the plains bison (*Bison bison*) ranged throughout much of the contiguous United States and southwestern Canada. The wood bison disappeared from Alaska by the early 1900s. While several plains bison reintroductions have occurred in Alaska, free ranging wood bison do not currently occur. Wood bison use open boreal and aspen forests with large wet meadows feeding mainly on sedges and grasses, but will also use leaves and bark of trees and shrubs. Wolves are the wood bison's primary predators, although bears will take calves.

An experimental herd of 110 (Tyler 2011) residing near Portage, Alaska is currently being prepared for reintroduction to Yukon Flats (including Yukon Flats National Wildlife Refuge lands), Minto Flats State Game Refuge, and/or the lower Innoko/Yukon River area (including private Bureau of Land Management lands). The Alaska Department of Fish and Game (ADF&G) has petitioned the USFWS to designate the reintroduced wood bison as a "nonessential experimental population" which would allow them to be treated as threatened; required consultation would apply only on national park and national wildlife refuge lands, designation of critical habitat would be prohibited, industry would be protected from legal action due to incidental harm of mortality, and the population could not be reclassified to endangered if it failed to increase (ADF&G 2009). Once reintroductions occur, the wood bison herds could be considered an experimental population and could be treated as a threatened species on National Wildlife Refuge lands.

Environmental Consequences

<u>Proposed Action</u>

If wood bison are reintroduced to the Minto Flats State Game Refuge prior to initiation of construction of the proposed Project, construction could disturb wood bison and affect a small amount of habitat within the refuge. The construction of the compressor station and the associated access road would result in increased noise and access to the refuge for hunting after wood bison are reintroduced. Because the herd is currently captive and handled daily by people, it would be unlikely for the wood bison to avoid people. This could result in increased mortality from vehicle collisions with wood bison if they are free-ranging and occur near the proposed Project. Bison could also negatively affect revegetation of the pipeline ROW if they graze on the newly emerged vegetation and trample the ROW. Reintroductions have not occurred and because the status of the reintroduced population is unknown, a determination of potential effects has not been made.

Aboveground and Support Facilities

The construction of the compressor station in this area and the associated access road would result in increased noise and could result in increased access to the refuge for hunting, which in turn could lead to increased human disturbance to the wood bison after their reintroduction. However, because reintroductions have not occurred and because the status of the reintroduced population is unknown, a determination of potential effects from construction and operation of aboveground and support facilities has not been made.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (Option 1) construct a new aerial suspension bridge; (Option 2) utilize the existing E.L. Patton Bridge; or (Option 3) utilize HDD methods to cross underneath the Yukon River. Construction and operation of the Yukon River crossing options would occur southwest of the Yukon Flats NWR where wood bison are proposed for reintroduction. Wood bison once reintroduced, would not be impacted by any one option over another for the Yukon River crossing.

Route Alternatives and Variations

Because construction and operation of the Denali National Park Route Variation would occur south of the Minto Flats State Game Refuge and therefore outside of wood bison habitat, the Denali National Park Route Variation would not affect wood bison.

Mitigation

Because reintroductions have not occurred and because the status of the reintroduced population is unknown, mitigation for wood bison has not been identified.

5.8.4.14 Eskimo Curlew

Affected Environment

The Eskimo curlew is federally listed (32 FR 48:4001) and state listed in Alaska as endangered (ADF&G 2010). The Eskimo curlew is a medium sized (12 inches), cinnamon brown shorebird, with a down-curved bill. The Eskimo curlew was once abundant; historical accounts indicate flocks of thousands migrated from northern North America to the Argentine pampas, crossing central North America and the Atlantic coast. They bred in Alaska and northern Canada and migrated south through the prairies of the U.S. to the grasslands in South America, spending most of their time in prairies and grasslands along the way (Ambrose 2008b). Currently, the Eskimo curlew is thought to be extinct. The last sighting of an Eskimo curlew was in 1962 on the coast of Texas (Ambrose 2008b). No critical habitat has been designated for the Eskimo curlew.

The primary threat to the Eskimo curlew was un-curtailed hunting by market hunters following the population crash of the passenger pigeon (*Ectopistes migratorius*). In addition to hunting, the conversion of prairies in the central U.S. to cropland and suppression of wildfires resulted in large-scale habitat loss. Cropland was not ideal feeding habitat during migration and suppression of wildfires resulted in succession of prairie grasslands to woodlands.

Environmental Consequences

<u>Proposed Action</u>

Because the Eskimo curlew is considered to be extinct the proposed Project would have no effect on this species.

5.8.4.15 Spectacled Eider

Affected Environment

Three distinct breeding populations of the spectacled eider occur; one in western Alaska on the central Yukon- Delta YK Delta, one on Alaska’s Arctic Coastal Plain (ACP), and one in northern Siberia. Spectacled eiders were federally listed as a threatened species throughout their range in May 1993 (58 FR 88:27474) because of a rapid population decline in the population breeding on the YK Delta. Designated critical habitat includes breeding habitat on the YK Deltaand marine molting and overwinter habitats in Norton Sound, Ledyard Bay, and the Bering Sea between Saint Lawrence and Saint Matthew Islands (66 FR 25:9146). Spectacled eiders are large sea ducks (21 inches) with feathering that extends down their bill. Males in breeding plumage during winter and spring have a black chest, white back, and a pale green head with a white spectacle-like patch around the eyes. Females and juveniles are mottled brown with pale brown eye patches.

No critical habitat for spectacled eiders has been designated on the ACP. Critical habitat was not designated on the coastal plain of the North Slope because habitat, particularly nesting habitat, was not considered to be limiting for this species. Elements of critical habitat that might warrant more scrutiny during oil and gas development include: (1) all deep waterbodies, (2) all waterbodies that are part of basin wetland complexes, (3) all permanently flooded wetlands and waterbodies containing either water sedge (*Carex aquatilis*), Arctic pendant grass (*Arctophila fulva*), or both, (4) all habitats immediately adjacent to these habitat types, and (5) all marine waters out to 25 miles (40 kilometers) from shore, associated aquatic flora and fauna in the water column, and the underlying benthic community (66 FR 25:9146). Many of these elements are found in the proposed Project area.

Threats to spectacled eiders include ingestion of contaminants (especially spent lead shot), predation, hunting, ecological effects of commercial fisheries, and complex changes in fish and invertebrate populations in the Bering Sea (65 FR 26:6114) (Sea Duck Joint Venture 2004; USFWS 2001a).

On Alaska's North Slope, nearly all spectacled eiders breed north of 70° latitude between Icy Cape and the Shaviovik River, within about 50 miles of the coast (65 FR 26:6114). Within this region, most spectacled eiders occur between Cape Simpson and the Sagavanirktok River (65 FR 26:6114). The current nesting population is estimated to be between 3,343 and 6,692 spectacled eiders with a significant annual declining trend of 1.5 percent (Larned et al. 2010). In general, very high densities of nesting spectacled eiders occur west of the Sagavanirktok River and are concentrated primarily within the (NPR-A); with densities between the Shaviovik and Canning rivers ranging from very low to medium (USFWS 2008, Figure 5.8-2).

Spectacled eiders presence in the Beaufort Sea is mainly limited to nearshore waters from May to September. Spring migration in the Beaufort Sea occurs in May and June when many marine birds use the lead system as a migratory pathway to breeding grounds in northern Alaska and the Canadian Arctic (Woodby and Divoky 1982). Molting flocks of spectacled eiders gather in shallow waters off the coast starting with males at the end of June (USFWS 2001a). Females with failed nests leave to molt at sea by mid-August while successful females stay with their young on the nesting grounds until late August to early September, when they start their southward migration (USFWS 2001a). Given the relatively low onshore densities of spectacled eiders near the proposed Project area (Figure 5.8-2), densities offshore are expected to be low.

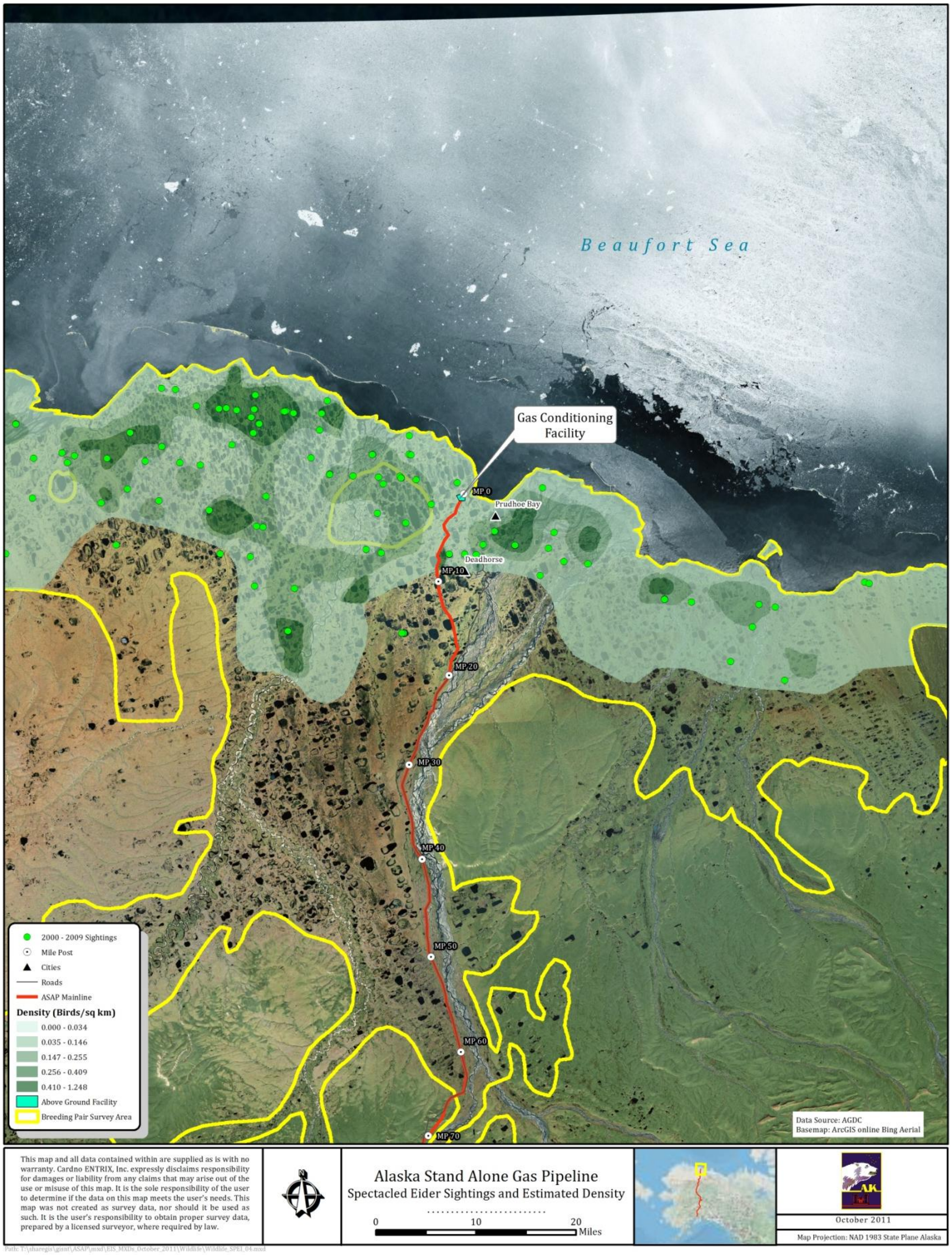

FIGURE 5.8-2 Arctic Coastal Plain Spectacled Eider Breeding Pair Survey Observations and Nesting Density

Environmental Consequences

Proposed Action

At most, 81 acres of potential spectacled eider breeding habitat could be disturbed for the construction of the proposed Project. Up to 72 acres would be permanently lost for the construction of the GCF and the buried and elevated portions of the pipeline. However, habitat loss is not likely to adversely affect spectacled eiders since nesting habitat for spectacled eiders is not limiting on the north slope of Alaska. Annual USFWS aerial surveys do not indicate that the proposed Project area is heavily used by spectacled eiders (USFWS 2008, Figure 5.8-2) and previous site-specific nesting surveys from 1991 to 1995 do not indicate that breeding pairs of spectacled eiders have used the area of the GCF for nesting (USFWS 2008, Figure 5.8-2; Troy Ecological Research Associates 1996). However, traffic along infield roads between Deadhorse and the GCF would be adjacent to areas used for breeding by spectacled eiders.

Potential disturbance to any nesting spectacled eiders in the Project area would be minimized through construction timing. Construction of the GCF and first 75 miles of the gas pipeline would primarily occur during the winter when spectacled eiders are not present on the north slope of Alaska. However, some construction staging activities and other site preparation activities and operation and maintenance activities are likely to occur during summer. Summer traffic along infield roads between Deadhorse and the GCF would be in addition to local field traffic and the additional traffic could disrupt breeding activities or collide with eiders or their young. To minimize potential traffic incidents, vehicles would be required to comply with existing speed limits and all activities associated with the proposed Project would comply with North Slope environmental standards and practices.

Birds can be negatively impacted by noise, especially during the nesting season when they may be restricted to one site for up to four weeks (Drewitt and Langston 2006). Increased noise at the Central Compressor Plant in the Prudhoe Bay oil field caused spectacled eiders to shift their distribution (averaging 1,600 feet to 2,000 feet) away from habitats close to the compressor plant (Anderson et al. 1992). However, noise associated with the GCF is not likely to disturb nesting spectacled eiders as they are not anticipated to nest in the immediate vicinity. Even if spectacled eiders were to nest near the GCF in the future, noise levels at the GCF are anticipated to be low because equipment would be housed within the facility and fitted with sound baffles to minimize noise generation.

Increased predator populations in the vicinity of oil field developments have likely increased predation on bird populations (Liebezeit et al. 2009). Increased human activity from the operation of the GCF may attract predators such as Arctic foxes, gulls, and ravens. Currently, facilities near the Project area in Prudhoe Bay adhere to strict protocols to minimize waste that may attract predators and monitor areas that provide nesting habitat. The proposed GCF would operate under these protocols and workers would be trained to remain in compliance to ensure that operation and maintenance activities that increase human activity at the GCF and along the pipeline are not likely to adversely affect spectacled eiders.

Occasionally eiders collide with structures and vessels during migration, especially along the coast and during periods of poor weather and visibility (USFWS 2010). The location of the proposed Project near the west shore of Prudhoe Bay is not likely to create an additional collision hazard for migrating eiders compared to coastal and nearshore structures such as the Endicott and North Star developments. Approximately nine vessels would be needed to transport materials and equipment for construction of the GCF to West Dock at Prudhoe Bay during the open water season. Eiders are thought to be susceptible to collision with human-made structures, including vessels, because they fly low and rapid over the water while migrating and are attracted to bright commercial lights on platforms, boats and construction areas at night (USFWS 2010). Certain types of lights, such as steady-state red, on structures increase collision risk, particularly in poor weather (USFWS 2010). In an effort to reduce collision risks resulting from bird attraction to lighted structures, the Bureau of Ocean and Energy Management (BOEM) requires that vessels in the Chukchi and Beaufort Sea program areas minimize the use of high-intensity work lights, especially within the 65-foot bathymetric contour (BOEMRE 2011).

Based on the existing information on spectacled eider nest distribution and near-shore habitat use within the Project area, the proposed Project may adversely affect spectacled eiders. However, the completion of site specific nest searches near the proposed GCF, the timing of construction activities during winter for the first 75 miles of the proposed Project, the AGDC's commitment to comply with North Slope environmental standards and practices, and coordination with the USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea would minimize impacts to spectacled eiders. Additional mitigation measures could be required after consultation between the AGDC and appropriate agencies.

Aboveground and Support Facilities

The only aboveground or support facility that may affect spectacled eiders is the GCF. The impacts noted above including noise production, increased mortality from collisions, predation and a loss of breeding habitat would apply to construction and operation of the GCF. These impacts are not expected to adversely impact spectacled eiders.

Mitigation

In addition to the mitigation measures previously mentioned for wildlife in Section 5.5.3, the following mitigation measures are recommended for spectacled eiders:

- All activities associated with the proposed Project would comply with North Slope Borough environmental standards and practices;
- Preconstruction nest surveys would be conducted prior to construction to determine site use by breeding spectacled eiders. Where spectacled eiders are found to be present, construction activities would be conducted outside of nesting and brood-rearing; and

- Coordinate with the USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea during periods of darkness or inclement weather in order to minimize collisions with spectacled eiders.

5.8.4.16 Steller's Eider

Affected Environment

The Alaska breeding population of the Steller's eider was federally listed as threatened in June 1997 (62 FR 112:31748) due to a contraction of its range on both the YK Delta and on the ACP (USFWS 2002). Designated critical habitat includes breeding habitat on the YK Delta and marine molting and overwinter habitats in the Kuskokwim Shoals in northern Kuskokwim Bay, and Seal Islands, Nelson Lagoon, and Izembek Lagoon on the north side of the Alaska Peninsula (66 FR 23: 8850). No critical habitat for Steller's eiders has been designated on the ACP. Steller's eiders are small sea ducks (17 inches) with a squared head and angular bill. Males in breeding plumage have a black back, white shoulders, chestnut breast and belly, a white head with a greenish tuft, and black eye patch. Females are mottled dark red-brown with a lighter eye ring. Both male and female have a blue patch with a white border on the upper wing (speculum).

Steller's eiders nest on coastal tundra next to ponds or in drained lake basins. Most nests are found within partially drained lake basins that contain a mosaic of shallow ponds in emergent sedge (*Carex aquatilis*) and pendant grass (*Arctophila fulva*) (65 FR 49:13262). Steller's eiders breeding in Alaska and Russia migrate south after breeding to molt along the coast of Alaska from Nunivak Island to Cold Bay, in Izembek Lagoon, Nelson Lagoon, and near the Seal Islands (USFWS 2002). Steller's eiders are typically associated with the nearshore environment, in protected waters generally less than 33 feet in depth (Larned 2006).

The Alaska breeding population of Steller's eiders is estimated at hundreds or low thousands (Larned et al. 2010; Sea Duck Joint Venture 2003; USFWS 2002). Steller's eiders occur at low densities across the ACP, although they are much more abundant near Barrow (Figure 5.8-3). Historical records document Steller's eiders nesting as far east as Wainwright; although nesting has not been verified east of the Colville River since the 1970s. The Barrow area appears to be the center of abundance and primary nesting area (Quakenbush et al. 2002; USFWS 2002).

Non-breeding and post-breeding eiders in Alaska use the nearshore area of the northeastern Chukchi Sea and large lakes around Barrow for summering and molting, with a few birds occasionally occurring as far east as the U.S.-Canadian border (Quakenbush et al. 2002; USFWS 2002). Documented sightings of Steller's eiders offshore in the Beaufort Sea are few. In the Beaufort Sea, only three were seen during offshore aerial surveys in 1999-2000, approximately 50 miles southeast of Barrow (Fischer and Larned 2004). As sea ice forms in the Arctic Ocean, flocks move south through open leads and eventually arrive at molting and wintering grounds in ice-free lagoons along the north and south side of the Alaska Peninsula, Cook Inlet, and the eastern Aleutian Islands (BOEMRE 2011).

The cause of the world-wide decline of Steller's eiders remains unknown (USFWS 2001b; USFWS 2002). Identified threats to their continued survival include: predation, hunting, ingestion of spent lead shot in wetlands, changes in the marine environment, and exposure to oil or other contaminants near fish processing facilities in southwest Alaska (USFWS 2001b; USFWS 2002).

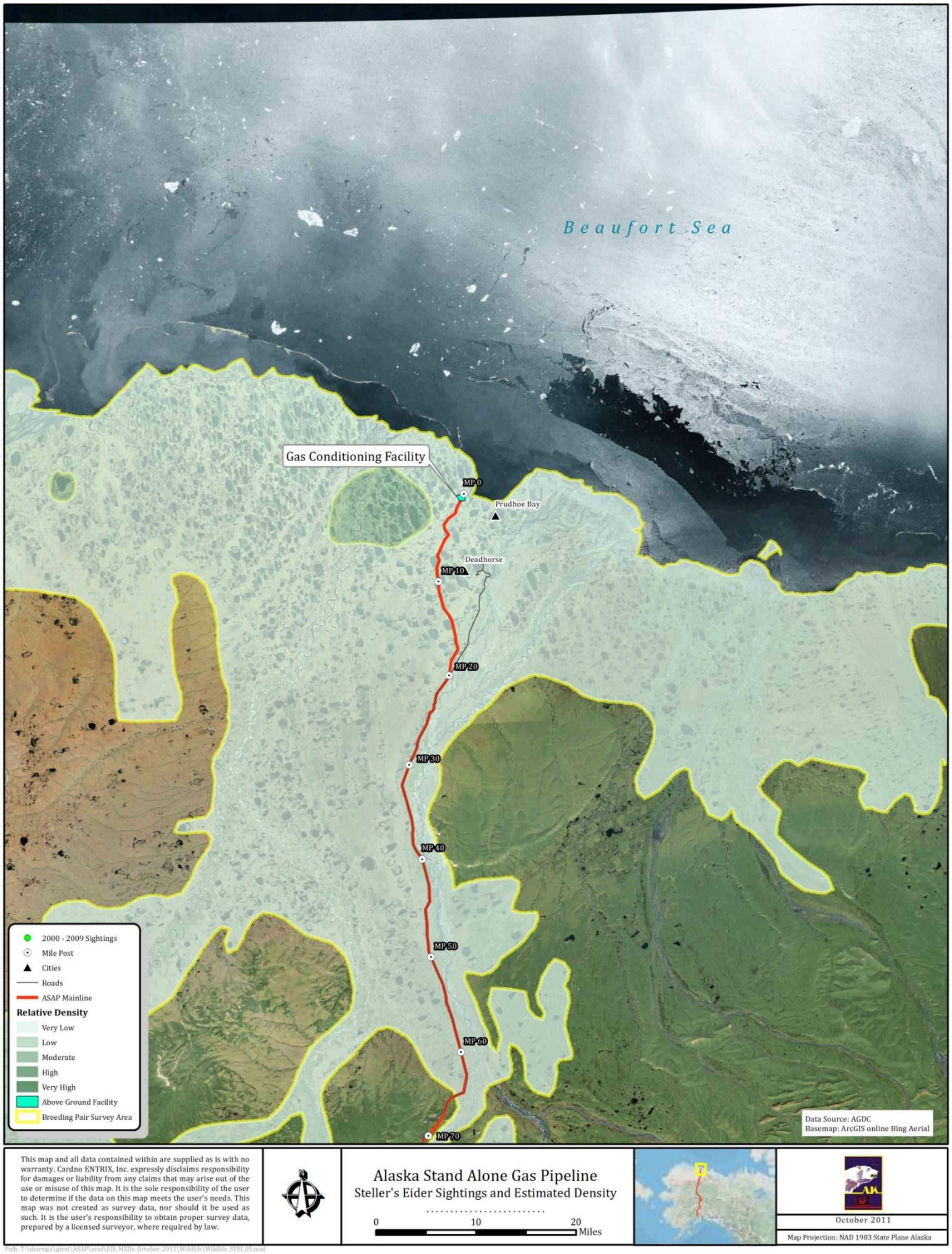

FIGURE 5.8-3 Arctic Coastal Plain Steller's Eider Breeding Pair Survey Observations and Nesting Density

Environmental Consequences

Proposed Action

Because no Steller's eiders have been verified nesting east of the Colville River since the 1970s, the proposed Project is not anticipated to disturb nesting Steller's eiders or their nesting habitat (Figure 5.8-3). However, eiders do occasionally collide with structures, including vessels, during migration. Collisions are more likely to occur along the coast and during periods of poor weather and visibility because they fly low and rapid over the water while migrating and become attracted to bright lights at night (USFWS 2010). Certain types of lights, such as steady-state red, on structures increase collision risk, particularly in poor weather (USFWS 2010). In an effort to reduce collision risks resulting from bird attraction to lighted structures, the BOEM requires that vessels in the Chukchi and Beaufort Sea program areas minimize the use of high-intensity work lights, especially within the 65-foot bathymetric contour (USFWS 2010). Approximately nine ships would be needed to ship materials and equipment for construction of the GCF to West Dock at Prudhoe Bay during the open water season. Steller's eiders could potentially collide with the GCF or vessels en route to or from West Dock during spring and fall migration; however, because few Steller's eiders are expected to occur east of the Project area, the potential for collision in or along the Beaufort Sea is very small.

Based on the existing information of Steller's eider nest distribution occurring outside of the Project area and their near-shore marine habitat use in the Beaufort Sea, the proposed Project may affect, but is not likely to adversely affect Steller's eiders. The nine shipments of material to West Dock are not expected to adversely affect Steller's eiders use of near-shore habitat. Near-shore habitat use for Steller's eiders is outside of vessel shipping lanes to West Dock. Steller's eider would likely be habituated to the regular vessel traffic use at West Dock. The timing of construction activities during winter for the GCF and the first 75 miles of the proposed Project, the AGDC's commitment to comply with North Slope environmental standards and practices, and coordination with the USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea would minimize impacts to Steller's eiders.

Aboveground and Support Facilities

Construction and operation of the GCF could potentially affect Steller's eiders; however no Steller's eiders have been verified nesting east of the Colville River since the 1970s. Steller's eiders could potentially collide with the GCF during spring and fall migration; however, because few eiders are expected to occur east of the Project area, the potential for collision is very small. All other aboveground or support facilities would occur outside of the current distribution of Steller's eiders. Aboveground and support facilities for the proposed Project would therefore have no affect on Steller's eider nesting habitat or to nesting Steller's eiders.

Mitigation

In addition to the mitigation measures previously mentioned for wildlife in the Wildlife Section 5.5.3, the following mitigation measures are recommended for Steller's eiders:

- All activities associated with the proposed Project would comply with North Slope Borough environmental standards and practices; and
- Coordinate with USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea during periods of darkness or inclement weather in order to minimize collisions with Steller's eiders.

5.8.4.17 Yellow-billed Loon

Affected Environment

The yellow-billed loon, the largest of the three loons occurring on Alaska's ACP, was designated a candidate for federal listing throughout its range in March, 2009 (74 FR 56:12932). Yellow-billed loons are considered vulnerable due to their low total population size, low reproductive rate, and specific breeding habitat requirements (Earnst 2004). Yellow-billed loons nest exclusively in coastal and inland low-lying tundra, in association with permanent, fish-bearing lakes (74 FR 56:12932). Lakes that are capable of supporting breeding yellow-billed loons have: abundant fish populations; depths greater than six feet; size of at least 33 acres; connections to streams that supply fish; convoluted, vegetated, and low-lying shorelines; clear water; and stable water levels. Nest sites are usually located on islands, hummocks, or peninsulas, along low shorelines, within three feet of water (74 FR 56:12932). Yellow-billed loons use nearshore and offshore marine waters close to their breeding areas for foraging in summer (74 FR 56:12932).

An estimated 2,944 to 4,194 yellow-billed loons occurred on the ACP in 2009 (Larned et al. 2010). The ten-year population trend for the ACP suggest that this breeding population has increased significantly at a rate of nearly 6 percent per year; while the 17 year population trend indicates the population has increased at a rate of 2 percent per year (Larned et al. 2010). Yellow-billed loons occur at low densities across the ACP, although they are much more abundant in the northeastern NPR-A west of the Project area (Figure 5.8-4).

Identified threats to the yellow-billed loon in Alaska include: oil and gas development especially within the NPR-A, marine pollution and overfishing, exposure to contaminants, climate change, subsistence and commercial fishing bycatch, and subsistence harvest (74 FR 56:12932).

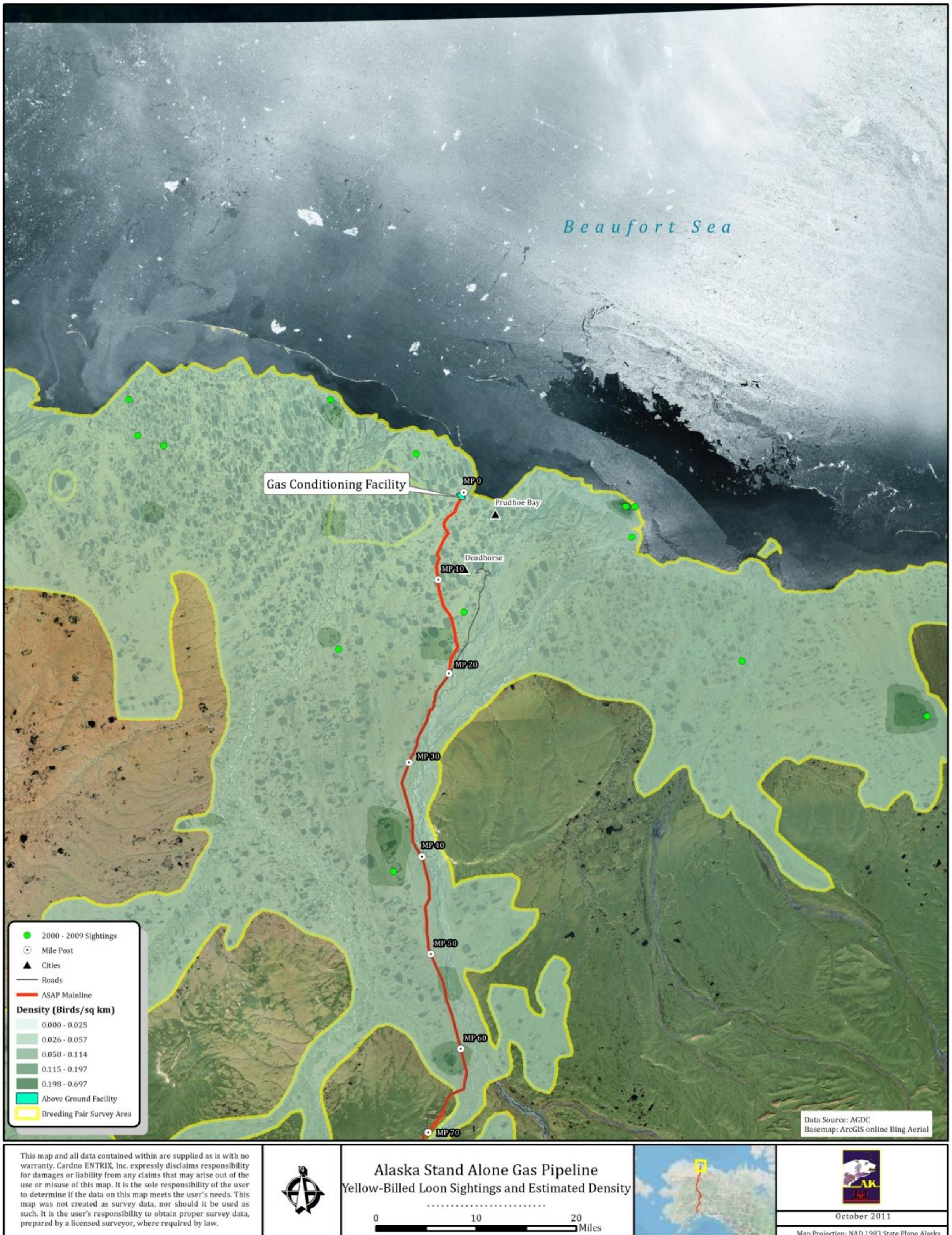

FIGURE 5.8-4 Arctic Coastal Plain Yellow-billed Loon Breeding Pair Survey Observations and Nesting Density

Environmental Consequences

Proposed Action

Construction activities for the portion of the pipeline from the GCF to MP 70 could disturb a few nesting yellow-billed loons; although most construction would occur during winter when yellow-billed loons are not present on the North Slope. Noise from operation of the GCF could disturb a few non-breeding or brood-rearing yellow-billed loons if they use habitats in or near Prudhoe Bay, although noise levels at the GCF are anticipated to be low because equipment would be housed within the facility and fitted with sound baffles to minimize noise generation. Noise associated with the GCF is not likely to disturb nesting yellow-billed loons as they are not anticipated to nest in the vicinity. No recent nest surveys have been completed for the Project area; however, annual USFWS aerial surveys indicate that the Project area crosses two lake basins where yellow-billed loons have been observed between 2000 and 2009 (Figure 5.8-4). Construction traffic along the pipeline route could cross areas used for breeding by yellow-billed loons. Construction traffic in summer would be in addition to local field traffic and the additional traffic could disrupt breeding or foraging activities or collide with loons and their young. Most construction would occur during winter, however some summer staging activities and other site preparation activities are likely to occur during summer. To minimize vehicle collision, vehicles would be required to comply with existing speed limits and all activities associated with the proposed Project would comply with North Slope Borough environmental standards and practices. Preconstruction nest survey should be conducted prior to construction to determine site use by breeding yellow-billed loons. Loons occasionally collide with structures during migration, especially along the coast and during periods of poor weather and visibility. The location of the proposed Project near the west shore of Prudhoe Bay is not likely to create an additional collision hazard for migrating loons compared to coastal and nearshore structures.

Determinations are not applicable to candidate species; however, the existing information indicates that a few yellow-billed loons may use the Project area for nesting. This area includes the vicinity of the GCF and pipeline within the Prudhoe Bay oil field and south along the Dalton Highway. Site specific nest searches near the proposed GCF and along the pipeline route should be required before project development to prevent disturbance to yellow-billed loons. The AGDC would commit to comply with North Slope environmental standards and practices; therefore, the proposed Project would not be likely to result in adverse affects to yellow-billed loons.

Aboveground and Support Facilities

Construction activities for the GCF could disturb a few nesting yellow-billed loons; although most construction would occur during winter when yellow-billed loons are not present on the North Slope. Yellow-billed loons may collide with the GCF during migration; however the GCF is not likely to create an additional collision hazard for migrating yellow-billed loons compared to coastal and nearshore structures. No other aboveground and support facilities occur would affect yellow-billed loons.

Mitigation

The AGDC would conduct site specific nest searches near the proposed GCF and along the pipeline route prior to construction. Vehicles would be required to comply with existing speed limits and all activities associated with the proposed Project would comply with North Slope environmental standards and practices. Equipment housed within the GCF facility would be fitted with sound baffles to minimize noise generation.

5.8.4.18 State-Protected Animals

The state of Alaska maintains a list of Alaskan endangered species and affords additional protection to these species. The protections afforded to animals and plants on this list are established by Alaska Statute AS 16.20.190 and by the Commissioner of Fish and Game. The short-tailed albatross, Eskimo curlew, blue whale, humpback whale and right whale are state endangered species. Table 5.8-2 includes the two Alaska endangered species that have been identified as potentially occurring in or near the proposed Project area. Table 5.8-2 includes the status, potential to occur, potential impacts and mitigation measures for the proposed Project.

TABLE 5.8-2 Alaska State Endangered Species Potentially Occurring in or near the Project Area

Species	Group	Status	Occurrence and Habitat	Potential Impacts	Proposed Conservation Measures
Eskimo curlew *Numenius borealis*	Bird – Shorebird	AK-E; ESA-E	Historically nested throughout central and western Alaska; no confirmed sightings of this species since the 1960s and the species is considered extinct.	If species still exists, nesting habitat loss, and disturbance to nest sites	Avoid construction during nesting period along occupied habitats.
Humpback Whale	Whale	AK-E; ESA-E	In Alaska, humpback whales are seasonal migrants and are found from southeastern Alaska, north and west through the Gulf of Alaska, Bering Sea, and into the southern Chukchi Sea from May–September.	Disturbance to humpback whales from increased vessel traffic may alter their behavior. Engine noise from vessels may mask whale calls which can disrupt communication among whales.	Applicant would ensure that all Project-related vessels would comply with any recommendations from NMFS/USFWS for vessel operations at the Port of Seward and the Port of Anchorage.

Sources: ADF&G 1998; Ambrose 2008a; Hunt and Eliason 1999; Larned et al. 2010; Swem 2008; Wright et al. 1998; Wright 2008.

AK-E = Alaska Endangered

ESA-E = Federally Endangered

5.8.5 Mitigation

The AGDC has committed to comply with recommendations from the NMFS and USFWS to prevent impacts to ESA listed species from vessel operations at all proposed port sites and along shipping routes. Mitigation measures proposed for vessel activities are also included in the Marine Mammal Section 5.7.

5.8.6 References

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5.9 LAND USE

This section describes the regulatory setting and the existing land uses, zoning, and land use plans within the Project area. Potential impacts to land use under the proposed Project and the Denali National Park Route Variation are discussed. Land use plans applicable to land intersected by the proposed Project are discussed in this section, including recreation plans; however, effects to the level of recreational use within the Project area are assessed in Section 5.10 (Recreation).

5.9.1 Affected Environment

Land management plans and regulations, landownership maps, aerial photography, and other information sources available in the public domain were used to describe the affected environment and to conduct the analysis of potential impacts to land use and ownership under the proposed Project.

5.9.1.1 Regulatory Setting

Federal Regulations

The proposed Project would intersect federal lands managed by the Bureau of Land Management (BLM) and the Department of Defense (DOD). Portions of the GCF to MP 540 segment would be located in the vicinity of, but would not intersect, lands managed by the U.S. Fish & Wildlife Service (USFWS) and the National Park Service (NPS). The Denali National Park Route Variation would intersect land managed by the NPS.

Bureau of Land Management

The BLM administers most of the Federal lands in the Project area. Under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C 1732), the Secretary of the Department of the Interior (DOI) has the authority to regulate use, occupancy and development of public lands and prevent unnecessary or undue degradation of public lands. The BLM, under the authority of the FLPMA, manages approximately 75 million surface acres of federal public land within Alaska through its Fairbanks and Anchorage District Offices. Section 503 of FLPMA provides for the designation of ROW corridors and encourages utilization of ROWs in-common to minimize environmental effects and the proliferation of separate ROWs. Bureau policy, as described in BLM Manual 2801.13B1, is to encourage prospective applicants to locate their proposals within corridors. Pursuant to the Mineral Leasing Act and 43 CFR 2880, the BLM has the authority to grant a ROW for a natural gas pipeline to cross federal lands under the BLM's jurisdiction or under the jurisdiction of two or more federal agencies, with the exception of lands in the National Park System, Outer Continental Shelf, and Indian Trust lands.

Wilderness Resources Management

The Wilderness Act of 1964 (16 U.S.C 1131-1136, 78 Stat. 890, P.L. 88-57) established the National Wilderness Preservation System and designated the first Wilderness Areas. Seven Wilderness Areas were designated in Alaska by the Alaska Lands Act (P.L. 96-487). The proposed Project would not affect Wilderness Areas.

Section 201 of FLPMA requires the BLM to maintain on a continuing basis an inventory of all public lands and their resources and other values. Instruction Memorandum (IM) 2011-154 directs BLM offices to conduct and maintain inventories regarding the presence or absence of wilderness characteristics, and to consider identified lands with wilderness characteristics in land use plans and when analyzing projects under NEPA.

The BLM does not manage any wilderness areas in the State of Alaska. In 1980, the BLM completed a special project Nonwilderness Assessment in Alaska along the Alaska Natural Gas Transportation System route (BLM 1980). As discussed in Appendix J, the 1980 Nonwilderness Assessment showed the area that would also be intersected by the proposed Project ROW lacked naturalness. Recent in the field observations have confirmed that the 1980 assessment is still valid. Therefore, BLM-managed lands that would be intersected by the ROW (see Figure 5.9-1) have been determined by the BLM to lack wilderness characteristics and size criteria because of land status and various manmade improvements that affect these criteria (Appendix J).

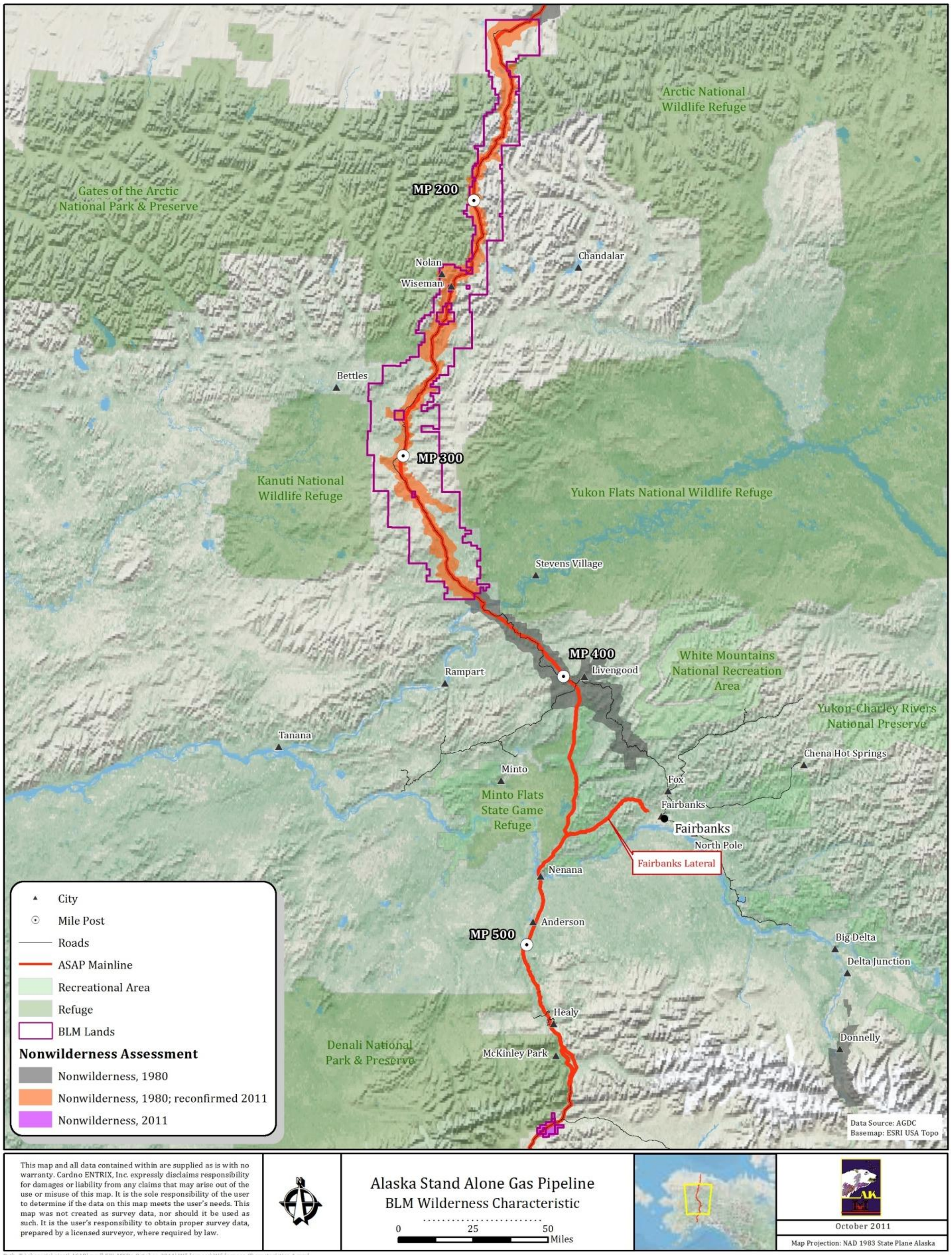

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FIGURE 5.9-1 BLM Wilderness Characteristics

National Park Service

Lands administered by the NPS in the vicinity of the proposed ROW include the Gates of the Arctic NPP and Denali NPP. The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. The Denali National Park Route Variation would intersect the boundary of the Denali NPP.

In 1980, Congress passed the Alaska National Interest Lands Conservation Act (ANILCA, 16 USC §§ 3101-3233, Pub. L. 96-487), which enlarged and renamed the park Denali National Park and Preserve. Section 101 of ANILCA describes the broad purposes of the new conservation system units (CSUs) throughout Alaska, including the Gates of the Arctic NPP and Denali NPP (NPS 2006). These are the following:

- Preserve lands and waters for the benefit, use, education, and inspiration of present and future generations.
- Preserve unrivaled scenic and geological values associated with natural landscapes.
- Maintain sound populations of, and habitat for, wildlife species.
- Preserve extensive, unaltered ecosystems in their natural state.
- Protect resources related to subsistence needs.
- Protect historic and archeological sites.
- Preserve wilderness resource values and related recreational opportunities such as hiking, canoeing, fishing, and sport hunting.
- Maintain opportunities for scientific research in undisturbed ecosystems.
- Provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so.

Section 202 stated that the Denali NPP additions are to be managed for the following additional specific purposes (ANILCA):

- To protect and interpret the entire mountain massif and the additional scenic mountain peaks and formations.
- To protect habitat for and populations of fish and wildlife, including, but not limited to, brown/grizzly bears, moose, caribou, Dall sheep, wolves, swans, and other waterfowl.
- To provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities.

Title XI of ANILCA establishes a comprehensive system for the approval or disapproval of transportation and utility system applications across public lands in Alaska. The Act sets forth criteria for considering the applications, including an assessment of the impacts on fish and wildlife and their habitat (§§ 3161-3173). Transportation systems that are proposed to cross a CSU created or expanded by ANILCA require an act of Congress if such transportation systems would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska.

The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. However, the Denali National Park Route Variation would intersect the boundary of the Denali NPP, including a portion of the Denali NPP designated as wilderness. The requirements of ANILCA Title XI would be complied with if the route through the Denali NPP is determined to be the preferred route.

The portion of the Denali National Park Route Variation that would intersect the boundary of the Denali NPP would be located entirely within the ADOT&PF ROW. Thus, it would require a permit from ADOT&PF to assure that there are no adverse impacts on the department's use of the ROW. In addition, because ADOT&PF does not have the authority to permit use of the ROW other than for highway purposes, a permit would be required from the NPS.

Section 6(f) of the Land and Water Conservation Fund

Section 6(f) of the Land and Water Conservation Fund (LWCF; 16 U.S.C 4601 et seq.) applies to public areas that have received LWCF monies to acquire or develop public recreation facilities. Section 6(f)(3) requires that these areas be maintained perpetually in public outdoor recreation use, unless the NPS approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. This statute would apply to lands that have received LWCF assistance. During scoping of the proposed Project, the NPS identified two Section 6(f) lands potentially crossed by the proposed Project: Denali SP and the Nancy Lakes State Recreation Area (SRA). Review of the currently proposed Project alignment and the route alternatives determined that the Nancy Lake SRA would not be crossed and is therefore not evaluated further. However, Denali State Park, acquired with the assistance of LWCF funds, would be intersected by the MP 555 to End segment.

Department of Defense

The GCF to MP 540 segment would intersect parcels within the Clear Air Force Station (AFS), which is managed by the DOD for military purposes. Clear AFS is located approximately five miles south of Anderson and is operated by the 13th Space Warning Squadron (USAF). The AFS uses the Solid State Phased Array Radar System to accomplish the following missions:

- Primary mission: Provide Early Warning of Intercontinental ballistic missiles and Submarine-launched ballistic missiles to the Missile Correlation Center at North American Aerospace Defense Command.
- Secondary mission: Provide Space Surveillance data on orbiting objects to the Air Force Space Command Space Control Center (Global Security 2005).

For the proposed Project to cross the AFS, the commander of the 13th Space Warning Squadron would have to concur with the BLM in granting a ROW crossing through the AFS.

United States Fish & Wildlife Service

Portions of the GCF to MP 540 segment would be adjacent to, but would not intersect, the Yukon Flats National Wildlife Refuge (NWR) and the Arctic National Wildlife Refuge (ANWR), both of which are administered by the USFWS. The proposed Project would be approximately 0.2 mile or more from either of these areas and neither of these wildlife refuges would be crossed by the proposed Project. Both NWRs are designated as CSUs under ANILCA (see the discussion of CSUs under the National Park Service subheader above). The proposed Project, however, would not cross either CSU.

The Yukon Flats NWR encompasses approximately 8.5 million acres of federal lands and an additional 2.7 million acres of selected and conveyed lands in east-central Alaska. Congress established the NWR in 1980 when it enacted ANILCA. Section 302(9)(B) of ANILCA sets forth the major purposes for which the Yukon Flats NWR was established and shall be managed. The Yukon Flats NWR was established to conserve canvasbacks and other migratory birds, Dall sheep, bears, moose, wolves, wolverines and other furbearers, caribou, and salmon; to fulfill the international treaty obligations; to provide opportunities for continued subsistence uses; and to ensure the necessary water quality and quantity.

When ANWR was established in 1960, its boundaries encompassed 9 million acres. In 1980, ANILCA enlarged the boundaries to over 19 million acres, designated 8 million acres of it as Wilderness, and designated three Wild Rivers. The purposes for which the ANWR was established and shall be managed, as set forth by Section 303(2)(B) of ANILCA, are identical to those purposes set forth for the Yukon Flats NWR, except that the populations to be conserved within the ANWR vary slightly (caribou herds, polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, snow geese, peregrine falcons and other migratory birds, and Arctic char and grayling).

State Regulations

Alaska Department of Natural Resources

Alaska Statute (AS) 38.04.065 Land Use Planning and Classification and 11 AAC 55.010-.030 requires that the Alaska Department of Natural Resources (ADNR) shall, with local governmental and public involvement under AS 38.05.945, adopt, maintain, and, when appropriate, revise regional land use plans that provide for the use and management of State of Alaska-owned lands. The Existing Land Use Plans subheading describes state plans applicable to the study area, including the Dalton Highway Master Plan, Tanana Valley State Forest Plan, North Slope Site Specific Plan (under development), Susitna Area Plan, Southeast Susitna Area Plan, the Public Review Draft Susitna Matanuska Area Plan, the Susitna Basin Recreation Rivers Management Plan, the Tanana Basin Area Plan, Denali State Park Management Plan, and the Scenic Resources Along the Parks Highway – Inventory and Management Recommendations. Additional information regarding the Scenic Resources along the Parks Highway – Inventory and Management Recommendations is included in Section 5.11 (Visual Resources).

The ADNR, Division of Mining Lands and Water, manages other state lands for multiple purposes. For those lands that are owned by the ADNR, but not covered by a land management plan, the ADNR, in coordination with the public, identifies important land resources and how their lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible multiple uses are allowed on these lands.

Alaska Department of Natural Resources, State Pipeline Coordinator's Office

As described in more detail in Section 1.2.6.4, the ADNR State Pipeline Coordinator's Office (SPCO) manages development on its lands on which the proposed pipeline ROW would be located. A State of Alaska Title 38 Right-of-Way Permit is required for use of State lands. The AGDC has submitted a Right-of-Way Leasing Act AS 38.35.050 Application for Pipeline Right-of-Way Lease.

Alaska Department of Fish & Game

The mission statement of the Alaska Department of Fish & Game (ADF&G) is "to protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principle." Pursuant to 5 AAC 95.420, activities except for lawful hunting, trapping, fishing, viewing, and photography occurring in state game refuges, state recreation areas, across designated wild and scenic rivers, or through state parks require a special area permit. In addition, the use of helicopters or motorized vehicles requires a permit.

The ADF&G manages the Minto Flats State Game Refuge, which would be intersected by the proposed GCF to MP 540 segment at various locations between Project MP 418.4 and MP 455.4. The refuge encompasses approximately 500,000 acres and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana. The refuge was established by the Alaska Legislature in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of hunting, fishing, trapping, and other compatible public uses within the Minto Flats area (ADF&G 1992).

ADNR Mental Health Trust Authority

Alaska Mental Health Trust Lands exist in the Project area. The Trust manages approximately 1 million acres of land across the State of Alaska. Income derived from trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska. Resource categories managed by the trust land office include coal, gas, materials (sand, gravel, rock, and stone), minerals, oil, real estate, and timber (STB 2010).

Alaska Railroad Corporation

The Alaska Railroad Corporation (ARRC) is an independent corporation owned by the State of Alaska. The State of Alaska prohibits the ARRC from selling, exchanging, or otherwise conveying a complete interest in its land. However, the ARRC leases non-operating lands to sustain its transportation assets (ARRC 2011). The proposed Project would require a permit from the ARRC prior to the use of ARRC-owned lands.

Alaska Department of Transportation & Public Facilities

The Alaska Department of Transportation and Public Facilities (ADOT&PF) designs, constructs, operates, and maintains the state's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors. These include more than 5,000 miles of paved and gravel highways; more than 300 aviation facilities, including 260 airports; 43 small harbors; and a ferry system covering 3,500 nautical miles and serving 33 coastal communities (ADOT&PF 2011). Pursuant to 17 AAC 15.011, ADOT&PF has the authority to grant a permit authorizing an applicant to construct or install utility facilities within a department ROW on lands owned by the State of Alaska. The proposed Project would utilize portions of ADOT&PF ROWs. The proposed pipeline would parallel the Dalton Highway corridor from the North Slope to near Livengood. The pipeline would then be routed south and would join the Parks Highway corridor west of Fairbanks near Nenana. From there the pipeline would continue south along the Parks Highway corridor, terminating at MP 737. It then would connect at MP 39 of the Beluga Pipeline near Wasilla.

Local Regulations

AS §§ 29.35 and 29.40 define the authority of cities and boroughs to provide for planning, platting, and land use regulations. Planning powers are either mandatory or optional depending upon the classification of the city or borough.

North Slope Borough

The North Slope Borough asserts jurisdiction over activities within its boundaries on private and state-owned lands. As a home rule borough, the North Slope Borough spells out its powers and duties through its adopted charter ratified by the voters, and it can exercise powers not prohibited by state or federal law or by the home rule charter (AS 29.10). Section 8.0101 of the North Slope Borough Charter established a planning commission with the administrative responsibility for platting, land use control, and zoning for the borough. The commission makes recommendations to the mayor regarding the comprehensive plan (see Existing Land Use Plans below for a description of the North Slope Borough Comprehensive Plan), capital improvements program, fiscal policies, and public services. The legislative assembly adopts land use and zoning regulations by ordinance.

Pursuant to the North Slope Borough Land Management Regulations (NSBMC §§ 19.10.010 – 19.70.060), the North Slope Borough requires compliance with its zoning and permitting ordinances and issues permits for development, uses, and activities on land within the Borough. For development within a North Slope Borough village, a Village District Permit must be obtained. The proposed Project would not intersect any Village District.

Prudhoe Bay

Prudhoe Bay, a census-designated place (CDP), would be intersected by the GCF to MP 540 segment. The GCF would also be located within this CDP. There are no land use restrictions for Prudhoe Bay that apply to pipeline development other than those afforded by the North Slope Borough.

Yukon-Koyukuk Census Area

The GCF to MP 540 segment and the Fairbanks Lateral would both intersect the Yukon-Koyukuk Census Area (YKCA). As described in Section 5.12 and shown in Figure 5.12-1, the YKCA is a 148,000 square mile portion of Alaska's Unorganized Borough, which encompasses nearly 323,400 square miles of the State. The Unorganized Borough comprises the lands of Alaska not within the boundaries of the state's organized boroughs. Planning and zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Nenana

The City of Nenana does not have rigorous land use or zoning designations. Development within the City requires mayoral approval of a Land Use Permit (J. Mayrand Pers. Comm. 2010).

CDPs

The GCF to MP 540 segment would intersect the boundaries of the following CDPs within the Yukon-Koyukuk Census Area: Coldfoot, Four Mile Road, Livengood, and Wiseman. As for the Unorganized Borough, planning and zoning within these CDPs is overseen by the state legislature.

Fairbanks North Star Borough

The Fairbanks North Star Borough (FNSB), as a second class borough, is required to provide for planning, platting, and land use regulations on an area-wide basis (both inside and outside of cities) within the borough in accordance with AS § 29.40. The borough's planning commission was established by Chapter 2.40 of the borough's Code of Ordinances. The commission is charged with preparing and recommending to the legislative assembly appropriate policies, plans, and ordinances for the implementation of the municipal planning, official map, comprehensive plan and zoning functions; acting as an appeals body of decisions of the Platting Board; and acting upon requests for exceptions to the Zoning Code (Title 18). The borough requires that an approved zoning permit be acquired prior to excavation, construction, relocation, or installation for a new land use. Pursuant to the Zoning Code, the installation and maintenance of utility lines are permitted uses in the zoning districts.

CDPs

The GCF to MP 540 segment would intersect the boundaries of the College and Ester CDPs, which are subject to the area-wide FNSB planning, platting, and land use regulations. The proposed Project segment would not be located within the City of Fairbanks municipal boundaries; therefore, there would not be any land use restrictions associated with the City of Fairbanks.

Denali Borough

As a home rule borough, the Denali Borough (DB) spells out its powers and duties through its adopted charter ratified by the voters, and it can exercise powers not prohibited by state or federal law or by the home rule charter (AS 29.10). Section 7.01 of the DB Charter established a planning commission to perform the functions of platting, planning, and zoning for the borough. The commission holds public hearings and makes recommendations to the legislative assembly regarding planning, zoning, amendments to ordinances, and the enforcement of appropriate regulations (Section 5.25).

Anderson, Healy, McKinley Park, and Cantwell

The City of Anderson and the communities of Healy, McKinley Park, and Cantwell would be intersected by the proposed pipeline. The City of Anderson is the only incorporated place within DB. There are no land use restrictions for these communities that apply to pipeline development other than those afforded by the DB. See the subsection Existing Land Use Plans below for a discussion of development within parcels owned by the City of Anderson.

Matanuska-Susitna Borough

The Matanuska-Susitna (Mat-Su) Borough, as a second class borough, is required to provide for planning, platting, and land use regulations on an area-wide basis (both inside and outside of cities) within the borough in accordance with AS § 29.40. The Mat-Su Borough may delegate these powers to a City within the borough (AS § 29.40.010).

The Mat-Su Borough's Planning Commission was established to perform the area-wide functions of planning, platting, and zoning. The Commission's recommendations are then transmitted to the Mat-Su Borough Assembly, a body of elected district representatives that sets policy and exercises legislative power within the Borough. According to MSB Chapter 15.24 Assembly, Zoning Functions, the Assembly has the authority, with the Planning Commission's recommendation, to establish building and land use regulations and create districts (MSB 15.24.015). With the assistance of the Planning Commission, the Assembly prepares and revises the Mat-Su Borough Wide Comprehensive Plan (Mat-Su Borough 2005a). The Mat-Su Borough Wide Comprehensive Plan provides general goals and policy recommendations for a 20-year period to address development patterns, technological advances, a growing population, and a diversifying economy.

The Mat-Su Borough uses both Borough-wide and special use district (SpUD) ordinances. Mat-Su Borough-wide ordinances employ setback standards, including a 75-foot water-body setback adopted by voter initiative; sanitary solid waste disposal sites; and mobile home park standards. SpUDs are tailored to a local community's special conditions and are unique to the geographic boundary of each community. Local communities have the ability to redefine a particular borough-wide measure through their SpUD ordinances (STB 2010). Land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit.

The MP 555 to End segment would pass through the communities of Trapper Creek, Susitna, Willow, Big Lake, and Point MacKenzie. Each of their Community Councils currently has or is developing a comprehensive plan. These community comprehensive plans are consistent with the general goals and recommendations of the Mat-Su Borough Wide Comprehensive Plan.

5.9.1.2 Existing Land Use

Land Ownership

Federal

The federal government owns parcels within the proposed ROW that are managed by the BLM, DOD (Clear AFS), NPS, and USFWS. The State of Alaska, University of Alaska, AHTNA, Inc. and the Toghotthele Corporation have selected federally-owned lands within the proposed Project ROW.

State

The State of Alaska owns the greatest number of parcels within the proposed ROW. Lands owned by the State of Alaska are managed by the ADNR under the guidance of regional land use plans (see Existing Land Use Plans). The proposed Project would utilize portions of state ROW. Pursuant to 17 AAC 15.011, ADOT&PF has the authority to grant a permit authorizing an applicant to construct or install utility facilities within a department ROW on lands owned by the State of Alaska. Portions of the proposed Project would cross trails established under Revised Statute 2477 (R.S. 2477), as discussed further below. As R.S. 2477 trail ROWs are easements and are not owned by the State, land ownership at these crossings are addressed under the respective land ownership sections.

ADNR Mental Health Trust Authority

Alaska Mental Health Trust Lands would be intersected by the proposed ROW. The Trust manages approximately 1 million acres of land across the State of Alaska. Income derived from trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska. Resource categories managed by the trust land office include coal, gas, materials, minerals, oil, real estate, and timber (STB 2010).

University of Alaska Fairbanks

The University of Alaska currently owns and manages approximately 150,000 acres in Alaska. Some of this land would be intersected by the proposed ROW. University "trust lands" are managed for the use and benefit of the University and are not considered state public domain land. The University develops, leases, and sells land and resources to generate funds for the University of Alaska's Land Grant Trust Fund (STB 2009).

Alaska Railroad Corporation

The Alaska Railroad Corporation (ARRC) is an independent corporation owned by the State of Alaska. The State of Alaska prohibits the ARRC from selling, exchanging, or otherwise conveying a complete interest in its land. However, the ARRC leases non-operating lands to sustain its transportation assets (ARRC 2011).

Local

The cities of Anderson and Nenana own parcels within the proposed ROW. Other local governmental entities having ownership of parcels within the proposed ROW include the DB, Mat-Su Borough, Nenana Airfield, and the Railbelt School District.

Alaska Native Regional and Village Corporations

In 1971, President Richard Nixon signed into law the Alaska Native Claims Settlement Act (ANCSA). Under ANCSA, aboriginal financial and land claims were settled in exchange for $962.5 million in compensation, as well as approximately 40 million acres of land (Norris 2002). The ANCSA established twelve for-profit Alaska Native regional corporations (a thirteenth corporation was later added for Alaska Natives living outside the State), which administer the claims from the settlement. In addition, more than 200 Alaska Native village corporations were created. Both the regional and village corporations own land in and around Native villages, with ownership proportionate to the enrolled populations of these corporations during the 1970s. Surface rights to the land are owned by the village corporations, with subsurface rights controlled by regional corporations. In turn, the village and regional corporations are owned by enrolled Alaska Natives (Linxwiler 2007). Approximately 80,000 Natives are enrolled under ANCSA, and receive 100 shares for the village corporation in which they are enrolled and the same amount for the regional corporation in which they are enrolled (Chance 1999).

Native corporation land is often held in large tracts and used for subsistence purposes or developed/sold to generate revenue for the corporation. Native regional corporation-owned lands within the Project area would consist of parcels with subsurface rights owned by the Cook Inlet Region, Inc. (CIRI), Doyon, Ltd., and Ahtna, Inc. The Toghotthele Corporation, a Native village corporation representing the Native village of Nenana, owns surface rights to parcels within the Project area.

As private land, uses on land owned by Native corporations are subject to approvals of the surface and subsurface landowners. The CIRI requires that a permit be obtained for use of CIRI lands. Permits may be granted for access only, commercial guides and outfitters, and recreational use (CIRI 2011). Doyon, Ltd. manages its lands for responsible economic development of natural resources, protection of cultural and historic sites, and commercial and non-commercial use by shareholders. Non-commercial use permits may be obtained by shareholders (Doyon Limited 2011). Ahtna, Inc. also requires a permit for use of its lands, including a permit fee for public and commercial activities. Ahtna, Inc. lands are managed for mineral exploration, timber resources, tourism, some types of hunting, and predator control, among other uses (Ahtna, Inc. 2011).

Native Allotments

Under the Alaska Native Allotment Act of 1906 (34 § 197), qualifying Alaska Natives were allotted up to 160 acres of non-mineral land. The proposed Project ROW would intersect

Alaska Native Allotments awarded under the Act. The Tanana Chiefs Conference manages a trust service with the Bureau of Indian Affairs and acts as trustee for native allotments property owners on behalf of the 42 villages of Interior Alaska.

Private Landowners

Private lands in the Project area are used for residential, agricultural, and commercial purposes. As private land, land uses are subject to approvals of the landowner.

Proposed Action

The majority (461.3 miles; 59.9 percent) of land traversed by the proposed Project ROW is under State ownership. Land ownership along the proposed Project ROW is displayed in Table 5.9-1(a). Federal land accounts for 31.8 percent (245.1 miles) of the land that would be crossed by the pipeline ROW. Native corporation (31.4 miles; 4.1 percent), private (22.2 miles; 2.9 percent), municipal/borough (9.2 miles; 1.2 percent), Native allotment lands (0.8 mile; 0.1 percent) would also be intersected.

Most of the Project ROW along the GCF to MP 540 segment would be on federal and state land. Of the 538.8 miles of land that would be crossed by the pipeline within the segment, federal land would account for 237.7 miles (44.1 percent), state land would account for 286.5 miles (53.1 percent), and private land would account for 8.4 miles (1.6 percent). The GCF to MP 540 segment would also cross through 5.2 miles (1.0 percent) of Native corporation land and 1.0 mile (0.2 percent) of municipal/borough land.

Most of the land that would be crossed by the Fairbanks Lateral is under state ownership (33.1 miles; 96.2 percent). The segment also would cross land under private ownership (0.5 mile; 1.5 percent) as well as 0.8 mile (2.3 percent) of Native allotment lands.

The MP 540 to MP 555 segment would cross land under state (8.0 miles; 51.3 percent), Native corporation (7.3 miles; 46.8 percent), and private (0.3 mile; 1.9 percent) ownership.

The majority of the MP 555 to End segment would be under state ownership (133.7 miles; 73.8 percent). Federal (7.4 miles; 4.1 percent), private (13 miles; 7.2 percent), municipal/borough (8.2 miles; 4.5 percent), and Native corporation (18.9 miles; 10.4 percent) lands would also be intersected.

TABLE 5.9-1(a) Current Ownership Crossed by the Proposed Project ROW in Distance (Miles)[a]

Segment	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation
Proposed Action						
GCF to MP 540	237.7	286.5	8.4	1.0	0.0	5.2
Fairbanks Lateral	0.0	33.1	0.5	0.0	0.8	0.0
MP 540 to MP 555	0.0	8.0	0.3	0.0	0.0	7.3
MP 555 to End	7.4	133.7	13.0	8.2	0.0	18.9
Proposed Action Total	**245.1**	**461.3**	**22.2**	**9.2**	**0.8**	**31.4**
Denali National Park Route Variation	**6.6**	**0.7**	**0.1**	**0.0**	**6.0**	**1.8**

[a] Landownership information does not include approximately 0.9 mile of waterbody crossings.

Note: Totals may not sum due to rounding.

Source: Landownership provided by client AGDC & BLM Land Ownership January 2011

TABLE 5.9-1(b) Current Ownership Occupied by the Operational Footprint of the Aboveground Facilities (Acres)

Aboveground Facility	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation
Compressor Station (MP 225)	1.4	0.0	0.0	0.0	0.0	0.0
Compressor Station (MP 286.6)	1.4	0.0	0.0	0.0	0.0	0.0
Compressor Station (MP 458.1)	0.0	1.4	0.0	0.0	0.0	0.0
GCF (GCF to MP 540)	0.0	68.7	0.0	0.0	0.0	0.0
NGL Extraction Facility (MP 555 to End)	0.0	0.0	0.0	5.2	0.0	0.0
Fairbanks Lateral Take-Off Facility (Fairbanks Lateral)	0.0	3.3	0.0	0.0	0.0	0.0
Total	**2.9**	**73.5**	**0.0**	**5.2**	**0.0**	**0.0**

Source: National Landcover Dataset USGS 2001.

As shown in Table 5.9-1(b), the majority of land that would be occupied by the aboveground facilities is currently under state ownership (73.5 acres), with the largest footprint attributable to the GCF (68.7 acres). Other types of land ownership include municipal/borough (5.2 acres) and federal ownership (2.9 acres).

An estimate of the volume of solid waste that would be generated by the proposed Project has not been developed; however, the Applicant would use ADEC-approved disposal sites. Therefore, no new disposal sites would be developed for the proposed Project and no additional land use impacts would occur as a result of solid waste generation. Similarly, construction camps for the proposed Project would be located on existing permitted construction sites; therefore, no new land use impacts would occur as a result of use of the construction camps.

Construction

Construction of the proposed Project pipeline ROW would affect a total of 10,556 acres (not including access roads - see instead Section 5.9.1.4). Land ownership that would be affected by the construction ROW is displayed in Table 5.9-2. State land would comprise 53.6 percent of the total, federal land 38.3 percent, and municipal/borough land 1.0 percent. Private (2.7 percent), Native allotment (0.1 percent), and Native corporation land (4.1 percent) would also be intersected, along with water (0.1 percent). Of the land affected, 7,656 acres or 72.5 percent would be in the GCF to MP 540 segment, 417.3 acres (4.0 percent) would be in the Fairbanks Lateral, 220.6 acres (2.1 percent) would be in the MP 540 to MP 555 segment, and 2,262 or 21.4 percent would be in the MP 555 to End segment.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: construct a new aerial suspension bridge (Option 1); utilize the existing E.L. Patton Bridge (Option 2); or utilize the HDD method (Option 3). Most of the land that would be crossed at the Yukon River is under state ownership (2.0 miles, 83.3 percent), with an additional 0.4 mile (0.2 percent) under federal management.

Construction of a new aerial bridge (Option 1) would require a construction area of approximately one acre of land within the ROW on each side of the Yukon River. Option 2 would result in the least impacts to land use since it would utilize the existing bridge and not require any additional construction areas. Option 3 would result in construction of one acre of land within the ROW on each side of the Yukon River in order to place the pipe underneath the river. Overall, more land would be impacted from building a suspension bridge (Option 1) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2).

Denali National Park Route Variation

The Denali National Park Route Variation would cross mainly federal (6.6 miles; 43.4 percent) and Native allotment (6.0 miles; 39.5 percent) lands. State (0.7 mile; 4.6 percent), private (0.1 mile; 0.7 percent), and Native corporation (1.8 miles; 11.8 percent) lands would also be crossed by the Denali National Park Route Variation.

Construction

Construction under the Denali National Park Route Variation would affect a total of approximately 35.4 fewer acres than under the MP 540 to MP 555 segment. While federal ownership would not be affected by the MP 540 to MP 555 segment, 81 acres under federal ownership would be affected by the Denali National Park Route Variation. Fewer acres of state, private, and Native corporation lands and more acres of Native allotment lands would be affected by the Denali National Park Route Variation than the MP 540 to MP 555 segment, as shown in Table 5.9-2.

TABLE 5.9-2 Land Ownership Affected by the Construction ROW (Acres)

Segment	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation	Water
Proposed Action							
GCF to MP 540	3,952.3	3,521.9	95.9	13.6	0.0	62.9	9.6
Fairbanks Lateral	0.0	401.1	6.2	0.0	10.0	0.0	0.0
MP 540 to MP 555	0.0	112.8	3.9	0.0	0.0	103.9	0.0
MP 555 to End	89.3	1,626.8	179.6	97.0	0.0	267.5	1.3
Proposed Action Total	**4,041.6**	**5,662.6**	**285.6**	**110.6**	**10.0**	**434.3**	**10.9**
Denali National Park Route Variation	**80.5**	**8.9**	**0.8**	**0.0**	**72.3**	**22.2**	**0.3**

Note: Based on 100 ft construction ROW (offset 40 ft west & 60 ft east of centerline).

Source: Landownership provided by client AGDC & BLM Land Ownership January 2011.

5.9.1.3 Land Cover

Proposed Action

Land cover in the proposed Project area was determined through the use of the National Land Cover Dataset (USGS 2001). Based on this data, the proposed Project would cross developed, agricultural, scrub-shrub, forest, water and wetlands, and barren land covers. Note that due to the use of desktop land cover data sources, numbers reported in this section may not match values reported for field derived data (such as wetland data).

As shown in Table 5.9-3, of the approximately 770.8 miles that would be crossed by the proposed Project ROW, much of the land cover would consist of forest (316.7 miles, or 41.1 percent), shrub/scrub (226.2 miles; 29.3 percent), and developed areas (131.0 miles; 17.0 percent). Lesser quantities of water/wetlands (73.2 miles; 9.5 percent), barren land (22.7 miles; 2.9 percent), and agricultural lands (1.0 mile; 0.1 percent) would also be crossed by the proposed Project ROW. As described above, these land covers are derived from the National Land Cover Dataset; therefore, the water/wetlands land cover category differs from the ‘water’ ownership classification described above.

Within the GCF to MP 540 segment, the most common land covers would include shrub/scrub (201.6 miles), forest (183.9 miles), and developed land (98.8 miles). The remaining land covers would be water/wetland (33.2 miles), barren land (21.7 miles), and agriculture (0.2 mile).

The Fairbanks Lateral would predominantly cross water/wetland (19.9 miles) and forest (12.8 miles). Other land covers would include developed land (1.1 miles) and shrub/scrub (0.6 mile).

Land covers along the MP 540 to MP 555 segment would include forest (10.7 miles), shrub/scrub (3.8 miles), water/wetland (1.0 mile), and barren land (0.1 mile).

Along the MP 555 to End segment, land covers would include forest (109.3 miles), developed land (31.1 miles), shrub/scrub (20.2 miles), water/wetland (19.1 miles), barren land (0.9 mile), and agriculture (0.8 mile).

TABLE 5.9-3 Land Cover Types Crossed by the Proposed Pipeline ROW (Miles)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	98.8	0.2	201.6	183.9	33.2	21.7
Fairbanks Lateral	1.1	0.0	0.6	12.8	19.9	0.0
MP 540 to MP 555	0.0	0.0	3.8	10.7	1.0	0.1
MP 555 to End	31.1	0.8	20.2	109.3	19.1	0.9
Proposed Action Total	**131.0**	**1.0**	**226.2**	**316.7**	**73.2**	**22.7**
Denali National Park Route Variation	**7.4**	**0.0**	**1.1**	**5.4**	**0.2**	**1.0**

Source: National Landcover Dataset USGS 2001.

Construction

The types of land cover along the construction ROW would vary. As shown in Table 5.9-4, the predominant land covers along the proposed Project construction ROW would be forest (3,886.5 acres; 36.8 percent), shrub/scrub (3,214.1 acres; 30.4 percent), and developed land (2,070.7 acres; 19.6 percent). Other land covers would include water/wetland (882.9 acres; 8.4 percent), barren land (489.7 acres; 4.6 percent), and agriculture (11.6 acres; 0.1 percent).

TABLE 5.9-4 Land Cover Affected by Proposed Construction ROW (Acres)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	1,586.9	2.2	2,895.2	2,304.3	390.5	477
Fairbanks Lateral	13.1	0.0	7.7	158.4	237.2	0.9
MP 540 to MP 555	0.3	0.0	52.5	153.9	13.1	0.7
MP 555 to End	470.4	9.4	258.7	1,269.9	242.1	11.1
Proposed Action Total	**2,070.7**	**11.6**	**3,214.1**	**3,886.5**	**882.9**	**489.7**
Denali National Park Route Variation	**88.6**	**0.0**	**13.3**	**67.8**	**3.2**	**12.2**

Source: National Landcover Dataset USGS 2001 within construction ROW (100 ft ROW with exception of 230 ft ROW in areas requiring cut and fill construction methods.)

Yukon River Crossing Options

More land would be impacted from building a suspension bridge (Option 1) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2). During construction, Options 1 and 3 would affect approximately 4.0 more acres of forestland, 4.0 more acres of water/wetland, 14.2 more acres of developed land and 0.8 more acres shrub/scrub land covers than Option 2.

Operation

The permanent ROW of the proposed Project would also affect land cover. As shown in Table 5.9-5(a), forest and shrub/scrub would be the most common land cover affected by the proposed Project permanent ROW, accounting for 1,339.5 acres (38.9 percent) and 1,065.9 acres (31.0 percent), respectively. The remaining affected land cover would include developed land (623.2 acres; 18.1 percent), water/wetland (274.5 acres; 8.0 percent), barren land (133 acres; 3.9 percent), and agriculture (3.7 acres; 0.1 percent).

The operational footprint of the aboveground facilities (Table 5.9-5(b)) would have the greatest effect on shrub/scrub, with 69.2 acres affected (primarily by the GCF). Other land covers within the operational footprint of the aboveground facilities would include forest (10.7 acres), water/wetland (1.2 acres), and developed lands (0.32 acre).

Yukon River Crossing Options

More land would be impacted from building a suspension bridge (Option 1) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2). For the permanent ROW, Options 1 and 3 would affect approximately 6.1 more acres of forestland, 2.0 more acres of water/wetland, 4.6 more acres of developed land and 0.3 more acres shrub/scrub land covers than Option 2.

TABLE 5.9-5(a) Current Land Cover Affected by the Permanent ROW (Acres)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	505.1	0.6[a]	975	856.6	128.8	129.1
Fairbanks Lateral	3.9	0.0	2.2	46.4	72.5	0.1
MP 540 to MP 555	0.0	0.0	13.9	39	3.6	0.2
MP 555 to End	114.2	3.1[b]	74.8	397.5	69.6	3.4
Proposed Action Total	**623.2**	**3.7**	**1,065.9**	**1,339.5**	**274.5**	**132.8**
Denali National Park Route Variation	**29.2**	**0.0**	**4.1**	**22.1**	**1.1**	**4.1**

[a] Consists entirely of cultivated crop land covers.

[b] Agricultural land covers along this segment include cultivated crops (2.8 acres) and pasture/hay land covers (0.4 acres).

Source: National Landcover Dataset USGS 2001 within Permanent ROW (53ft Federal Lands ROW and 30ft State/Private Lands ROW).

TABLE 5.9-5(b) Current Land Cover Affected by the Operational Footprint of the Aboveground Facilities (Acres)

Aboveground Facility	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation
Compressor Station (MP 225)	0.0	0.0	1.4	0.0	0.0	0.0
Compressor Station (MP 286.6)	0.0	0.0	0.2	1.3	0.0	0.0
Compressor Station (MP 458.1)	0.0	0.0	0.0	1.4	0.0	0.0
GCF (GCF to MP 540)	0.0	0.0	67.6	0.0	1.1	0.0
NGL Extraction Facility (MP 555 to End)	0.32	0.0	0.0	4.7	0.1	0.0
Fairbanks Lateral Take-Off Facility (Fairbanks Lateral)	0.0	0.0	0.0	3.3	0.0	0.0
Total	**0.32**	**0.0**	**69.2**	**10.7**	**1.2**	**0.0**

Source: National Landcover Dataset USGS 2001.

Denali National Park Route Variation

Compared to the MP 540 to MP 555 segment, the Denali National Park Route Variation segment would cross more barren land (1.0 mile) and less forest (5.4 miles), shrub/scrub (1.1 miles), and water/wetland (0.2 mile). Whereas the MP 540 to MP 555 segment would not cross developed land, the Denali National Park Route Variation would cross 7.4 miles of developed land (see Table 5.9-3).

Construction

As shown in Table 5.9-4, construction of the Denali National Park Route Variation would affect more acres of developed land than the MP 540 to MP 555 segment (88.6 acres compared to 0.3 acre), more acres of barren land (4.1 acres compared to 0.2 acre) and fewer acres of shrub/scrub, forest, and water/wetland.

Operation

Under the Denali National Park Route Variation, approximately 29 acres of developed land would be affected by Project operations; in contrast, the MP 540 to MP 555 segment would not affected developed land. Operation of the Denali National Park Route Variation would affect more acres of barren land but fewer acres of shrub/scrub, forest, and water/wetlands than the MP 540 to MP 555 segment (see Table 5.9-5(a)).

5.9.1.4 Temporary and Permanent Access Roads

The proposed Project would rely, to the extent practicable, on existing marine transport, rail transport, and public roads to transport equipment, materials, and personnel. Where necessary, access roads would be constructed to provide access to the proposed pipeline ROW, compressor stations, block valves, camps, laydown yards, material sites, and water sources.

Proposed Action

Construction

Construction of the proposed Project would require the use of 523.8 acres for access roads (see Table 5.9-6(a)), including 381.3 acres in the GCF to MP 540 segment, 120.7 acres in the Fairbanks Lateral, 4.8 acres in the MP 540 to MP 555 segment, and 17.0 acres in the MP 555 to End segment. The construction ROW of the access roads would predominantly affect forest (309.0 acres), shrub/scrub (126.7 acres), and developed lands (65.2 acres). Water/wetland (21.0 acres) and agricultural lands (0.7 acre) would also be affected (see Table 5.9-6(b)).

Yukon River Crossing Options

No new access roads would be required for any of the three options selected to cross the Yukon River.

Operation

Proposed Project operations would require approximately 542.3 acres for permanent access roads, including 403.0 acres in the GCF to MP 540 segment, 121.0 acres in the Fairbanks Lateral, 4.9 acres in the MP 540 to MP 555 segment, and 13.6 acres in the MP 555 to End segment (see Table 5.9-6(a)). The operational ROW of the access roads would predominantly affect forest (325.0 acres), shrub/scrub (121.5 acres), and developed land (64.8 acres). Water/wetland (30.1 acres) and agricultural land (1.2 acres) would also be affected (see Table 5.9-6(b)).

Yukon River Crossing Options

No new access roads would be required under any of the options for crossing the Yukon River.

TABLE 5.9-6(a) Land Affected by Access Roads[a] (Acres)

Segment	Construction[b] ROW	Operational[c] ROW
Proposed Action		
GCF to MP 540	381.3	403.0
MP 540 to MP 555	4.8	4.9
MP 555 to End	17.0	13.6
Fairbanks Lateral	120.7	120.9
Proposed Action Total	**523.8**	**542.3**
Denali National Park Route Variation	**-**	**-**

[a] Access Roads acreage is for only that portion of the 50ft ROW of the access roads that falls outside the permanent and construction ROW of the proposed Project pipeline, otherwise the area is already accounted for within the pipeline acreage.

[b] Construction acreage is for both permanent and temporary access roads.

[c] Operational acreage is only for permanent access roads.

Notes: Total Number Access Roads Mainline = 133; Total Number Access Roads Fairbanks = 5

Source: AGDC Access Roads. Acres of disturbance were calculated based upon 50-foot with right of way.

TABLE 5.9-6(b) Current Land Cover Affected by Access Roads[a] (Acres)

Land Cover	Fairbanks Access Roads		Mainline Access Roads		Block Valves	
	Construction[b] ROW	Operational[c] ROW	Construction[b] ROW	Operational[c] ROW	Construction[b] ROW	Operational[c] ROW
Developed	27.5	27.5	37.6	36.8	0.1	0.5
Agriculture	0.0	0.0	0.7	1.2	0.0	0.0
Shrub/Scrub	4.4	4.4	122.0	116.3	0.3	0.8
Forest	81.2	81.2	227.4	242.9	0.4	0.9
Water/Wetland	7.6	7.7	13.4	22.3	0.0	0.1
Barren Land	0.0	0.0	1.9	2.0	0.0	0.1
Total	**120.7**	**120.8**	**403.0**	**421.5**	**0.8**	**2.4**

[a] Access Roads acreage is for only that portion of the 50ft ROW of the access roads that falls outside the permanent and construction ROW of the proposed Project pipeline, otherwise the area is already accounted for within the pipeline acreage.

[b] Construction acreage is for both permanent and temporary access roads.

[c] Operational acreage is only for permanent access roads.

Notes: Total Number Access Roads Mainline = 133; Total Number Access Roads Fairbanks = 5

Sources: AGDC Access Roads; USGS 2001 National Landcover Dataset.

Denali National Park Route Variation

The AGDC has not proposed any access roads along the Denali National Park Route Variation.

5.9.1.5 R.S. 2477 ROW and 17(b) Easements Intersected by the Proposed Project

Proposed Action

R.S. 2477 ROW

The proposed Project would intersect trails established under R.S. 2477. R.S. 2477, located in Section 8 of the Mining Law of 1866, states: "The right of way for the construction of highways over public lands, not reserved for public uses, is hereby granted." Although the law was repealed by Congress with the enactment of FLPMA in 1976, the pre-existing rights attributable to R.S. 2477 trails established under the statute remain in effect. Where an R.S. 2477 ROW exists, a new landowner's title is subject to the ROW, which must still be honored (ADNR 2001a).

Twenty R.S. 2477 trails would be crossed by proposed Project construction and operation, as shown in Table 5.9-7(a). The GCF to MP 540 segment would intersect 14 of these ROWs, and the Fairbanks Lateral and MP 555 to End segment would cross 2 and 4 of these ROWs, respectively. No R.S. 2477 ROW would be intersected by the MP 540 to MP 555 segment.

17(b) Easements

The proposed Project would intersect easements designated under Section 17(b) of ANSCA, which allows reserving easements on lands that will be conveyed to Alaska Native Village and Regional Corporations to allow public access to public land and water. 43 CFR 2650.4-7 describes the guidelines that are used in reserving easements in conveyance documents. 17(b) easements are reserved and managed by the federal government.

Ten 17(b) easements would be crossed by proposed Project construction and operation, as shown in Table 5.9-7(b). The GCF to MP 540 segment would intersect one of these easements, and the MP 540 to MP 555 and the MP 555 to End segment would cross two and seven of these easements, respectively. No 17(b) easements would be intersected by the Fairbanks Lateral.

Yukon River Crossing Options

No R.S. 2477 trails or 17(b) easements would be intersected by crossing the Yukon River.

TABLE 5.9-7(a) R.S. 2477 ROW Intersected by the Project

Segment	R.S. 2477 Trail ROW	File Number	Approximate Mileposts
Proposed Action			
GCF to MP 540	Hickel Highway	RST 450	65.1, 306.4
	Wiseman-Chandalar	RST 254	223.5
	Coldfoot-Chandalar Lake Trail	RST 9	246.2
	Caro-Coldfoot	RST 262	246.2
	Coldfoot-Junction Trail 49	RST 591	246.2
	Slate Creek	RST 412 / RST 412	246.2, 260.4
	Hunter Creek-Livengood	RST 468	405.1
	Dunbar-Brooks Terminal	RST 66	406.2, 452.5, 454
	Dunbar-Minto Tolovana	RST 1595	457.9
	Nenana-Kantishna	RST 346	476.1
	Kobi-McGrath	RST 345	499.8
	Rex-Roosevelt	RST 491	500.7
	Kobi-Kantishna	RST 343	500.7
	Healy-Diamond Coal Mine Dirt Road	RST 709	530.3
Fairbanks Lateral	Easter-Dunbar	RST 70	
	Ester Dome - Nugget Creek Trail	RST 1602	
MP 540 to MP 555	None		
MP 555 to End	Cantwell Small Tracts Road (Lovers Lane)	RST 625	567.8
	Goose Creek Road	RST 1506	686.3
	Nancy Lake-Susitna	RST 149	719.6
	Knik-Susitna	RST 118	732.2
Denali National Park Route Variation	None		

TABLE 5.9-7(b) 17(b) Easements Intersected by the Project

Segment	17(b) Easement Number	Approximate Mileposts
Proposed Action		
GCF to MP 540	7 D9, L	484.6
Fairbanks Lateral	None	n/a
MP 540 to MP 555	21, L	549.4
	17a, L	553.3
MP 555 to End	16 C5, L	558.1
	25 C4	558.1
	25 C5	558.2
	15 C5, L	561.4
	5h D1, L	572.5
	6b C5, L	582.2
	100 C4	584.5
Denali National Park Route Variation	17a, L	549.5

Source: BLM Easements Systems accessed October 2011.

Denali National Park Route Variation

The Denali National Park Route Variation would not cross any R.S. 2477 ROWs or 17(b) easements.

5.9.1.6 Forest Land

Proposed Action

Construction

As shown in Table 5.9-4, construction of the proposed Project ROW would affect approximately 3,886.5 acres of forest land. As shown in Table 5-9.8, the proposed Project would have the greatest effect on evergreen forest, of which 2,116.8 acres would be affected. In addition, approximately 1,012.4 acres of deciduous forest and 757.3 acres of mixed forest would be affected by construction of the proposed Project.

Yukon River Crossing Options

If the AGDC selects Option 2, utilize the existing E.L. Patton Bridge, the construction ROW would affect approximately 0.5, 2.5, and 1.1 fewer acres of deciduous, evergreen, and mixed forest, respectively.

TABLE 5.9-8 Forest Types which would be Affected by the Construction ROW (Acres)

Segment	Deciduous Forest	Evergreen Forest	Mixed Forest
Proposed Action			
GCF to MP 540	450.1	1,643.9	210.3
Fairbanks Lateral	35.1	115.6	7.7
MP 540 to MP 555	5.5	136.8	11.6
MP 555 to End	521.7	220.5	527.7
Proposed Action Total	**1,012.4**	**2,116.8**	**757.3**
Denali National Park Route Variation	**0.0**	**64.8**	**3.0**

Source: USGS 2001 National Landcover Dataset within Construction ROW (100 ft ROW with exception of 23 0ft ROW in cut/dill Lands).

Operation

As shown in Table 5.9-5(a), the proposed Project permanent ROW would affect approximately 1,339.5 acres of forestland. As shown in Table 5-9.9, the permanent ROW would have the greatest effect on evergreen forest, of which 328.7 acres would be affected. In addition, approximately 780.0 acres of deciduous forest and 230.7 acres of mixed forest would be affected by construction of the proposed Project.

Yukon River Crossing Options

For Options 1 and 3, the permanent ROW would affect would affect approximately 0.1, 0.8, and 0.3 fewer acres of deciduous, evergreen, and mixed forest, respectively.

TABLE5.9-9 Forest Types that would be Affected by the Permanent ROW (Acres)

Segment	Deciduous Forest	Evergreen Forest	Mixed Forest
Proposed Action			
GCF to MP 540	147.5	646.7	62.3
Fairbanks Lateral	10.5	33.4	2.4
MP 540 to MP 555	1.0	35.6	2.4
MP 555 to End	169.7	64.3	163.6
Proposed Action Total	**328.7**	**780.0**	**230.7**
Denali National Park Route Variation	**0.0**	**21.1**	**1.0**

Source: USGS 2001 National Landcover Dataset within Permanent ROW (53ft Federal Lands ROW and 30ft State/Private Lands ROW).

Denali National Park Route Variation

Construction

As shown in Table 5.9-8, approximately 67.8 acres of forestland would be affected by construction of the Denali National Park Route Variation, compared to approximately 153.9

acres under the MP 540 to MP 555 segment. Forest types that would be encumbered include evergreen forest (64.8 acres) and mixed forest (3.0 acres).

Operation

As shown in Table 5.9-5a, operation of the Denali National Park Route Variation would permanently remove approximately 22.1 acres of forestland, which would be approximately 16.9 acres less than those lands removed by the MP 540 to MP 555 segment. Forest types affected (see Table 5.9-9) would include evergreen forest (21.1 acres) and mixed forest (1.0 acre).

5.9.1.7 Transportation and Utilities Crossed by the Proposed Project

Proposed Action

The proposed Project ROW would cross railroads, utilities (including the TAPS), trails, driveways, and local and arterial roads. As shown in Table 5.9-10, the proposed Project ROW would intersect railroads 13 times. Arterial and local roads would be crossed 47 and 159 times, respectively. In addition, trails/driveways would be intersected 307 times. Utilities would be intersected by the proposed Project ROW 70 times, and the TAPS ROW would be crossed 17 times.

TABLE 5.9-10 Transportation and Utilities Crossed by the Proposed Project (Number)

Segment	Railroads	Arterial	Local	Trail/ Driveway	Utilities	TAPS
Proposed Action						
GCF to MP 540	5	40	98	102	14	17
MP 540 to MP 555	0	0	1	1	2	0
MP 555 to End	5	6	57	199	52	0
Fairbanks Lateral	3	1	3	5	2	0
Proposed Action Total	**13**	**47**	**159**	**307**	**70**	**17**
Denali National Park Route Variation	**2**	**0**	**0**	**0**	**0**	**0**

Denali National Park Route Variation

As shown in Table 5.9-10, the Denali National Park Route Variation would intersect railroad ROWs twice. This segment would not cross roads, trails/driveways, utilities, or the TAPS. In comparison, the MP 540 to MP 555 segment would cross one local road, one trail/driveway, and would cross utilities twice.

5.9.1.8 Agricultural Land and Prime and Important Farmlands

Proposed Action

Construction

As shown in Table 5.9-4, agricultural lands would be least affected by the proposed Project construction ROW (11.6 acres; or 0.1 percent of the total construction ROW). Construction of the GCF to MP 540 segment would affect 2.2 acres of cultivated crops, while the MP 555 to End segment would affect 8.4 acres of cultivated crops and 1.0 acre of pasture/hay.

While the construction ROW would have minimal effects on agricultural land, the proposed Project would intersect approximately 744.8 acres of farmland of local importance (see Table 5.9-11). This acreage meets the criteria for Farmlands of Local Importance as established by the Fairbanks Soil and Water Conservation District (SWCD) and the Matanuska-Susitna Borough. No prime farmlands, unique farmlands, or farmlands of statewide importance have been designated in Alaska.

Yukon River Crossing Options

The construction ROW for the Yukon River crossing options would not affect farmland of local importance.

TABLE 5.9-11 Farmland of Local Importance Affected by the Proposed Project ROW (Acres)

Segment	Construction (Temporary)	Operation (Permanent)
Proposed Action		
GCF to MP 540	66.3	20.2
Fairbanks Lateral	6.5	1.8
MP 540 to MP 555	0.0	0.0
MP 555 to End	672.0	201.3
Proposed Action Total	**744.8**	**223.3**
Denali National Park Route Variation	**0.0**	**0.0**

Note: Calculations include both the area inside and outside the ADOT&PF ROW.
Source: United States Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS) 2011.

Operation

The proposed Project permanent ROW would affect approximately 4.0 acres of agricultural land cover (see Table 5.9-5(a)). Operation of the GCF to MP 540 segment would affect less than one acre of cultivated crops, while the MP 555 to End segment would affect approximately 2.8 acres of cultivated crops and approximately 0.4 acre of pasture/hay. As shown in Table 5.9-11, the permanent ROW would affect approximately 223 acres of farmlands of local importance, with the majority of that acreage (90 percent) affected by the MP 555 to End segment.

Yukon River Crossing Options

The permanent ROW for the Yukon River crossing options would not affect farmland of local importance.

Denali National Park Route Variation

The Denali National Park Route Variation would affect neither agricultural lands nor farmlands of local importance.

5.9.1.9 Existing Zoning

North Slope Borough

North Slope Borough Municipal Code Title 19 addresses land use and zoning. The northern portion of the ROW is zoned by North Slope Borough as Resource Development, while the majority of the ROW within the North Slope Borough is zoned as Transportation Corridor.

The Resource Development (RD) District, according to North Slope Borough code (19.40.080), is "intended to address the cumulative impacts of large scale development, and to offer developers quick, inexpensive, predictable permit approvals. The purpose of the Resource Development District is to accommodate large scale resource extraction and related activities which:

(1) Do not permanently and seriously impair the capacity of the surrounding ecosystem to support the plants and animals upon which Borough residents depend for subsistence;

(2) Are planned, phased and developed as a unit, or series of interrelated units under an approved Master Plan, with provisions made for necessary public and private facilities; and

(3) Meet the policies of the Comprehensive Plan and Coastal Management Program as well as the conditions of approval and special policies imposed on each individual Resource Development District at the time of designation. North Slope Borough Code 19.40.080

According to North Slope Borough code (19.40.090), the Transportation Corridor District was "established to provide a strip of land to accommodate linear transportation facilities such as roads and pipelines." A development permit is required for development of new transportation facilities, including "gas lines, oil lines, associated roads, pump stations, pipeline maintenance facilities, resource extraction and necessary supporting developments" within the Transportation Corridor District.

Yukon-Koyukuk Census Area

The Yukon-Koyukuk Census Area is part of the Unorganized Borough, comprising the lands of Alaska not within the boundaries of the state's organized boroughs. Zoning within the

Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Fairbanks North Star Borough

The FNSB Zoning Map and Zoning Code are extensions of the Comprehensive Plan land use categories, and are the administrative tools for implementing land use policies and regulations. Zoning district establish allowable uses for land. The Fairbanks Lateral would intersect the General Use (GU-1) and Rural Estate (RE-4) land uses. Pursuant to the Zoning Code (Title 18), the installation and maintenance of utility lines are permitted uses in zoning districts.

Denali Borough

The GCF to MP 540, MP 540 to MP 555, MP 555 to End, and Denali National Park Route Variation segments would intersect the Denali Borough (DB). According to the DB Comprehensive Plan (2009), land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (Denali Borough Planning Commission 2009). There are no prohibitions on land zoned unrestricted. [Ord. 96-04 § 2.]

Matanuska-Susitna Borough

The Mat-Su Borough has zoning, land use, and building regulations. Land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit. The Mat-Su Borough has platting authority and a Code Compliance Division. The State Fire Marshal is the State Building Official. While the Mat-Su Borough does not have a Borough-wide zoning code, it regulates land use through special land use districts, residential land use districts, and other mechanisms (STB 2010).

The MP 555 to End segment would intersect the Denali SP SpUD. The construction ROW would intersect 451 acres, while the permanent ROW would intersect 135 acres. Utility substations are conditionally permitted under the SpUD ordinance (17.17.070). Structures, except for signs, are required to be set-back at least 75 feet from the Parks Highway (17.1.110).

5.9.1.10 Existing Land Use Plans

This section summarizes existing land use and land management plans applicable to the Project study area. These plans were reviewed to determine whether the proposed Project would be consistent with them. Table 5.9-13 identifies the relationship between the applicable plans and the proposed Project.

U.S. Bureau of Land Management

Pursuant to Section 202 of the FLPMA, the BLM has developed resource management plans (RMPs) to guide the BLM's management actions on the public lands covered by each plan. The GCF to MP 540 segment (including crossing the Yukon River) intersects BLM lands managed under the guidance of the Utility Corridor and Central Yukon RMPs. Furthermore, the MP 555 to End segment would intersect BLM lands managed under the guidance of the East Alaska RMP. Figure 5.9-2 shows the RMP planning areas within the State of Alaska. In addition, the BLM is the statutorily-designated federal administrator for the Iditarod National Historic Trail (INHT), managed according to the Iditarod National Historic Trail Comprehensive Management Plan (BLM 1986).

Utility Corridor RMP

The Utility Corridor Proposed RMP/FEIS was designed to provide for multiple uses of planning area resources while also providing resource protection for the approximately 6.1 million acres of BLM-administered surface lands (of which 5.8 million acres are BLM-administered mineral estate) within the RMP planning area. An overriding priority of the plan is to preserve the Utility Corridor for the transportation of energy minerals (BLM 1989). Both the Inner and Outer Corridors within the RMP planning area are designated as FLPMA section 503 ROW corridors under 43 C.F.R 2806.2. The RMP establishes 13 Area of Critical Environmental Concern (ACECs) and 5 Special Recreation Management Areas (SRMAs), and recommends the upper Nigu River areas for inclusion in the National Wilderness Preservation System (BLM 1991).

Within the RMP planning area, the proposed Project would intersect the Galbraith Lake ACEC and the Toolik Lake RNA. At approximately 56,000 acres, Galbraith Lake ACEC is managed for the preservation of cultural resources, rare/sensitive plants, scenic values, and lambing areas. As both an RNA and ACEC, Toolik Lake RNA (approximately 82,800 acres) is managed for research activities and the preservation of cultural resources. The Dalton Highway and multiple energy transmission ROWs (e.g., TAPS, Trans Alaska Gas Pipeline System, and Alaska Natural Gas Transportation System) cross the RNA. The RMP specifies that management of the ACECs will not restrict existing or future energy transportation systems.

Central Yukon RMP

The Central Yukon RMP guides management of 9.5 million acres in west-central Alaska. Under the RMP, the Central Yukon Planning Area is managed for resource development, subsistence, commercial use, and protection of environmental resources. The majority of lands within the planning boundary are open to mineral leasing and mineral location. The plan designates ACECs and eight Research Natural Areas for inclusion within the Ecological Reserve System (BLM 1986).

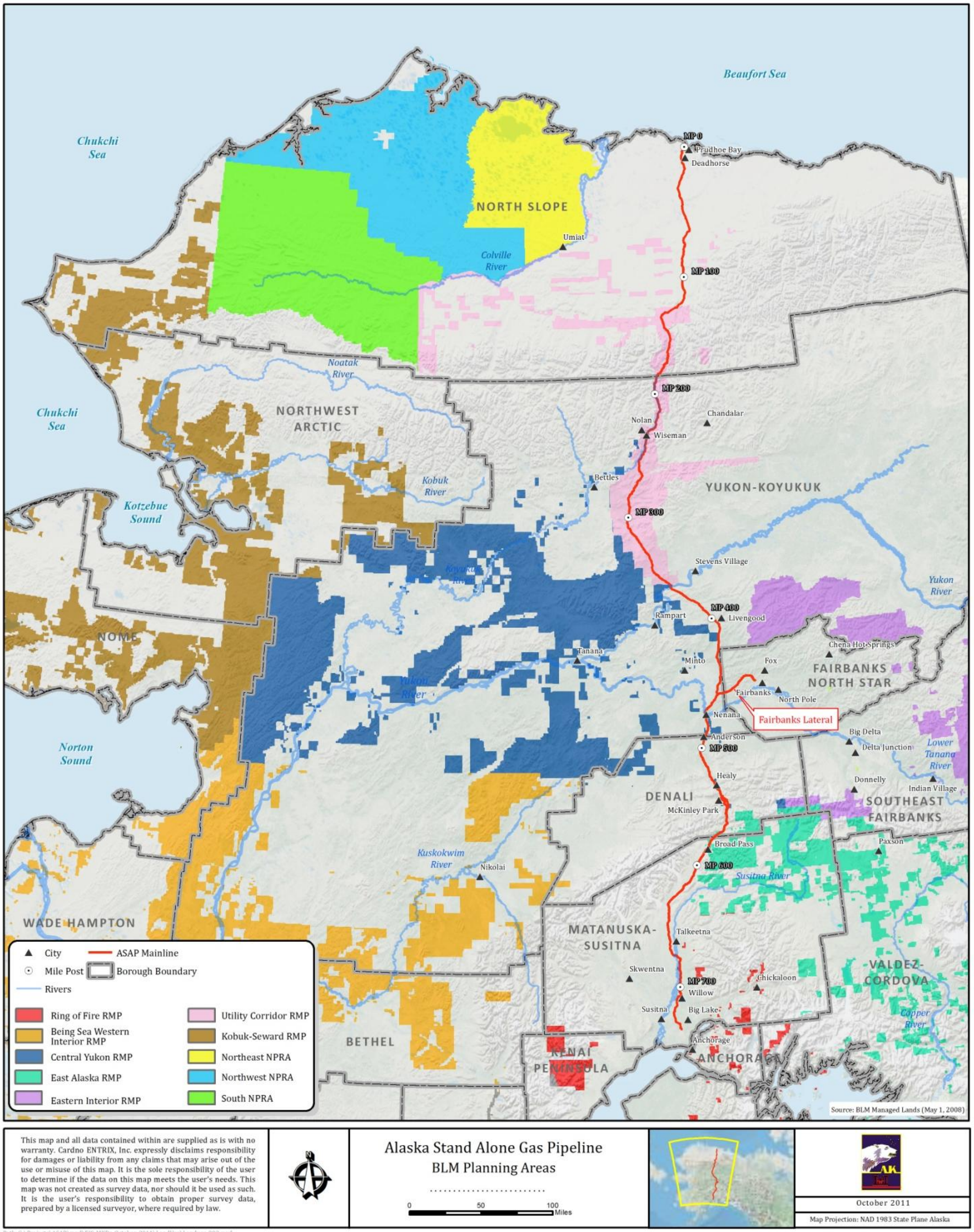

FIGURE 5.9-2 BLM Planning Areas

East Alaska RMP

The East Alaska RMP/FEIS guides management of 7.1 million acres in eastern Alaska, including approximately 5.5 million acres of lands that are selected by the State of Alaska or Alaska Natives. Under the RMP, the East Alaska Planning Area is managed to protect and enhance vegetative communities; fish and wildlife resources; natural, cultural, and geological resources; and recreational opportunities. In addition, the Planning Area is managed to protect and prevent damage to public land resources and to enhance those resources where feasible. The RMP designated the Bering Glacier Research Natural Area, five SRMAs, specific trails, and developed restrictions on OHVs and snowmobile usage (BLM 2007).

Iditarod National Historic Trail Comprehensive Management Plan

The Iditarod National Historic Trail Comprehensive Management Plan is a Congressionally-mandated management plan for the collection of trail resources collectively known as the "Iditarod National Historic Trail" (INHT). Under the plan, no single agency or organization manages the entire trail; instead, the plan calls for cooperative management by Federal, state, and local agencies. The plan establishes a common guide used to promote the preservation, enjoyment, use, and appreciation of the trail. It also identifies trails and sites comprising the historic trail system, and recommends possible management actions for protecting significant segments, historic remnants, and artifacts for public use and enjoyment. The BLM coordinates the cooperative management of the INHT land and is the primary point of contact for matters involving the entire trail. The BLM's duties under the plan include reviewing for appropriateness and consistency any draft regulations affecting segments of the INHT. State, city, municipal, or borough land managers responsible for trail segments or historic sites identified in the plan are encouraged to enter into cooperative agreements with the Federal government and to collaboratively define actions that are consistent with the plan's management objectives on a segment-by-segment or site-by-site basis (BLM 1986 and STB 2010). The MP 555 to End segment would intersect the INHT at MP 732.6.

National Park Service

Lands administered by the NPS in the vicinity of the proposed Project ROW include the Gates of the Arctic NPP and the Denali NPP. The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. However, the Denali National Park Route Variation would intersect the boundary of the Denali NPP. U.S. Congressional approval to construct and operate a gas pipeline through the Denali NPP would therefore be required (see the discussion in Section 5.9.1.1).

At 6 million acres, the Denali NPP is one of the largest national parks in the United States. The park includes a designated wilderness area and an international biosphere reserve. The park is managed according to the Consolidated General Management Plan (NPS 2008).

The 8.4-million acre Gates of the Arctic NPP is the central component of a 700 square mile portion of the Brooks Range. The ANWR is to the east, and the Noatak Preserve is to the west.

The park is managed according to the 1986 General Management Plan, which the NPS is currently in the process of amending (NPS 2011)

United States Fish & Wildlife Service

The GCF to MP 540 segment is greater than 0.2 mile from the ANWR and the Yukon Flats NWR, both of which are administered by the USFWS. Long-term management of each NWR is guided by a Comprehensive Conservation Plan (CCP).

The original CCP for the ANWR was signed into effect in 1988, and is currently being revised by the USFWS. In the revised CCP, the USFWS will conduct wilderness reviews of most non-wilderness lands in the ANWR, including those within the coastal plain (USFWS 2010).

The Yukon Flats NWR CCP recommended 650,000 acres (8 percent of the refuge) in the White-Crazy Mountains for wilderness designation. The Secretary of the Interior has not yet submitted the recommendation to the President, who would then submit it to the U.S. Congress for action. While the CCP does not directly address transportation or utility ROWs, the plan designates refuge lands in the minimal management category (USFWS 1987).

State of Alaska

Alaska Department of Natural Resources

State plans applicable to the Project area include the Dalton Highway Master Plan, Tanana Valley State Forest Plan, North Slope Site-Specific Plan, Southeast Susitna Area Plan, Susitna Area Plan, the Public Review Draft Susitna Matanuska Area Plan, the Susitna Basin Recreation Rivers Management Plan, the Tanana Basin Area Plan, Denali State Park Management Plan, and the Scenic Resources Along the Parks Highway – Inventory and Management Recommendations.

For those lands that are owned by the ADNR, but not covered by a land management plan, the ADNR, in coordination with the public, identifies important land resources and how their lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible, multiple uses are allowed on these lands.

Tanana Valley State Forest Management Plan

The Tanana Valley State Forest's (TVSF) 1.81 million acres lie almost entirely within the Tanana River Basin, located in the east-central part of Alaska. The Forest is open to mining, gravel extraction, oil and gas leasing, and grazing, although these activities are not frequently conducted. Timber production is the major commercial activity. The Bonanza Creek Experimental Forest, a 12,400-acre area dedicated to forestry research, is also located within the TVSF. Management of the TVSF is guided by the Tanana Valley State Forest Management Plan 2001 Update (ADNR 2001b).

North Slope Site-Specific Plan

The ADNR is currently developing a plan that may classify up to 32,000 acres and will identify lands that are suitable for conveyance to the North Slope Borough.

Susitna Matanuska Area Plan

The ADNR has revised the state land use plan for over 9 million acres of state land in the Susitna and Matanuska River Valleys. The Susitna Matanuska Area Plan (SMAP) revises the majority of the 1985 Susitna Area Plan, encompassing most of the land within the Matanuska-Susitna Borough. The SMAP designates primary uses on state land, provides general management guidelines for a variety of land uses and resources, and identifies specific management intent for individual units of land (ADNR 2010).

Southeast Susitna Area Plan

The Southeast Susitna Area Plan establishes land use designations, management intent, and management guidelines for more than 250,000 acres of state uplands, shorelands, and tidelands in the lower Susitna Valley. This plan supersedes the 1982 Willow Sub-Basin Area Plan, a portion of the 1985 South Parks Highway Subregion of the Susitna Area Plan, the 1989 Deception Creek Land Use Plan, and the 1991 Kashwitna Management Plan (ADNR 2008).

Susitna Basin Recreation Rivers Management Plan

The Susitna Basin Recreation Rivers Management Plan governs land and water management practices for state-owned lands along the Little Susitna State Recreation River, including water and riparian habitats and a 1-mile-wide corridor of land surrounding the rivers. The plan includes goals and management practices for recreation, fish and wildlife habitat, and public access, among others (ADNR 1991).

Tanana Basin Area Plan

The Tanana Basin Area Plan guides management of approximately 14.5 million acres of state-owned land and 1.7 million acres of federal land selected for conveyance to the state in the Tanana Basin. The plan designates surface and subsurface uses for each management unit within the seven major planning regions (ADNR 1986).

Susitna Area Plan

The 1985 Susitna Area Plan provided area-wide land management policies, land use designations for specific sites, priorities for implementing, and procedures for review and amendments within an approximately 15.8-million acre planning area (ADNR 1985). The majority of the plan has since been superseded by the SMAP and the Southeast Susitna Area Plan; however, the MP 555 to End segment intersects an area still guided by the Susitna Area Plan.

Denali State Park Management Plan

The 325,240-acre Denali SP is bisected by the George Parks Highway and bordered on the west by the Denali NPP. The Alaska State Legislature created Denali SP (AS 41.21.150-152) in 1970 for the purposes of tourism related development, the provision of recreational opportunities for Alaskans, and the preservation of the area's natural resources. The ADNR Division of Parks and Outdoor Recreation manages park lands and development of recreational facilities according to the Denali SP Management Plan. Primary uses of the park are camping, hiking, fishing, viewing Denali, canoeing, rafting, river boating, hunting, and trapping (ADNR 2006).

Dalton Highway Master Plan

The Dalton Highway extends from its junction with Elliott Highway one mile west of Livengood up to Deadhorse Airport, 414 miles north. The highway is operated and maintained by the ADOT&PF. The Dalton Highway Master Plan, released by the ADNR Division of Mining, Land & Water in 1998, guides management of the highway. The highway is managed for economic development, public safety, and natural resource management. The Plan includes mitigation measures and recommendations related to fish and wildlife concerns, off-road access, and future travel impacts (Dalton Highway and Advisory Planning Board 1998).

Alaska Department of Fish & Game

The Minto Flats State Game Refuge Management Plan contains policies related to transportation/utility corridors through the refuge (ADF&G 1992).

Local

North Slope Borough

The North Slope Borough asserts jurisdiction over activities within its boundaries on private and state-owned lands. The North Slope Borough adopted a Comprehensive Plan for the Borough on October 11, 2005. The North Slope Borough is in the process of developing comprehensive land use plans for the North Slope villages. None of these villages would be intersected by the proposed Project.

Yukon-Koyukuk Census Area

The GCF to MP 540 segment and the Fairbanks Lateral both would intersect the Yukon-Koyukuk Census Area. This Census Area is part of the Unorganized Borough comprising the lands of Alaska not within the boundaries of the state’s organized boroughs. Planning and zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Nenana

The City of Nenana does not have rigorous land use or zoning designations. Development within the City requires mayoral approval of a Land Use Permit (J. Mayrand Pers. Comm. 2010).

Fairbanks North Star Borough

The Fairbanks Lateral would intersect the FNSB, which has developed comprehensive zoning, planning, and land use regulations. The FNSB Planning and Zoning regulations apply outside of incorporated areas within the Borough. The FNSB Regional Comprehensive Plan establishes goals, strategies, and actions for the Borough's land uses. The Comprehensive Plan provides land use guidance through its land use map and land use category designations (FNSB 2005). Comprehensive Plan land use categories that would be crossed by the Fairbanks Lateral are shown in Table 5.9-12.

TABLE 5.9-12 FNSB Regional Comprehensive Plan Land Categories Intersected by the Project

Land Category	Definition
Reserve Area	Area to be reserved under public ownership until sufficient data is available to make definitive planning judgments. Permitted uses include mining, hunting, fishing, trapping, recreation, forestry, and agriculture. No foreseeable development plans, but development is possible.
Preferred Agricultural Land	Land consisting of well-drained agricultural soils, located at elevations of less than 1,200 feet, on slopes that are farmable and outside of the URBAN and PERIMETER areas, but with proximity to transportation and markets.
High Mineral Potential	Areas in the RURAL and OUTSKIRT areas that have been identified as having a high potential for mineral deposits. The priority land use in these areas is mining. Land uses incompatible with mining are discouraged.

Source: Fairbanks North Star Borough Community Planning Department 2005.

The Vision Fairbanks Downtown plan is an element of the Comprehensive Plan and guides development of the downtown core area (FNSB 2008). The downtown planning area would not be intersected by the proposed Project.

Denali Borough

The GCF to MP 540, MP 540 to MP 555, MP 555 to End, and Denali National Park Route Variation segments would intersect the Denali Borough (DB). According to the DB Comprehensive Plan, land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (DB 2009). There are no prohibitions on land zoned unrestricted (Ord. 96-04 § 2).

Matanuska-Susitna Borough

As described within the subsection Regulatory Setting above, the Mat-Su Borough Wide Comprehensive Plan provides general goals and policy recommendations for a 20-year period to address development patterns, technological advances, a growing population, and a diversifying economy (Mat-Su Borough 2005a).

The MP 555 to End segment would pass through the communities of Trapper Creek, Susitna, Willow, Big Lake, and Point MacKenzie. Each of their Community Councils currently has or is developing a comprehensive plan. These community comprehensive plans are consistent with the general goals and recommendations of the Mat-Su Borough Wide Comprehensive Plan.

Trapper Creek Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Trapper Creek Community Council. The council is currently developing the Trapper Creek Community Council Comprehensive Plan.

Susitna Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Susitna Community Council. The Susitna Community Council Comprehensive Plan guides the use of public and private lands, and directs community and agency decisions about improvements to roads, trails, and other public services and facilities. The plan also establishes strategies for economic development, environmental protection, and improved local governance (Mat-Su Borough 2005b).

Willow Area Community Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Willow Community Council. The Willow Area Community Comprehensive Plan, currently in draft form, was developed by the Willow Community Council to provide for planned and orderly growth in the Willow area while enhancing economic opportunities, respecting individual property rights, and preserving the area's scenic, recreational, rural, agricultural, and residential qualities (Mat-Su Borough 2009).

Big Lake Community Council Area Comprehensive Plan Update

The MP 555 to End segment and the Cook Inlet NGLEP Plant would intersect land managed by the Big Lake Community Council. The Big Lake Community Council Area Comprehensive Plan Update was developed by the Big Lake Community Council to address the challenges and opportunities facing the community by establishing broad goals and policies intended to guide growth over the next 10 to 20 years (Big Lake Community Council 2009).

Draft Point MacKenzie Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Point MacKenzie Community Council. The Point MacKenzie Community Council Comprehensive Plan, currently in draft form, was developed by the Point MacKenzie Community Council to guide the community's growth and development through the year 2030 by addressing the multitude of issues facing the community, ranging from land use, to economic development, to public facilities, and more (Mat-Su Borough 2010).

5.9.2 Environmental Consequences

5.9.2.1 No Action Alternative

The No Action Alternative would have no effects on existing land ownership and uses because the proposed Project would not be constructed.

5.9.2.2 Proposed Action

Effects to Land Use Planning

As described above, the proposed Project would intersect lands managed according to numerous federal, state, borough, and local management plans. Table 5.9-13 below describes the consistency of the proposed Project with existing land use and management plans and shows the acreage affected within each planning boundary. With the exception of the Denali NPP and 6(f) lands, all other lands with applicable land use plans or documents would have provisions for utility crossings; therefore, the proposed Project would be compatible with these plans.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
Bureau of Land Management	Utility Corridor Resource Management Plan/Environmental Impact Statement Record of Decision (1991)	GCF to MP 540: Construction = 3,846 acres Operation = 1,439 acres **Yukon River Crossing Options:** Construction = 2.2 acres Operation = 0.0 acre	MP 123.5 to 240.5 MP 248.2 to 360	The proposed RMP/Final EIS identifies the Inner and Outer portions of the Utility Corridor within its planning area. The proposed Project would not be located in the Utility Corridor. In addition to the Management Practices and Allowable Uses for the Galbraith Lake ACEC and Toolik Lake RNA, the protection measures and stipulations detailed in Appendices K and L of the proposed RMP/Final EIS would apply in the event that the BLM granted the ROW authorization for the proposed Project.
	Resource Management Plan and Record of Decision for the Central Yukon Planning Area (1986)	GCF to MP 540: Construction = 53 acres Operation = 17 acres **Yukon River Crossing Options:** Construction = 3.2 acres Operation = 1.6 acres	MP 359.8 to 360.5 MP 490.5 to 491.5 MP 529.4 to 532	The following policies would apply to access to or across BLM lands managed under the RMP: Access to or across public lands will be considered on a case-by-case basis. Under this RMP, the use of vehicles of greater than 1,500 pounds GVW will be allowed by authorization only. Vehicle use may be authorized under a mining plan of operations (43 CFR 3809), with a permit (43 CFR 2800 or 43 CFR 2920), or by other appropriate means. Approval would be subject to conditions that minimize the impact to other land uses and/or prevent unnecessary damage to the environment.
	East Alaska RMP (2006)	MP 555 to End: Construction = 78.7 acres Operation = 23.7 acres	MP 570.4 to 577.1	The required operating procedures and oil and gas leasing stipulations described in Appendix C of the RMP/Final EIS would apply in the event that the BLM granted the ROW authorization for the proposed Project.
	Iditarod National Historic Trail Comprehensive Management Plan (1986)	Intersected by MP 555 to End segment	MP 732.6	The plan does not provide guidance related to utility corridors.
National Park Service	Denali National Park & Preserve Consolidated General Management Plan (2008)	**Denali National Park Route Variation:** Construction = 82 acres Operation = 30 acres	MP 539.6 to 554.9	Transportation systems that are proposed to cross a CSU created or expanded by ANILCA require an act of Congress if such transportation system would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska. Current legislation proposed by Alaska Senators Begich and Murkowski, 'The Denali National Park and Preserve Natural Gas Pipeline Act' would allow a pipeline through the park.
	Gates of the Arctic National Park & Preserve General Management Plan (1986)	Not applicable.	Not applicable.	The proposed Project ROW would not intersect the boundaries of this CSU.
U.S. Fish &	Yukon Flats National	Not applicable.	Not applicable.	The proposed Project ROW would not intersect the boundaries of this CSU.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
Wildlife Service	Wildlife Refuge Comprehensive Conservation Plan (1987)			
	Arctic National Wildlife Refuge Comprehensive Conservation Plan (1988; under revision)	Not applicable.	Not applicable.	The proposed Project ROW would not intersect the boundaries of this CSU.
Alaska Department of Natural Resources	Tanana Valley State Forest Management Plan 2001 Update	GCF to MP 540: Construction = 227 acres Operation = 54 acres Fairbanks Lateral: Construction = 20 acres Operation = 6 acres		The plan contains the following policies relevant to the proposed Project: Other land management proposals may be initiated by other agencies or private individuals and may include requests for rights-of-way, commercial leases, timber or material sales, or permits for mineral activity, trapping cabins, or grazing. The following process will be used to review these permit or conveyance requests. Applications for use of State Forest land, including mining or prospecting, will be forwarded to the Northern Regional Office of the Division of Mining, Land and Water. The Division of Mining, Land and Water will distribute the applications for review by agencies, including the Northern Regional Office of the Division of Forestry. The Division of Forestry will review applications for consistency with this plan and other existing laws and policies. The Division of Forestry will then return applications to the Division of Mining, Land and Water with stipulations for processing. The Division of Forestry may also require additional review of applications after interagency or public comment. Although preliminary decisions or final findings will continue to be made by the Division of Mining, Land and Water, applications must be consistent with the stipulations given by the Division of Forestry. No permits, leases, disposals, or rights-of-way will be authorized for use of State Forest land that are not consistent with stipulations from the Division of Forestry. TIMBER MANAGEMENT II. MANAGEMENT GUIDELINES H. Salvage of Timber From Land Clearing Timber with commercial or personal use values should be salvaged from lands that are to be cleared for other uses such as mining, transportation or utility corridors, and habitat enhancement projects, where feasible and prudent. See Chapter 1 for statutory direction for the Tanana Valley State Forest. TRAILS

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				G. Trail Crossings II. MANAGEMENT GUIDELINES When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses a trail corridor. PUBLIC ACCESS I. GOALS Maintain, enhance, or provide adequate access to publicly-owned land and resources. II. MANAGEMENT GUIDELINES J. Pipeline Crossings The ADNR should work with Alyeska Pipeline Service Company to identify options to develop new pipeline crossings. Future pipelines (such as the Trans-Alaska Gas Line) should provide more places for public crossings to state land for hunting, fishing, recreation, timber harvest, settlement, and other uses or provide a mechanism to improve or develop future public crossings as the need arises.
	North Slope Site Specific Plan	GCF to MP 540: Construction = 2,970 acres Operation = 848 acres	MP 0 to 186.8	The plan is under development.
	Susitna Matanuska Area Plan (February 2010 Public Review Draft)	MP 555 to End: Construction = 753 acres Operation = 226 acres	MP 575.5 to 681	The SMAP specifies land management policies for each of the 11 regions within the plan boundaries. The Parks Route would intersect the North Parks Highway, Petersville Road, and Susitna Lowlands regions. Prior to making an authorization decision, the ADNR takes into account the management guidelines and statement of intent specific to each unit within a region. The SMAP emphasizes minimizing land use conflicts through plan guidelines and intent rather than through prohibitions, although prohibitions are sometimes identified. Other uses are initially presumed compatible with the primary use. However, if the ADNR determines that a use conflict exists and that the proposed use is incompatible with the primary use, the proposed use shall not be authorized or it shall be modified so that the incompatibility no longer exists (11 AAC 55.040 (c)). The Area-wide Land Management Policies include management guidelines relevant

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				to pipeline development: Shorelands and Stream Corridors C. Public Access Adjacent to Waterbodies. Pursuant to AS 38.05.127, legal public access will be reserved to protect the public's right to travel to and along the ordinary high water (OHW) of a waterbody without encouraging trespass. Permits, leases, and plans of operation for commercial and industrial uses, transportation facilities, pipelines and other water dependent uses may be authorized on state uplands adjacent to waterbodies if their activities are consistent with the management intent for the area and if they maintain tideland and stream bank access, and protect important fish and wildlife habitat, public water supplies, and public recreation. Trails and other forms of non-motorized public access are generally considered to be appropriate within these areas, if they meet the conditions listed in 11 AAC 96.025. H. Buffer, Easement, and Building Setback Widths. d) Public access easements, including 'to and along' easements required under AS 38.05.127, or utility easements adjacent to tidelands, lakes, and streams: 50 feet. Other types of utility easements may be less than this width, depending on the purposes of the easement. Public Access F. Alignment with Crossings. When it is necessary for power lines, pipelines or roads to cross trails, crossings should be at a 90-degree angle. Vegetative screening should be preserved at trail crossings.
	Southeast Susitna Area Plan (2008)	MP 555 to End: Construction = 1,282 acres Operation = 384 acres	MP 681 to 736.4	The Area-wide Land Management Policies include management guidelines relevant to pipeline development. These guidelines are identical to those found in the SMAP (see above).
	Susitna Area Plan (1985, as amended)	MP 555 to End: Construction = 1,416 acres Operation = 425 acres	MP 647 to 736.4	The Area-wide Land Management Policies listed in the plan include management guidelines relevant to pipeline development: Forestry 2. Management Guidelines **B. Timber Salvage.** Timber with commercial or personal use value should be salvaged from lands that are to be cleared for other uses, such as farms and transportation or utility corridors. Trail Management

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				G. Trail Crossings. When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses a trail corridor.
	Susitna Basin Recreation Rivers Management Plan (1991)	MP 555 to End: Construction = 10 acres Operation = 3 acres	MP 729 to 731	The plan includes goals and management practices for recreation, fish and wildlife habitat, and public access, among others. No specific mention of management guidelines relevant to pipeline development.
	Tanana Basin Area Plan (1986)	GCF to MP 540: Construction = 1,789 acres Operation = 533 acres Fairbanks Lateral: Construction = 417 acres Operation = 125 acres MP 540 to MP 555: Construction = 221 acres Operation = 57 acres MP 555 to End: Construction = 312 acres Operation = 78 acres **Denali National Park Route Variation:** Construction = 185 acres Operation = 61 acres	MP 395.5 to 575.6 (Mainline) MP 0 to 34.4 (Fairbanks Lateral)	The Area wide Land Management Policies listed in the plan include management guidelines relevant to pipeline development: Trail Management **G. Trail Crossings.** When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses or co-locates within a trail corridor. In addition, the Transportation Goals specified in Chapter 2 apply to forms of utility or resource transportation corridors. The following transportation corridors were identified in the plan: •Alaska Natural Gas Pipeline •Alaska Railroad Extension •Prince William Sound - Upper Tanana Railroad Corridor •Western Access Railroad Corridor •Twin Mountain Access Route •Parks Highway - Kantishna – McGrath Highway Corridor •Upper Wood River (Bonnifield Mining District) Access •Nenana - Totchaket Area Access •TAPS Oil Spill Contingency Plan Access Routes Existing transportation routes identified by the plan include the RS2477 trails and existing highways maintained and operated by ADOT&PF. Utility corridors are prohibited within the following units: •Management Unit 2H: Minto •Management Unit 3B: South Shore Lake Minchumina

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				•Management Unit 3E: Middle Cosna-Zitziana Watersheds
	Denali State Park Management Plan (2006)	MP 555 to End: Construction = 451 acres Operation = 135 acres	MP 608.6 to 645.7	The plan designates land use within park boundaries. Land use designations adjacent to the Parks Highway consist of Natural Area and Recreation Development. Areas designated Natural Area are intended to be relatively undeveloped and provide users opportunities for a high value, natural experience. Figure 11 within the plan provides guidelines for activities and facilities within the various land-use designations in the park. For both the Natural Area and Recreation Development designations, utilities, transmission lines, and pipelines are allowable by permit only when no viable alternative exists. Tower heights are limited to 85 feet. Best practices must be employed to minimize impacts to viewsheds, especially within the viewsheds of areas with high public use.
	Dalton Highway Master Plan (1998)	GCF to MP 540: Construction = 5,943 acres Operation = 2,084 acres	MP 0 to 405	The plan specifies development nodes along the Dalton Highway Corridor at the following locations: Yukon River Crossing, Coldfoot, Chandalar Shelf, Happy Valley and Deadhorse. Each node is a distinct and compact cluster of development. Oil and gas development activities, transportation, and incidental or minor governmental activities are allowed to locate outside of nodes if the needs of the activity are demonstrably better met outside the nodes.
	Scenic Resources Along the Parks Highway – Inventory and Management Recommendations (1981)			See the Visual Resources portion of this report (Section 5.12) for a discussion of this plan's applicability to the proposed Project.
Alaska Department of Fish & Game	Minto Flats State Game Refuge Management Plan (1992)	GCF to MP 540: Construction = 286 acres Operation = 86 acres	Intermittently between MP 418.5 to 455.5	The Minto Flats State Game Refuge Management Plan contains policies related to transportation/utility corridors through the refuge: Transportation and utility corridors, including railroads, roads, powerlines, and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established. Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of this plan: 1) protection and enhancement of habitat resources; 2) conservation of fish and wildlife populations; and 3) the continuation of fishing, hunting, trapping, and other public uses compatible with habitat protection and enhancement and fish and wildlife conservation. Additionally, corridor proposals must demonstrate that there is a significant public need for the corridor that cannot be reasonably met off-refuge,

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				that the use of refuge lands and impacts to refuge resources are avoided or minimized to the maximum extent feasible, that public access to the refuge is maintained, and that impacts to refuge resources are fully mitigated. Given the distribution of habitats and public uses within the refuge, the potential for incompatibility between corridor development and resource values appears to be greater within the portion of the refuge north of the Tanana River. Therefore, the highest priority should be given to avoiding the future siting of transportation and utility corridors in the most valuable refuge habitats north of the Tanana River.
North Slope Borough	North Slope Borough Comprehensive Plan (2005)	GCF to MP 540: Construction = 2,970 acres Operation = 848 acres	MP 0 to 186.8	**Issue #32:** Drill pads and pipelines encroach upon subsistence zones. Goal: Minimize impacts to subsistence from development, sport hunting, and other outside influences. *Objective/Policy:* Coordinate with village residents to reduce the footprint of development and encourage common use of facilities. *Objective/Policy:* Mitigate impacts to subsistence from development. *Objective/Policy:* Develop a program to compensate village residents for impacts to subsistence. **Issue # 81:** Development activities can impact fish and wildlife populations, habitat, and their capacity to continue to support subsistence activities. Goal: Minimize habitat fragmentation from construction of resource development infrastructure that impacts migratory patterns of fish and wildlife. Goal: Encourage development to use best available technology to reduce adverse impacts of fish and wildlife. *Objective/Policy:* Coordinate with the Borough and local residents when preparing resource development plans to avoid or reduce impacts to fish and wildlife. *Objective/Policy:* Monitor fish and wildlife populations and habitat before, during, and after development activities to document impacts. *Objective/Policy:* Incorporate measures such as buried pipelines, common rights-of-way, and directional drilling to minimize adverse effects on fish and wildlife migration and habitat. **Issue #90**: A small percentage of local residents are presently employed by outside companies. Goal: Increase local hire in outside companies, such as the oil and gas industry. **Issue #118:** Resource development changes the character of the landscape and

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				alters the way local people use the land. Goal: Minimize visual and other impacts on community character. *Objective/Policy:* Locate and design oil and gas facilities to minimize visual and other impacts on community character. **Issue #156:** Oil field infrastructure, including roads, pads, and pipelines cause physical changes in the environment. Goal: Minimize physical changes in the environment from oil field infrastructure. *Objective/Policy:* Work with industry in the permitting process to incorporate mitigation measures that reduce impacts. *Objective/Policy:* Develop incentives for industry to develop alternative designs to minimize development footprint and consolidate facilities. **Issue #160:** There is a lack of regulations for oil and gas pipelines. Goal: Develop and implement state regulations for oil and gas pipeline installation, operation, and maintenance. *Objective/Policy:* Develop agreements with the state for minimum criteria and inspections. *Objective/Policy:* Bring public attention to the issue to encourage development of state regulations for pipelines. **Issue #162:** Communities are concerned about the potential impacts of demobilizing oil and gas facilities in the future. Goal: Require industry to rehabilitate oil and gas facility sites as resources are depleted. Goal: Assure adequate funds and resources for demobilization and restoration activities are established. *Objective/Policy:* Encourage public participation in demobilization planning. *Objective/Policy:* Enforce existing permit requirements for demobilization. *Objective/Policy:* Monitor demobilization efforts. *Objective/Policy:* Work with federal and state agencies to ensure that adequate funds and resources for demobilization and restoration activities are being reserved. **Issue #42:** The resource industry does not adequately coordinate with local subsistence users prior to development or dismantlement of oil and gas facilities. Goal: Improve coordination with local subsistence users prior to development and dismantlement activities. *Objective/Policy:* Use the Kuukpik Subsistence Oversight Panel (KSOP) as a model

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				for improving coordination and local participation in planning for and monitoring resource exploration and development activities. *Objective/Policy:* Investigate other models for coordinating subsistence and resource development, including Canadian hunting and trapping associations. **Issue #57:** State and federal government entities and the oil and gas industry do not fully understand the importance of traditional and contemporary local knowledge to Borough residents. Goal: Recognize the importance of cultural values and traditional and contemporary local knowledge to Borough residents. *Objective/Policy:* Educate state, federal, and local government entities and the oil and gas industry about the importance of traditional and contemporary local knowledge to Borough residents. *Objective/Policy:* Develop a handbook for government entities and the oil and gas industry that relays the importance and utilization of traditional and contemporary local knowledge. *Objective/Policy:* Seek out and incorporate aspects of traditional and contemporary local knowledge during project design, permitting, and environmental impact assessments. **Issue #97:** Borough communities are not energy self-sufficient. Goal: Develop energy strategies for the villages to achieve greater self-sufficiency. *Objective/Policy*: Develop alternative energy sources for Borough communities, such as coal, natural gas, and wind power. *Objective/Policy*: Look for ways that oil and gas development can provide natural gas to village communities. **Issue #165:** Some communities close to natural gas resources do not have supply facilities. **Issue #166:** It is expensive to develop natural gas facilities for supply and distribution to small communities. Goal: Develop gas supply facilities in communities within close proximity to natural gas. Goal: Obtain grants and other funding sources to develop supply and distribution facilities. *Objective/Policy*: Identify communities for potential gas supply development. *Objective/Policy*: Develop business relationships with funding partners and the

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				resource development industry. *Objective/Policy*: Define roles and responsibilities for operations and maintenance. *Objective/Policy*: Identify and apply for funding for project development, implementation, and maintenance.
Fairbanks North Star Borough	FNSB Regional Comprehensive Plan (2005)	Fairbanks Lateral: Construction = 360 acres Operation = 108 acres	MP 9 to 34.4	The FNSB Zoning Map and Zoning Code are extensions of the Comprehensive Plan land use categories, and are the administrative tools for implementing land use policies and regulations. Pursuant to the Zoning Code, the installation and maintenance of utility lines are permitted uses in the zoning districts.
Denali Borough	Denali Borough Comprehensive Plan (2009)	GCF to MP 540: Construction = 593 acres Operation = 189 acres MP 540 to MP 555: Construction = 221 acres Operation = 57 acres MP 555 to End: Construction = 312 acres Operation = 78 acres **Denali National Park Route Variation:** Construction = 185 acres Operation = 61 acres	MP 490.5 to 575.5	Land in the Borough is zoned unrestricted unless otherwise provided for by ordinance. There are no prohibitions on land zoned unrestricted. [Ord. 96-04 § 2.]
Matanuska-Susitna Borough	Mat-Su Borough Wide Comprehensive Plan (2005 update)	MP 555 to End: Construction = 1,949 acres Operation = 585 acres	MP 575.5 to 736.4	The plan states that "[i]n order for the Borough to keep pace with new technologies and globalization of the economy, recommendations should be considered for other modes of transportation such as electrical, communications, and pipelines" (p. 8). The plan includes the following policy for orderly development of multi-modal transportation, including pipelines: Policy T1-4: Develop an effective multi-modal transportation plan that provides recommendations for modes of transportation including surface, air, waterborne, rail, public transit and trails, pipeline, electrical, and communications. Such a plan should strive to better connect the borough's various communities and neighborhoods.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
	Trapper Creek Community Council Comprehensive Plan	MP 555 to End: Construction = 304 acres Operation = 91 acres	MP 645.5 to 673	Plan is under development.
	Susitna Community Council Comprehensive Plan (2005)	MP 555 to End: Construction = 231 acres Operation = 69 acres	MP 674 to 693	The plan does not provide guidance related to utility corridors.
	Willow Area Community Comprehensive Plan (draft September 2009)	MP 555 to End: Construction = 347 acres Operation = 104 acres	MP 693 to 721.6	The draft plan does not mention utility corridors.
	Big Lake Community Council Area Comprehensive Plan Update (August 2009)	MP 555 to End: Construction = 55 acres Operation = 16 acres	MP 729.8 to 734.5	Strategy 4 of the plan recommends that utilities be placed underground for future development in the Big Lake Community.
	Point MacKenzie Community Council Comprehensive Plan (draft December 2010)	MP 555 to End: Construction = 24 acres Operation = 7 acres	MP 734.5 to 736.4	The plan contains language relevant to pipeline development through the area, including expressing a need for “expanded utility infrastructure” (p.22) and encouraging “development of efficient energy sources in the community” (p.12). Furthermore, Goal 5 intends to: Encourage the routing of major “linear” infrastructure projects to locate away from existing or planned commercial or residential areas unless doing so will clearly result in unreasonable land use outcomes or conflicts. Limited available public land for development in the Point MacKenzie community will result in a majority of the development occurring along Point MacKenzie Road. Every effort should be made to retain the open nature and natural beauty of this corridor. **Objective 1:** New “linear” projects should locate along existing easements and rights-of-way.

Transportation/Utilities

As described above and as shown in Table 5.9-10, the proposed Project ROW would cross railroads, utilities (including the TAPS), trails, driveways, and local and arterial roads. Potential effects would include disruption to traffic flow and utility service. However, Project design features would minimize these effects. For major road crossings, the Applicant proposes to use a boring method that would neither affect the road surface nor impede traffic flow. Arterial roads would be crossed using trenchless methods. For road crossings where the pipeline cannot be installed by boring, a trench would be excavated. In such cases, a temporary bypass or bridge would be built to minimize the effects to traffic flow.

All railroad crossings would be installed by trenchless methods; therefore, there would not be disruptions to railroad service.

TAPS crossings and critical access road crossings would be installed by trenchless methods. Effects from crossing existing foreign pipelines and utility lines would be minimized by boring below the existing pipeline or utility.

Effects to transportation and utilities due to construction of the proposed pipeline are expected to be minor and temporary. Given that the pipeline would be buried, no effects to transportation or utilities due to operation of the proposed pipeline are anticipated. Maintenance of the proposed pipeline in areas of road and utility crossings would result in temporary and minor effects similar to the construction phase.

The Applicant has committed to develop and implement traffic control plans to minimize negative impacts to local businesses during construction. Additional mitigation measures to further reduce potential effects to traffic flow and utility service are described under the subheading Mitigation below.

Section 6(f) of the Land and Water Conservation Fund

The proposed MP 555 to End segment of the proposed Project would cross Denali State Park, which is Section 6(f) parkland, between MP 608.6 and MP 645.8. While a portion of the pipeline would remain within the ADOT ROW when crossing Denali SP, the construction ROW would affect approximately 114 acres and the permanent ROW would affect approximately 45 acres outside of the ADOT ROW. The proposed Project would therefore trigger a 6(f) conversion and would require approval from the NPS for the conversion of lands. In addition, a ROW permit would be required from the ADNR Division of Parks and Outdoor Recreation.

The NPS would consider conversion of public outdoor recreation areas to another use if the following conditions are met:

- Practicable alternatives to the conversion have been evaluated and rejected on a sound basis;
- The property proposed for substitution is of at least fair market value as that of the property to be converted; and

- The property proposed for replacement is of reasonably equivalent usefulness and location for recreational purposes as that being converted.

R.S. 2477 Trails and 17(b) Easements

As described above and as shown in Tables 5.9-7(a) and (b), the proposed Project would intersect twenty R.S. 2477 ROW and ten 17(b) easements. The proposed Project would not infringe upon the existing rights attributable to the R.S. 2477 trails and 17(b) easements that it would cross.

Temporary effects may result during construction, when a small portion of each intersected trail and easement may need to be disturbed during the process of burying the proposed pipeline. Similar temporary effects may occur during maintenance should it be necessary to dig up a portion of pipeline buried within R.S. 2477 ROW and 17(b) easements. Temporary alternative access across Native-owned land may need to be negotiated with the Native land owner and the Federal agency administering the easement. It may be necessary to acquire alternative legal access prior to blocking 17(b) easements across Native land. The Applicant has proposed a mitigation measure that would retain existing public access routes and uses. Additional mitigation measures to limit effects on R.S. 2477 trails and 17(b) easements during construction and maintenance are described under the subsection Mitigation below. Operation of the proposed Project would not be expected to affect the use and access through the R.S. 2477 ROW and 17(b) easements.

Forest Land

Tables 5.9-8 and 5.9-9 show the acreage of forest types that would be cleared for construction and operation of each segment of the proposed Project ROW. Tables 5.9-14 and 5.9-15 show the acreages of forest land that would be affected by the proposed Project within the federal and state planning areas intersected by the ROW. After Project construction, those forested areas outside of the permanent Project facilities (i.e., permanent ROW, new access roads, and aboveground facility footprints) would be allowed to revert to pre-Project conditions. Forest land would not be restored within the permanent Project footprint; therefore, there would be a long-term conversion of forest land use in these areas. The volume of commercial timber within areas that would be cleared for the proposed Project ROW has not been quantified by a timber survey.

The 2006 Alaska Forest Resources and Practices Act (FRPA, AS 41.17) governs how timber harvesting, reforestation, and timber access occur on state, private, and municipal land. Forest management standards on federal land must also meet or exceed the standards for state land established by the Act (ADNR 2011). Section 41.17.083 of the FRPA provides guidance regarding the clearing of forest land for non-timber purposes:

> A state agency, municipality, or public utility shall determine whether the timber to be removed has significant salvage value before approving or conducting clearing of forest land for purposes other than timber harvest. If the timber has significant salvage value, the

agency or utility shall salvage the timber as part of the clearing process (§10 ch 34 SLA 1990).

The FRPA provisions for timber salvage within lands that would be cleared for the pipeline ROW would assure that timber resources affected by the proposed Project would be properly utilized. The Applicant would conduct a desktop analysis, supplemented with surveys, of merchantable timber in the proposed Project area in 2011. The AGDC would determine the appropriate evaluation methods in coordination with regulatory agencies during the design and construction phase of the proposed Project. A mitigation measure addressing timber salvage in all areas of the pipeline ROW is prescribed under the Mitigation subheading below.

TABLE 5.9-14 Timber Resources in Federal and State Planning Areas Affected by the Construction ROW (Acres)

Land Use Plan	GCF to MP 540	Fairbanks Lateral	MP 540 to MP 555	MP 555 to End	Proposed Action Total	Yukon River Crossing Options	Denali National Park Route Variation
BLM							
Utility Corridor RMP	801.8	0.0	0.0	0.0	801.8	0.4	0.0
Central Yukon RMP	10.8	0.0	0.0	0.0	10.8	0.4	0.0
East Alaska RMP	0.0	0.0	0.0	1.7	1.7	0.0	0.0
NPS							
Denali NPP Consolidated General Management Plan	0.0	0.0	0.0	0.0	0.0	0.0	29.8
ADNR							
State Lands not Covered by an Area Plan	1,155.9	0.0	0.0	0.0	1,155.9	6.8	0.0
North Slope Site Specific Plan	13.8	0.0	0.0	0.0	13.8	0.0	0.0
Susitna Area Plan	0.0	0.0	0.0	894.7	894.7	0.0	0.0
Tanana Basin Area Plan	1,134.5	158.4	153.9	100.0	1,546.8	0.0	67.8
Southeast Susitna Area Plan	0.0	0.0	0.0	672.9	672.9	0.0	0.0
Susitna-Matanuska Area Plan	0.0	0.0	0.0	408.2	408.2	0.0	0.0
Tanana Valley State Forest Management Plan	213.8	10.0	0.0	0.0	223.8	0.0	0.0
Susitna Basin Recreation Rivers Management Plan	0.0	0.0	0.0	9.5	9.5	0.0	0.0
Denali State Park Management Plan	0.0	0.0	0.0	363.9	363.9	0.0	0.0
Dalton Highway Master Plan	1,302.0	0.0	0.0	0.0	1,302.0	0.0	0.0
ADF&G							
Minto Flats State Game Refuge Management Plan	286.3	0.0	0.0	0.0	286.3	0.0	0.0

Source: USGS 2001 National Landcover Dataset (Evergreen Forest, Mixed Forest, and Deciduous Forest).

Agriculture

Effects to agricultural land would be minimal, with only 0.1 percent of the construction area affected by the proposed Project ROW consisting of agricultural land (see Table 5.9-4). As allowable land uses generally permitted within the permanent right-of-way would include agriculture, including the use of farming equipment and the cultivation of row crops, and pastureland, impacts to these agricultural lands would generally be limited to the duration of Project construction.

The State of Alaska does not contain prime farmland, prime forest land, or prime rangeland. In addition, no unique farmlands or farmlands of statewide importance have been designated in Alaska. Important farmland, prime forest land, and prime rangeland receive protection from the Farmland Protection Policy Act (FPPA) and United States Department of Agriculture (USDA) Departmental Regulation No. 9500-3, Land Use Policy. The USDA regulation, 7 C.F.R. Part 658, implements the FPPA. As shown in Table 5.9-11, the construction and permanent ROWs for the GCF to MP 540 segment, Fairbanks Lateral, and MP 555 to End segment would affect soils designated as Farmlands of Local Importance by the Fairbanks SWCD and the Matanuska-Susitna Borough.

Developed Areas

As described above and as shown in Tables 5.9-3 through 5.9-5(b), the proposed Project would affect developed areas. A survey has not been conducted to determine the location and number of structures, residential or otherwise, within close proximity to the ROW and aboveground facilities. However the density of development in the proximity of the ROW is inferred by the class locations assigned to the various sections of the proposed pipeline (see Section 5.18 Reliability and Safety).

The proposed Project has the potential to affect developed land by exposing residences or commercial/industrial buildings located near the Project ROW and aboveground facilities to dust and noise primarily during Project construction. Section 5.16 (Air Quality) and 5.167 (Noise) discuss the effects related to dust and noise, respectively. Furthermore, in some areas the proposed Project would result in the removal of trees within the proposed ROW that currently provide a visual buffer between private properties and the Parks Highway.

In addition to noise, dust, and visual effects, the proposed Project has the potential to affect developed areas by hindering short or long-term land uses on lands within or in near proximity to the ROW. Some current land uses would be converted to long-term utility use for the life of the proposed Project. The long-term conversion would put permanent constraints on development of private land. To facilitate pipeline integrity management and safety inspection activities, it is assumed that the Applicant would not permit permanent structures that are not easily removed to remain on the permanent ROW. No dwellings could be placed within the permanent ROW (53 feet on federal lands ROW and 30 feet on state/private lands ROW), which would be maintained in an open condition for the life of the pipeline. Mitigation measures to reduce the effects to developed areas are prescribed under the Mitigation subheading below.

5.9.2.3 Denali National Park Route Variation

Effects to Land Use Planning

The Denali National Park Route Variation would intersect lands managed according to the Denali NPP Consolidated General Management Plan, the Tanana Basin Area Plan, and DB Comprehensive Plan. Table 5.9-13 above describes the consistency of the proposed Project with existing land use and management plans and shows the acreage affected within each planning boundary.

Transportation/Utilities

As shown in Table 5.9-10, the Denali National Park Route Variation would intersect the railroad ROW twice. This segment would not cross roads, trails/driveways, utilities, or the TAPS. All railroad crossings would be installed by trenchless methods; therefore, no disruption to railroad service would occur.

R.S. 2477 Trails and 17(b) Easements

The Denali National Park Route Variation would not intersect R.S. 2477 ROW and 17(b) easements.

Denali National Park and Preserve

The Denali National Park Route Variation would intersect the boundary of the Denali NPP. As discussed in Section 4.0, currently, Federal laws do not allow construction of this route variation within Denali NPP (see further discussion of applicable federal authorities in Section 1.2.6.3 ANILCA TITLE XI). Federal legislation that would allow the route variation has been introduced by the Alaska delegation, and is currently being considered by the U.S. Congress. If authorized by Congress, the NPS would have authority to authorize a ROW for the alternate route or mode which would result in the least environmentally damaging practicable alternative (LEDPA) upon the area.

Therefore, the AGDC would work with NPS to adjust and refine the proposed route through Nenana Canyon to assure that the route or mode which would result in the LEDPA upon the area would be constructed.

Forest Land

The Denali National Park Route Variation would affect evergreen forest and mixed forest (see Tables 5.9-8 and 5.9-9). The volume of commercial timber within areas that would be cleared for the proposed Project ROW has not been quantified by a timber survey. As shown in Tables 5.9-13 and 5.9-14, the Denali National Park Route Variation would result in forest land being cleared from lands managed according to the Denali NPP Consolidated General Management Plan and the Tanana Basin Area Plan. It should be noted that forest land that would be cleared in the area managed by the Denali NPP Consolidated General Management Plan is located within the ADOT&PF ROW.

As for the proposed Project, the FRPA provisions for timber salvage within lands that would be cleared for the Denali National Park Route Variation ROW would assure that timber resources affected by the proposed Project are properly utilized. The same mitigation measure addressing timber salvage in areas of the proposed Project ROW applies to the Denali National Park Route Variation.

Agriculture

The Denali National Park Route Variation would neither affect agricultural lands nor farmlands of local importance.

Developed Areas

As described above and as shown in Tables 5.9-3 through 5.9-5(a), the Denali National Park Route Variation would affect developed areas. The same types of effects would occur as for the proposed Project, and the same mitigation measures prescribed under the Mitigation subheading below apply to the Denali National Park Route Variation.

5.9.3 Mitigation

5.9.3.1 Transportation/Utilities

The Applicant would obtain appropriate permits prior to crossing roads. These permits would be a direct result of consultation between the Applicant and the associated federal, state, borough, or municipal agency and thus would include specific guidance on detour routes; speed/load limits; and other use limitations, conditions, restrictions, or requirements by the issuing agency.

Where appropriate, the Applicant would post caution signs on roads to inform motorists of construction and potential slow traffic conditions. Flaggers, warning signs, lights, and barriers would also be used during construction to ensure worker and public safety.

5.9.3.2 R.S. 2477 Trails and 17(b) Easements

As described above, temporary effects may occur to R.S. 2477 trails and 17(b) easements during Project construction and maintenance. These effects should be minimized by ensuring the connectivity of the trails and easements at all times. This may be achieved by connecting the trails or easements via a bypass, or by placing wooden ramps over the ditches temporarily created during pipeline construction and maintenance.

5.9.3.3 Forest Land

Where feasible and prudent, timber with commercial or personal use values would be salvaged from lands that would be cleared for the pipeline ROW.

5.9.3.4 Developed Areas

The following measures are prescribed to mitigate for Project effects to developed areas:

- Before construction begins, surveys would be conducted to confirm the location of buildings relative to the pipeline and to ascertain whether the buildings are occupied residences or businesses;
- The Applicant would consider preserving landscaping and mature trees in some cases;
- The Applicant would accelerate construction schedules where possible to reduce the effects on nearby residences and businesses;
- Trash and debris would be removed and disposed from the construction site each day;
- The Applicant would install plating to cover open trenches during non-construction times in developed areas;
- For areas in which the pipeline is within 25 feet of a residential structure, the Applicant would delay excavation of the pipeline trench until the pipe is ready to be installed, then immediately backfill after installation;
- Following installation of the pipeline and backfilling, the Applicant would restore all fences, landscaping improvements, shrubs, lawn areas, and other structures to pre-construction aesthetics (or as directed by the landowner);
- The Applicant would hire individuals with knowledge of local horticulture and turf establishment practices for developed landscape restoration;
- Residential, commercial, and industrial landowners would be compensated for construction-related impacts based upon land values determined by local professional appraisers. Damaged infrastructure would be repaired or replaced by the Applicant, or the owner would be compensated for the damage;
- Notify impacted landowners prior to the initiation of construction across their property and if there would be any interruptions to residential access during construction; and
- Continue public outreach efforts to notify the public of the Project schedule and developments.

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